ANGLO-SCANDINAVIAN IRONWORK FROM 16-22 COPPERGATE, YORK

c.850-1100 A.D.

Volume 1 of 2

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DECLARATION

The matter contained in this thesis is the result of my own original research with the following exceptions:

Metallographic analyses of the objects and slags were undertaken by Gerry MacDonnell and analyses of non-ferrous plating were by Paul Wilthew, both of whom are or were (Wilthew) based at the Ancient Monuments Laboratory. Acknowledgement is indicated at the relevant points in the text.

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Much of the material contained in Chapters 3 and 6 will be published in Anglian and Anglo-Scandinavian Ironwork from 16-22 Coppergate, Volume 17 fascicule 6 of the series Archaeology of York (Hereafter referred to as AY 17/6).

ABSTRACT

The principal subject of this thesis is some 4500 iron objects excavated in Anglo-Scandinavian contexts at 16-22 Coppergate, York. Although about half of the objects were identified as nails, the other half functioned in a wide range of activities. There are tools for trades and crafts, structural fittings, dress fittings, items of horse equipment and weapons. Of particular interest were items identified as bar iron, blanks and scrap which, together with large quantities of slag, were suggestive of smithing on the site.

The description and discussion of the material is prefaced by an examination of theoretical approaches to classification and interpretation which set a framework for the subsequent analysis.

The artefacts are initially described in terms of a classification based on practical function. This is followed by classification on the basis of features which cut across practical function. In order to discover the meaning of the material for the history of the site, a detailed discussion of the nature of site contexts is undertaken and it is concluded that the evidence for an iron smithing industry during the 10th century is as good as can be expected from a deeply stratified urban site.

Comparative material from other sites, principally in England, is reviewed to set the Coppergate objects in

a wider context and it is suggested that the York smiths worked in the mainstream of the methods and techniques of the 9th-11th centuries.

The final chapter pursues some of the ideas on interpretation raised earlier in attempt to reveal the meaning of the artefacts for the economic and social context in which they were produced.

ABBREVIATIONS

ae	copper alloy / bronze
ag	silver
au	gold
AY17/6	<u>The Archaeology of York</u> Volume 17 no.6 Anglian and Anglo-Scandinavian ironwork from 16-22 Coppergate
B.L.	British library
B.M.	British Museum
D.U.A.	Department of Urban Arcahaeology, Museum of London
ES	Early Anglo-Saxon
G	grave number
HV	Vicker's hardness
I, i	indeterminate
LMMC	London Museum Medieval Catalogue
LS	Late Anglo-Saxon
MS	Middle Anglo-Saxon
na	not applicable
n.av.	not available
sf	small find number
sn	tin
US	Unstratified
WB	Coppergate watching brief
Y.A.T	York Archaeological Trust

STYLE and DATES

1. The York Archaeological Trust house style is used throughout, although slightly modified in the bibliography.

2. Dates: Years or centuries are given where possible, but the following terms are also used:

For the York area:	Anglian	c.410-850
	Anglo-Scandinavian	c.850-1066
	medieval	c.1050-1500

For the rest of England:	early Anglo-Saxon	c.410-650
	middle Anglo-Saxon	c.650-850
	late Anglo-Saxon	c.850-1066

For Scandinavia:	Vendel (Sweden only)	c.600-800
	Viking Age	c.800-1050
	medieval	c.1050-1500

CHAPTER 1 INTRODUCTION

1.1 The ironwork from 16-22 Coppergate

The products and working methods of the late Anglo-Saxon or Anglo-Scandinavian blacksmith have, until recently, been largely unknown in this country. Weapons, usually chance finds, have been subjected to formal classification and metallographic investigation, but swords and spearheads can only have formed a small part of the smiths' output. Major programmes of excavation, largely on urban sites, are, however, gradually providing new information on a wide range of products and manufacturing techniques. There have been important discoveries in the Anglo-Scandinavian town of York itself (Richardson 1959; Waterman 1959; Radley 1971; MacGregor 1982; Tweddle 1986) and in other towns such as Lincoln (unpublished) and Thetford (I.Goodall 1984; Goodall and Ottaway forthcoming). By far the most substantial body of data for the study of 9th-11th century ironwork is, however, the material from 16-22 Coppergate, York which forms the subject of this thesis.

Anglo-Scandinavian contexts at 16-22 Coppergate produced over 4500 iron objects. Although nearly 2200 are classified as nails (3.44), the remainder include an enormous variety of items ranging from bar iron and smiths' blanks to tools for a range of crafts, structural fittings, dress fittings, horse equipment and weapons (see Appendix 1 for a summary). Furthermore, the anoxic burial conditions at 16-22 Coppergate ensured that the vast majority of objects were well preserved and original surfaces with important detail, usually lost to corrosion, survived. Anglo-Scandinavian contexts also produced a substantial quantity of ironworking residues including both smelting and smithing slag. Taken together the objects and residues offered the chance of a comprehensive archaeological study of one of man's most important crafts at a crucial phase in its development.

My principal aim is, therefore, to reconstruct, in detail, the practice of York's Anglo-Scandinavian smiths, their working methods, their products and the social and economic context in which they operated. I propose to do this by not only examining the objects themselves, but also by using their relationship to the archaeological contexts in which they were found. As Wilson (1976a, 253) points out, knowledge of craft and industry in the Anglo-Saxon period must rely heavily on artefactual material as there are only scarce references in documentary sources. Most work on the subject has, however, been based on objects which have survived unburied or, if excavated, come from unstratified or poorly-dated contexts.

1.2 The site at 16-22 Coppergate

The site at 16-22 Coppergate, excavated for York Archaeological Trust under the direction of Richard Hall between 1976 and 1981, was the largest in the city of York up to that time in terms of both area and volume of deposits. It lies on a spur of land between the rivers Foss and Ouse (Fig.1.1) bounded to the west by Coppergate, a street leading to the only bridge across the Ouse in Anglo-Scandinavian and medieval times, and to the east by the banks of the Foss. In historical terms the site is in an area of Roman settlement some 200m south-east of the fortress. After c.400 A.D. the area appears to have been deserted until the mid 9th century when, contemporary with, although not necessarily as a result of, the incursion of Viking armies and settlers into the York area, occupation began again. By the 10th century 16-22 Coppergate clearly lay in the heart of the Anglo-Scandinavian town.

The occupation sequence on the site itself may be described in the following sequence (after Hall 1984; 1989, 286) and a simplified plan of each Anglo-Scandinavian Period appears in Fig.1.2. Roman occupation (Period 1) was represented by traces of timber and stone buildings occupied between the late 1st and mid 4th centuries and by a small cemetery of the 4th century. Between the late 4th or 5th centuries and mid 9th century (Period 2) the site was deserted and saw the accumulation of homogeneous loamy deposits. Occupation in the immediate area, if not on the site itself, appeared to recommence in the mid 9th century and continued until, perhaps, the early years of the 10th century (Period 3); rubbish was dumped here in surface layers and in a large number of pits which penetrated

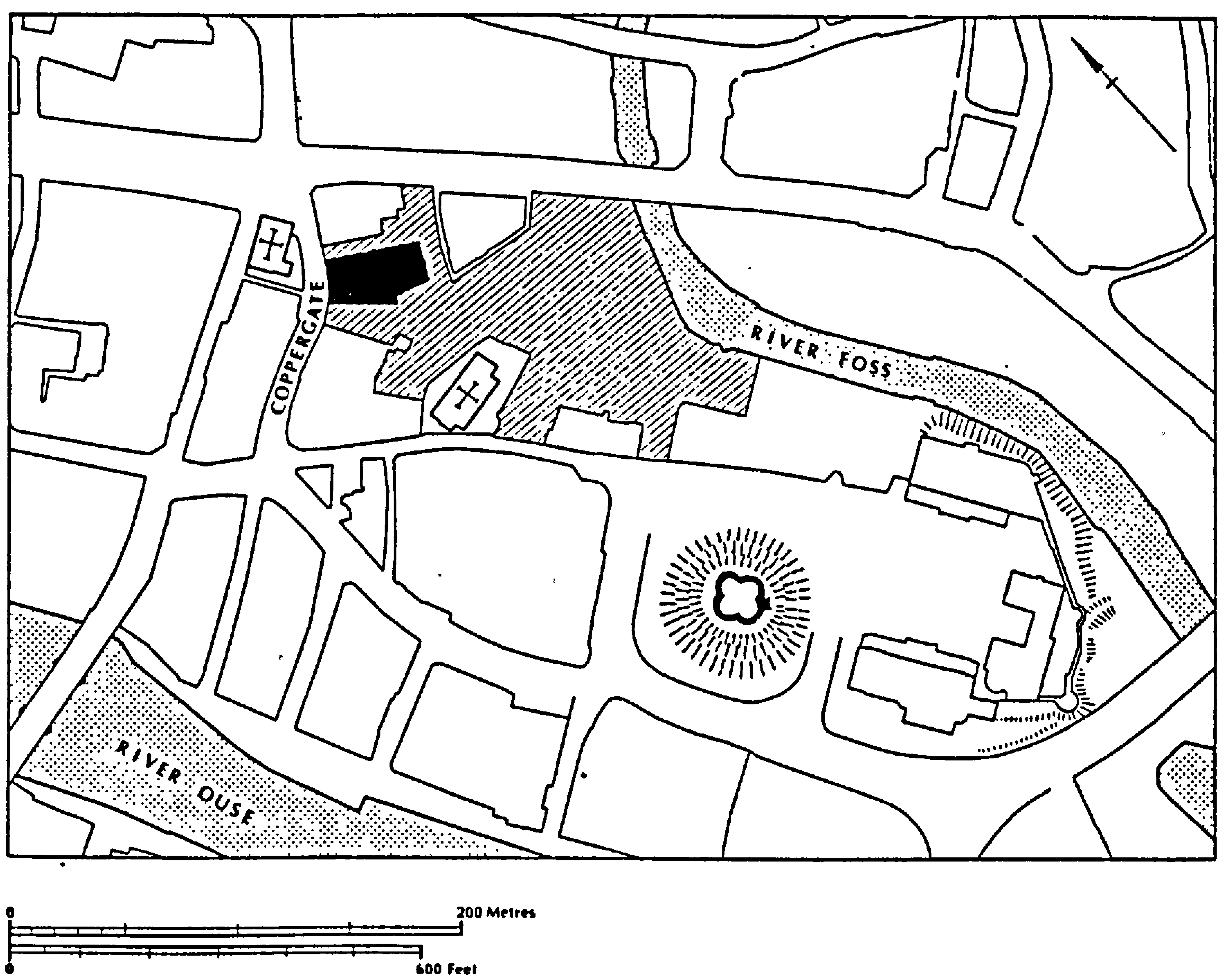


Fig.1.2 Modern plan of the Coppergate area with the redevelopment site hatched and the excavation area within it

underlying deposits. Post and stake alignments may have represented property boundaries but no certain building was identified, although an area in the centre of the western end of the site, where there were no pits, may have been the site of a building of which little trace survived. The best evidence for craft activity on the site in this period took the form of a hearth probably used for glass working. It should be noted at this point that a few contexts could not be conclusively assigned to Period 1 or 3 although on artefactual grounds Period 3 is more likely; the artefacts from the contexts appear under the heading Period 1-3 in the catalogue, but have been subsumed under Period 3 in discussion.

Between c.900 and c.930 (Period 4A) there was a realignment of boundaries suggesting that the street Coppergate was laid out by this time and there may have been buildings on the street frontage.

In c.930-5, at the beginning of Period 4B, four tenements were laid out (A-D) divided by post and wattle fences traceable over the whole site, except its eastern third, and the majority of the strata within the fenced areas appeared to respect the divisions. At the western end of the tenements buildings were constructed with upright timber posts and a wattle curtain, one of their gable ends facing the street frontage. Subsequently there appears to have been one major episode of reconstruction, but many other minor alterations. The

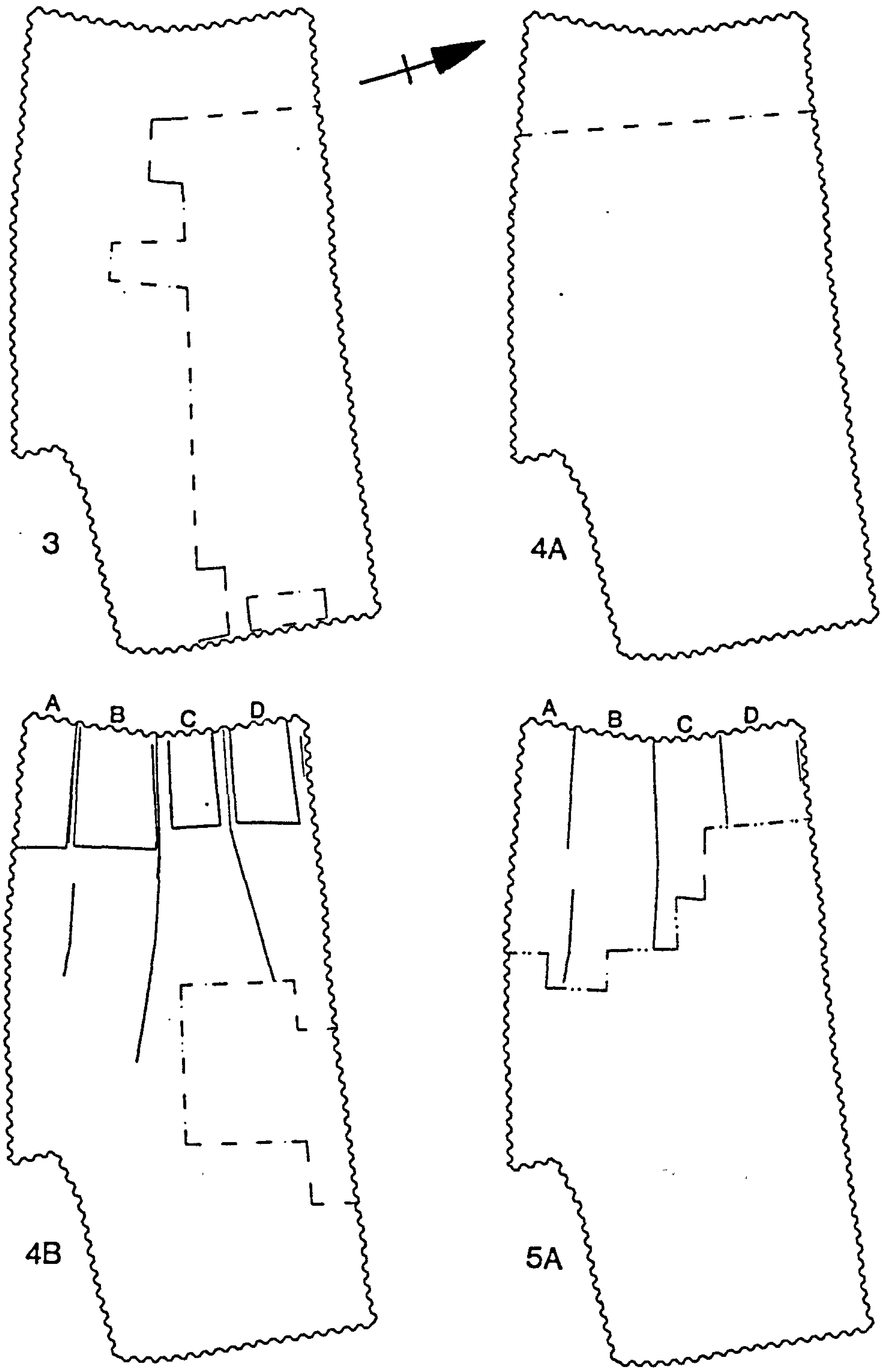


Fig.1.2 16-22 Coppergate Period plans showing areas of excavation and principal structural features (Continued over)

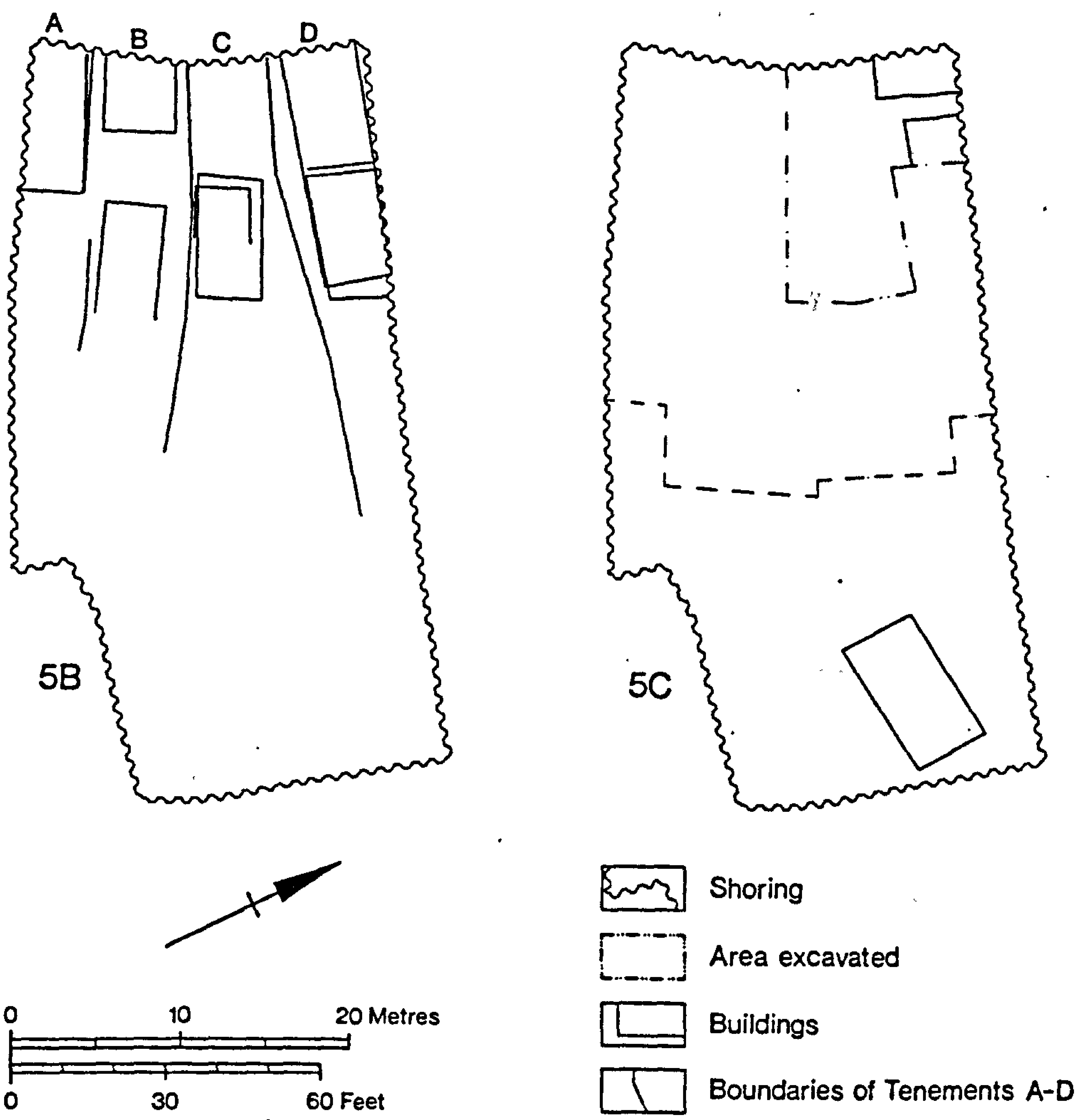


Fig.1.2 (Continued)

buildings in Tenements C and D were the best preserved as those in A and B were heavily disturbed by the Period 5B sunken buildings (see below). The floors were earthen and rose steadily due to trampling in of mud and refuse.

All the buildings contained large central hearths (Fig.1.3), measuring up to 1.8m x 1.2m, which were replaced one above the other as the floor level rose. They were constructed of clay usually lined with limestone blocks or re-used Roman tile, but on at least one occasion timber beams were used. The hearths in the Tenement C and D buildings were the best preserved. It should also be noted that pre-dating the earliest rectangular hearth in Tenement C was a small clay-lined pit some 25cms in diameter and 10cms deep. Substantial quantities of craft-related debris were found in Period 4B contexts not only from ironworking, but also from non-ferrous metalworking, and amber , jet , leather , textile and woodworking.

Period 4B lasted until c. 975 when an episode (Period 5A) of reconstruction began on the street frontage with the replacement of the post and wattle buildings by buildings with sunken basements up to 1.5m deep. On Tenements B and D there were two in line and in A and C a single building. The digging out of these basements involved considerable redeposition of earlier

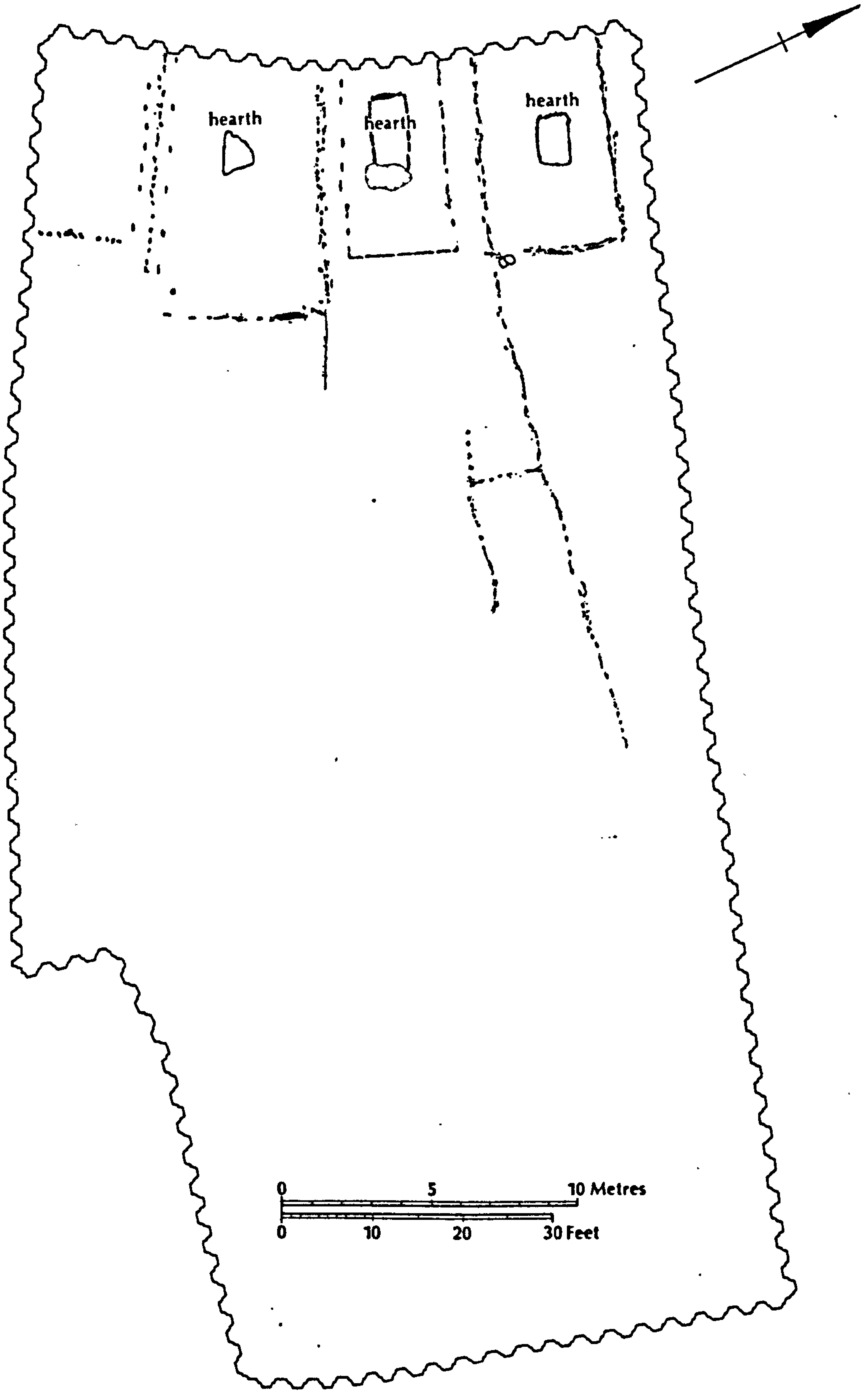


Fig.1.3 16-22 Coppergate in Period 4B showing the location of post and wattle buildings with central hearths

deposits so that a substantial proportion of the artefacts from the majority of contexts ascribed to Period 5A may be taken to be residual. Following the digging of the basements, building walls of sturdy planks and posts were introduced. Although there is some debate as to the superstructure above ground level, the sunken floors were apparently occupied and further debris from crafts and trades was found embedded in them as well as in surface layers. The life and eventual disuse of these buildings, when their basements were filled with refuse deposits, is referred to as Period 5B and is dated c.975 - 1050. It should also be noted at this point that in a small area in the centre of the south side of the site, the stratigraphy later than Period 3 was difficult to relate to the main period divisions and so the artefacts from the relevant layers are provenanced to Period 4-5.

Deposits dating to the mid to late 11th century were found at the western end of the site associated with buildings surviving only in Tenement D (Period 5CF); at the east end of the site deposits of similar date (Period 5CR) were located, some of which were associated with a post-built structure, possibly a warehouse or boat shed, erected c.1014-54.

There are also layers of dumped material in this period which may derive from activity on the street frontage. Deposits at the street frontage later than c.1100 had been completely removed by recent building cellars but medieval deposits and structures were recovered in the eastern half of the site. Although the earliest deposits here may have been deliberate landfill which effectively sealed the Anglo- Scandinavian strata, the pottery indicates that they must have included many residual Anglo-Scandinavian iron objects. I do not refer to them, however, unless their formal attributes leave little room for doubt as to origin.

As Figure 1.2 shows it was, unfortunately, not possible to excavate the site in its entirety to the natural ground level, largely because of a lack of funds. The earliest deposits up to and including those assigned to Period 4A were only excavated in an L-shaped area running along the street frontage and the southern half of the remainder of the site. Roman stratigraphy and Period 3 Anglo-Scandinavian stratigraphy was identified throughout this area; Period 2 layers were only identified along the street frontage. Similarly, Period 4A strata could not be traced beyond the street frontage area. Deposits attributable to Period 4B were identified over the whole site with the exception of an area in the centre of Tenements C and D where excavation was not completed. Period 5A contexts were again confined largely to the street frontage area, but Period 5B contexts contemporary with the sunken buildings were again identified over the whole site.

Subsequent to the main excavation a watching brief was maintained on the removal of unexcavated material from the site during development and in areas around it. To the north the remains of a timber building in the next tenement to Tenement D was found which was probably 11th century.

In common with most urban sites dug in the 1970s it is clear that the Coppergate excavation took place under considerable pressure; both time and funding limits imposed serious constraints on what was possible. The then annual lottery of government funding awards and continual changing of deadlines meant forward planning in a strategic sense and the setting of academic objectives was very difficult. In retrospect it must be counted a serious loss not to have excavated the whole site at least through the Anglo-Scandinavian levels. Apart from the unrecorded destruction of artefacts during site development, the analysis of contextual data of the sort discussed in Chapter 5 has been severely hampered by the lack of directly comparable spatial patterning for each of the major site periods.

It is also evident that, due to lack of resources, problems were encountered in recording the vast quantity of stratigraphic data from the site. There is no reason to doubt that, in the majority of instances, strata were isolated, excavated and described to a reasonable standard, but production of a record usable for post-excavation analysis has proved a serious obstacle. In this respect 16-22 Coppergate is probably no different from many urban excavations of its time, but the result has been a considerable delay in producing the division of the individual contexts into the periods outlined above. More detailed information on the sequence of contexts than that given above remained virtually inaccessible until close to the time of writing. It also proved difficult to obtain information on the location of contexts and on the volume of deposits in different parts of the site and in the various periods.

Computerisation, now standard on York Archaeological Trust excavations, will, it is hoped, reduce many of the problems of producing a usable and accessible record, but they will only be fully overcome when the prevailing methodology of urban archaeology is re-evaluated. It has, in my view, been too often the case that excavators have overlooked the potential of synthesis between different categories of data. Once removed from the ground, the relationship between structures, deposits, artefacts and environmental material is rarely reconstructed and excavation publications usually preserve rigid distinctions. The material will be studied and evaluated by specialists in their particular field so that reports on structures, pottery, ironwork etc. will be written solely in terms of the intrinsic significance of the material rather than in relation to wider considerations. Since this disaggregative approach is dominant in urban archaeology and is reinforced by the institutional structure of field units with their field workers and finds specialists, excavators are usually unable to appreciate the type of site information that is required for an analysis integrating artefacts and structural and depositional data.

My second aim in this thesis is, therefore, to demonstrate the potential, but also the problems, of integrating artefactual, structural and depositional data in the context of an urban excavation. Because of the problems of access to the record, 16-22 Coppergate is, in a way, not an ideal site to use for this sort of exercise; the quantity and diversity of the material has, however, made it a worthwhile, if frustrating, task. Research into the interpretation of urban archaeological sites is, undoubtedly, a subject in its infancy but I believe the approach adopted in Chapter 5 forms a useful basis for future work.

1.3 Method and theory

To tackle the reconstruction of the 9th-11th smithing industry, and to place it in its context, requires tools of both a practical and conceptual nature. Approaches to both method and theory in archaeology are changing rapidly at present but I have attempted to incorporate the results of developments in a number of fields.

In terms of methods of practical analysis the Coppergate ironwork has benefited from the advances in radiography and conservation which have emerged over the last 10 years. A major programme of conservation resulted in cleaning of something like two -thirds of the iron objects (excluding nails) and it has, therefore, been possible to examine and draw them unencumbered by corrosion products and in something like the state in which they entered their archaeological context. A major programme of metallography, involving the sectioning of 94 objects (Appendix 2), also represents a significant exploitation of new techniques since the subject of archaeometallurgy hardly existed in this country until the pioneering work of Tylecote (1962, 1986). The programme was designed to relate technical to archaeological problems so that emphasis was placed on edged tools which represent the best guide to the level of technical achievement of a smith but other objects were also examined for comparative purposes. Within the edged tools knives were the most numerous group examined (3.30.8); specimens were chosen in an attempt to relate formal features to metallographic structure and to assess developments in technique through the Anglo-Scandinavian era.

Of equal importance to these practical tools is the employment of new conceptual tools. Before the 1960s there was relatively little debate on theory in archaeology and little self-critical examination of assumptions by archaeologists. The discussion of theoretical approaches has, however, proceeded at a rapid rate since the advent of the "New Archaeology" in the early 1960s and has opened up many new perspectives on the meaning of the physical remains of the past. Of particular interest, as far as my work on iron objects is concerned, are approaches to the practice and interpretation of classification. The introduction where possible, of measurement and quantification to classification is, I believe, of great importance and I have attempted to introduce a few simple statistical procedures, especially in the discussion of knives (3.30 and 6.3.30), which should go some way to reorganising a very poorly developed field of study. With regard to interpretation I am particularly interested in the problems surrounding the definition of function which assume a particularly acute nature in the study of iron objects because of their role in so many fields of human activity.

Because of my interest in examining the

implications of theoretical issues surrounding classification and function, my thesis is structured in a rather different way to the parallel publication fascicule 17/6 in the The Archaeology of York series (AY17/6).

The artefactual data in the fascicule is the same for both studies and their catalogues are virtually identical, although the order has been changed slightly in this study to take account of research subsequent to the completion of the fascicule. The aim of reconstructing the smithing industry is also the same and has meant ordering the description of the artefacts in Chapter 3 in much the same way. In the fascicule, however, I have made a number of assumptions regarding the methodology of classification and inferences of meaning about the 16-22 Coppergate site which I intend to examine here with greater rigour. Constraints of time and funding for the fascicule and of space in the publication forbid inclusion of little over and above the description of the material, a summary of its chronological and spatial distribution on the site and reference to parallels. The fascicule does not, moreover, attempt to set the the ironwork in a detailed social and economic context; public funds are not available for what is counted as pure research.

In the light of these remarks, I have adopted the following sequence for this thesis. Chapter 2 will review theoretical approaches to archaeology with particular reference to classification. Chapters 3 and 4 will build on this discussion and present a classification of the ironwork taken as a single assemblage of the Anglo-Scandinavian period without any attempt to consider it in terms of chronological or spatial factors. Having attempted to assess the intrinsic meaning of the artefacts, however, Chapters 5, 6 and 7 tackle the problems of giving the artefacts meaning in relation to extrinsic variables including the site stratigraphic sequence and assemblages from other sites of the period from c.700 - 1100 in adjacent geographical areas.

Before embarking on this programme it is necessary, however, to briefly describe the origin and properties of iron, the principles and methods involved in working it, and what is known of the role of the smith in 9th-11th century society. The development of the relationship between man and metal underlies everything I have to say.

1.4 Sources of Iron

Iron is a metal whose ores occur widely in Britain and northern Europe, although many sources which were worked in antiquity are no longer viable today. Relatively little is known, however, about the pattern of exploitation in medieval and earlier times and, so far as Anglo-Scandinavian York is concerned, the location of ore sources must remain speculative.

Tylecote (1986, 124-8) identified and described three main forms of ore in Britain. The carbonate ores are the most common and occur in, amongst other places, sedimentary deposits in the Cleveland Hills, North Yorkshire and north Lincolnshire. Either of these areas is a possible source of the ore used for objects produced in Anglo-Scandinavian York. Tylecote (1962, 265) notes that smelting slag of probable 'Saxo-Norman' date from an excavation near the Roman fortress south corner tower (Stead 1958) was high in phosphorous content and may therefore have been brought from Cleveland deposits as near as Easingwold, some ten miles north of York, or from the so-called 'nodular beds' to the south-west. The nodular form of carbonate ore occurs commonly in the coal measures and the West Yorkshire coalfield is likely to have been a source for York.

The second form of ore is known as haematite ore. This was much sought after in early ironworking as it is low in phosphorous. This is important since a high phosphorous content may cause problems in steel making as it inhibits the absorption of carbon into iron. These haematite ores occur mainly in west Cumberland and the Furness area. The small pieces of haematite found at 16-22 Coppergate have no connection with iron smelting, however, but had been used as an abrasive in amber working.

The third form of iron ore is known as limonite. Limonites are hydrated iron oxides and consist mainly of the crystalline oxide geothite, with varying amounts of absorbed water. These ores frequently occur as so-called 'bog iron'. Formed under arctic conditions, they are widespread in northern and western parts of Britain and deposits outwardly resemble peat. They can be found under turf or moorland and, in Scandinavia, at the bottom of lakes. Since deep mining was not really feasible until the post-medieval period, bog ore was especially favoured in the 9th-11th centuries as it is near the surface. It has been shown, for example, that the smelting slag from 9th-10th century Hedeby was probably derived from limonite ores (Piaskowski 1983, 59) which occur widely in Schleswig-Holstein. In the Vendel and early Viking periods in Sweden iron production appears to have been largely confined to areas where bog ore was present (Hyenstrand 1981, 44). There is little comparable evidence from England, although the analysis of slags from 9th-11th century deposits at Stamford (Tylecote et al. 1982) indicates the use of ironstone outcrops rather than bog ore. Bayley (1984), however, suggests that bog ore was used in late Anglo-Saxon Thetford, since it is over 30km from the nearest ironstone outcrops.

It was not until the later 11th and 12th centuries that new sources of ore were opened up on the clay ironstones with new mining techniques. As Schubert (1957, 81) has pointed out, in the north this was often the result of the efforts of the Cistercians at places such as Kirkstall, Byland and Fountains. Schubert also notes that ironstone of good quality was imported in the medieval period including so-called Osmund iron from Sweden which was especially suitable for steel making. Unfortunately, it is not possible at present to establish whether iron ore from Scandinavia was also imported during the Anglo-Scandinavian period.

1.5 Smelting

The extraction of wrought iron from its ore has been described in detail by a number of authorities, notably Tylecote (1986, 128-31) on whose work the following summary is based. In the period between the late 9th and 12th centuries the extraction process was probably not a great deal different from that employed in the Roman period and before. This is the so-called 'direct process' in which the iron remained solid throughout, as opposed to the indirect process in which it was produced as molten iron, which would then be cast in moulds and 'puddled' to produce wrought iron.

Iron may be reduced from the various forms of iron oxide ore at c.800 degrees Celsius but iron ores also contain other minerals which have to be disposed of as slags. In general terms, smelting slags consist of iron oxides and silica. They must be removed in liquid form at a temperature at which the unwanted materials become fluid i.e. c.1150 degrees Celsius. The iron is then produced in the solid state as a bloom from which the slag partly drains away and the rest is largely removed by hammering, although, to a greater or lesser extent, some slag occurs in all wrought iron objects giving it a fibrous appearance. The bloom is an extremely heterogeneous product and attempts to reduce this heterogeneity account for many of the processes involved in early blacksmithing.

At its simplest, smelting may take place in a covered pit known as a bowl furnace and such furnaces were probably usual throughout the Anglo-Saxon and Anglo-Scandinavian periods. Examples are thought to have existed at, for example, the middle Anglo-Saxon sites at Millbrook, Sussex (Tebbutt 1982) and Ramsbury, Wiltshire (Haslam 1980), and on late Anglo-Saxon sites at Stamford (Mahany et al. 1982). The so-called shaft furnace where the pit was surmounted by a shaft built of clay, perhaps c. 2m high, had been used in the Roman period and may also have been used in post-Roman times, although there is little evidence for it. The difference between the two furnace forms is important because the main aim in iron smelting is to reduce the metal oxides with carbon monoxide. Carbon monoxide is formed by partial combustion of charcoal with air passed through a tuyère or tube in the furnace side. The air needs to be a certain distance from the tuyère before it contains sufficient carbon monoxide to reduce the iron ore to iron. Any iron ore too near the tuyère is likely to remain unreduced and become slag. If iron ore is in contact with carbon monoxide for a long time there is less likelihood of it becoming slag and so the result of the smelt is more efficient. This is achieved most satisfactorily in a shaft above the furnace. The shaft also creates a better draught which saves the need for labour at a bellows. The question of whether the shaft type of furnace was used in and around 9th-11th century York is clearly of some interest given the probable large volume of iron used in the city at this time, but unfortunately no certain iron smelting structures of the period have been identified in the locality.

It is unlikely that there was much change in furnace type or smelting process immediately after the Norman conquest. It was not until the later medieval period that water power was exploited to power bellows for the furnace. This led eventually to the development of the blast furnace which could create temperatures high enough to produce cast iron.

1.6 Smelting Slag from 16-22 Coppergate

(Description of the slag is adapted from McDonnell forthcoming in AY17/6)

Some 21.70kg of smelting slag were recovered from Anglo-Scandinavian contexts, but compared to sites where certain smelting hearths or furnaces have been found this is not a particularly large quantity. The single furnace pit and two hearths at Millbrook, for example, produced 40kg (McDonnell and Nicholson 1982). The characteristic smelting slag is known as tap slag which has an uneven upper surface caused by rapid cooling as the slag flowed, or was tapped, from the smelting furnace. It has a blue or black lustre and a fine crystalline texture. In size the pieces from Coppergate range from small fragments to large channel-shaped plates over 100g in weight. Tap slag was often run into small pits and left to solidify giving rise to slag cakes or plano-convex lumps of slag. They often have a rod-shaped piece of slag attached to them indicating the form of the feeder pipe.

On some occasions the furnace did not achieve sufficient temperatures to enable the slag to flow freely from it. The slag could either be raked from the furnace or left to cool within it. In either case massive amorphous pieces of slag were formed which are distinguished by having large charcoal impressions and a vesicular appearance. This form of slag can be difficult to distinguish from smithing slag if it has been broken into small pieces , but in most cases very large lumps over 500g in weight occur and this material has been included as smelting slag.

The chronological and spatial distribution of smelting slag from 16-22 Coppergate, including its implications for smelting taking place on the site, will be discussed in Chapter 5.6.

1.7 The Physical and Chemical Properties of Wrought Iron
(Based on Tylecote 1986, Chapters 6-8)

An iron bloom smelted by the direct process outlined above is usually relatively pure iron with few impurities apart from slag strings. The iron exists in a form known as ferrite which is a relatively soft material, softer even than most copper alloys.

Iron can, however, exist in a number of structural forms depending on the way the atoms agglomerate into crystals or grains. The grain size and form vary according to the way the iron is treated or combined with traces of other elements notably carbon. In general terms a structure with relatively large grains will produce iron which is harder but more brittle than iron with relatively small grains which will be softer but more durable.

Pure ferrite is a stable structure up to 911 degrees Celsius after which the iron assumes a structure known as austenite. Iron with a small carbon content may however become austenite at c.720 degrees C. An austenitic structure renders the iron more able to absorb the extra carbon needed for steel, in a process usually known as carburisation. Although iron is ductile at temperatures below 720 degrees Celsisus, a forge which can be heated to higher temperatures is clearly vital for the production of hard, edged tools and weapons. When carbon is introduced into iron it forms iron carbide or cementite, which forms in the ferrite grain boundaries. In iron with a carbon content of over 3% a structure known as pearlite will be found which appears as laminations of ferrite and cementite. Although its definition in the literature on the subject is notoriously imprecise, I define iron with 3% or more carbon as steel. Certain types of iron absorb carbon more efficiently than others, but the most serious absorption problems occur with iron rich in phosphorous. It may also be noted, however, that a high phosphorous content can itself create iron which is harder than pure ferrite but it has a brittle structure not usually suitable for tools.

Another iron structure seen in wrought iron artefacts is martensite created when iron has been deliberately hardened by heating it beyond the temperature at which it remains ferrite and then cooling, or quenching, it rapidly. This process (often known as 'heat treatment') ensures that the carbon content acquired during carburisation is not lost as would happen if the object were allowed to cool slowly. The quenching medium is usually water but other fluids may be used to prevent over-rapid cooling which can cause brittleness.

The hardness and, to an extent, the quality of blades can be measured by indenting a prepared area with a pyramidal diamond indenter under a controlled load (Tylecote and Gilmour 1986, 7). This leaves an impression the size of which is a measure of hardness usually referred to as Vicker's Hardness (HV). Above 100g the load applied has little effect on the hardness measurement; the measurement of the Coppergate material was usually with a 1kg load and the other measurements from other sites quoted in 6.3.30.6 and 6.4.3. can be taken to be directly comparable, except in the case of the Hedeby knives which were measured with a 30g load (Pleiner 1983) which renders the results only broadly comparable (Tylecote and Gilmour 1986, 7).

Some caution should be exercised in evaluating and comparing hardnesses as corrosion of steeled edges can cause considerable distortion of original values. Nevertheless it is worth noting that modern mild steel has a hardness of c.150HV, a modern axe c.600HV, a kitchen knife c.680HV and a stainless steel table knife c.550HV (Tylecote and Gilmour 1986, 264).

1.8 Forges, Tools and Techniques

It will always be difficult to identify Anglo-Saxon or Anglo-Scandinavian smithing sites on the ground since their structures were probably insubstantial and the equipment relatively portable. The presence of a site will be suggested, therefore, by an accumulation of debris such as blanks, scrap, slag, tools and tuyeres, the clay or stone objects which held the nozzle of the smiths bellows. To prove the existence of a site, however, it remains crucial to be able to relate the debris directly to suitable hearths.

In the Roman world it is known that substantial stone-built raised smithing hearths were used (Tylecote 1986, 163), but examples are unknown in northern Europe in the second half of the first millennium. Reliable contemporary illustrations of smithing are rare, although the smith at work in one late Anglo-Saxon manuscript (B.L. Cotton Claudius B IV fo10) appears to have a stone-built hearth, and a scene on the 10th century stone cross at Halton, Lancashire appears to show a smith working at a raised hearth. It is likely, however, that, in general, smithing hearths were often little different from the bowl smelting furnace and the pit could have been used for both purposes successively. Two simple pits used for smithing were, for example, recognised at Ramsbury (Haslam 1980, 12-3). A forging hearth need not, however, even be a hole in the ground since reducing (i.e. oxygen free) conditions are not needed. A fire set up on the ground surface may be quite adequate.

At 16-22 Coppergate the small clay-lined pit in the Period 4B post and wattle building in Tenement C could have been used for ironworking, but more likely smithing hearths were the well-built rectangular examples in the same building and in the contemporary Tenement B, C and D buildings. It is possible that these hearths originally had some associated above ground structure but little trace remained to suggest this. Stone-built raised hearths may not have been in general use until the 12th century at the earliest. They are shown in medieval illustrations such as the Holkham Bible picture book dated c.1325 (B.M. Sloane MS 3983 fo5r) and have been found in excavation at, for example, Waltham Abbey, Essex (Huggins and Huggins 1973).

A few smithing tools were found at Coppergate (3.2 - 3.9) but material from other sites, especially Scandinavian graves (Petersen 1951; Müller-Wille 1977a), and the Mästermyr tool chest (Arwidsson and Berg 1983), along with evidence of tool marks on finished iron objects indicates the range of tools available. Anvils occurred in various sizes and included both simple blocks and the L-shaped, or beaked anvil, which could be used as a form of mandrel for turning iron plate to make tubes and sockets. Swages, in the form of grooves and sockets cut into the anvil face, were used for making objects of particular shapes from thin strip. Most of the anvils known are relatively small but heavy smithing could also have employed large stones as referred to in the Norse Saga of Egil Skallagrimsson (Pálsson and Edwards 1976, 78) and a sarsen used for smithing was found at Ramsbury (Haslam 1980, 17-8). Hammers were used for a wide variety of smithing and metalworking tasks according to the size, weight and form of the head. The Mästermyr chest produced six hammer heads with broad flat faces which probably illustrate the usual range of the blacksmith of the 9th-11th century (Arwidsson and Berg 1983, 30, pl.20-1, 65-67, 69-71). The three largest are described as "sledge- hammers" (nos. 69-71) and weigh 1.6 - 1.85 Kg. They would have been used for working or shaping large pieces of iron and the smith would probably have wielded them with both hands while the iron was held in place by an assistant. The other three hammer heads (nos. 65-7) are described as "hand hammers" which were used by themselves or with other tools, such as punches, for shaping, welding or finishing iron objects. A set-hammer is a hafted, heavy, squat tool which was held on the surface of a piece of iron and struck with a sledge-hammer. It was used for heavy duty smoothing or drawing down (i.e. thinning out). Tongs were used to grip pieces of hot metal while they were being worked. A range of punches would have been used for making holes in, or impressions on the surface of the metal. They were usually struck directly on the head with a hammer and would have been held by wires or withies while being struck. Tanged punches would have been held by the handle and could only have been used in ironworking when the metal was at a relatively low temperature. Chisels were used for cutting metal. Files were used by smiths for smoothing, trimming and finishing iron forgings. Plate shears were used for cutting sheet iron.

One of the smiths most basic working processes was heavy hammering to draw up and draw down (i.e. thicken or thin out) pieces of bar iron with hammers. Equally important was the more delicate beating and shaping in the manufacture of objects out of iron plate. A particularly high level of skill was, however, required for successful welding. This is, essentially, the joining of two pieces of iron, usually by hammering them together at red heat. To secure a good weld it is crucial to prevent oxidation of the surfaces to be joined during heating. This may require the use of a flux, usually sand, which absorbs the oxygen and creates the fine hammer scale found on smithing sites. The Anglo-Scandinavian smiths seem to have been very successful at welding and high quality butt and scarf welds, for example between knife blade backs and cutting edges, have been detected in metallographic work. Some even showed little trace under microscopic examination implying intercrystalline mixing at the boundary of the two pieces of iron.

To make steel suitable for edged tools a smith introduced carbon into iron by carburisation, or cementation, which basically involved heating iron in a carbon rich environment, usually charcoal. The carbon will gradually be absorbed at the surface of the iron, but since the process of absorbtion was slow, only fairly thin strips could be treated in this way initially, and then welded together to form a thicker piece. Reduction of the inevitable heterogeneity of composition requires considerable folding and re-welding, but the higher carbon iron will still tend to lie in bands creating what is usually known as a piled structure. Not only bar iron, but also finished objects may be carburised. This is necessary if there are features of the object, such as file teeth, which can only be cut into it while the iron is soft.

As I noted in 1.7 above, in order for iron to retain the high carbon content it acquires while hot (i.e after undergoing 'heat treatment') it must be quenched rapidly. The usual quenching medium is water but since the martensitic structure formed by quenching may be exceedingly brittle, a slightly less sudden cooling to produce a more durable structure may be effected in oil. Alternatively a piece of steel can be protected by sandwiching it between two pieces of ferritic iron and this may explain the innovation of the 'sandwich-welded' blades on knives and other objects in the 9th-10th centuries (3.30.8; 6.4.3.). Another process to reduce the brittleness of a quenched structure is tempering, which is a gentle reheating of the iron to between 100 and 600 degrees Celsius. This reduces the carbon content slightly but makes the iron more durable. Excessive hammering at low temperatures, also known as 'cold-working', sometimes undertaken to increase the sharpness of a blade, will, however, reduce grain size and make the metal soft. Ferritic iron can be cold-worked without awkward consequences and much of the relief work on the Coppergate objects was probably done when they were cold.

1.9 Smithing Slag from 16-22 Coppergate

(The description of the material is adapted from MacDonnell forthcoming in AY17/6)

Some 180 Kg of smithing slag was recovered from

Anglo-Scandinavian contexts. Smithing slag is a highly silicaceous material presumed to result from reactions between iron oxide on the surface of the metal being worked, and silica in the sand used as a flux to clean the surface of the metal to inhibit further oxidation. Smithing slag usually occurs as amorphous pieces up to several hundred grammes in weight. The hearth bottom is a characteristic form of smithing slag and is plano-convex. It developed in front of the tuyère in the smith's hearth as a result of the slag dripping down into its base, hence its form. The upper surface often has a depression resulting from the air blast from the bellows forcing the semi-liquid slag to its sides. The hearth bottom grows until it impedes the air flow, or reduces the area of working, and is then cleared out. Most smithing slag lumps found in excavation are probably embryonic hearth bottoms removed from the hearth before they were fully developed.

16-22 Coppergate also produced hammer scale in two forms: flake and spheroidal. Flake hammer scale is the oxide scale formed on the surface of the iron during heating and broken off by thermal shock, abrasion or hammering. Spheroidal hammer scale is formed by the expulsion of liquid slag during the welding together of pieces of iron. Hammer scale is found on smithy floors, especially around the anvil, and its presence at 16-22

Coppergate is good evidence for smithing taking place on the site itself; being very fine material it is unlikely to survive much redeposition. It was, however, only recovered from soil samples taken for biological and finds recovery purposes and its occurrence cannot be plotted systematically.

1.10 Decorative Techniques

Smiths might use the properties of different types of iron for decorative purposes. Patterns may be formed in the surface of knives, swords, axes and other objects by twisting and welding together strips of iron of differing micro-structure (i.e. chemical content). The important variable component in the iron is usually carbon, but may also be phosphorus (Anstee and Biek 1961), although a pattern-welded object created by high and low phosphorous banding is unlikely to be very hard.

The purpose of pattern-welding has been the subject of some debate. Some authorities claim the patterns to be purely a by-product of an attempt to create a hard yet flexible blade and others claim the patterns are intended to be primarily decorative. The debate appears, however, to some extent a product of a confusion over the definition of pattern-welding. Pattern-welding is sometimes taken to include piling, any mixing of high and low carbon strips, so that in these terms pattern-welding would have a practical function. It would seem preferable, however, to distinguish between piling, which is not usually intended to be decorative, but is an attempt to create an improved iron composition, and pattern-welding which is decorative in intention, but which may or may not have improved composition as a side effect. The lengthy hammering of strips needed to form and twist them would, however, reduce the slag inclusions and reduce grain size thus producing a harder iron. There is no guarantee, however, that pattern-welding is automatically an indicator of a blade of better quality than one forged in the ordinary way.

In addition to pattern-welding, other decorative effects on iron objects were achieved in the 9th-11th centuries by inlay or plating. Inlay was sometimes done with iron itself (Tylecote 1986, 198-9) and the best known examples are the inscriptions on sword blades usually thought to refer to to the sword's manufacturer or its magical properties. More common was inlay with non-ferrous metal such as silver, tin, or copper. This was applied either by cutting a groove into the iron and hammering in the non-ferrous metal in the form of wire or by roughening the surface of the iron and hammering on the non-ferrous metal in the form of thin foil (Evison 1955; Tylecote 1986, 198).

Plating with non-ferrous metal, usually tin or copper alloy, was widely used from the 8th century onwards partly for decorative purposes and partly as a corrosion resistant. On occasions the plating metal also served as a solder. The processes of tinning and brazing (as plating with copper alloy is known) is described by the medieval monk Theophilus (Hawthorne and Smith 1979, 183-7) and involved preparing the object by filing to create a key and then dipping in a bath of molten metal.

1.11 The Smiths

It is likely that smiths often enjoyed a high social rank among the craftsmen of the 9th-11th centuries in view of the degree of skill required in the working of iron, and the heavy dependence of the economy on iron tools for agriculture and other crafts. This is expressed in the late 10th century conversation piece known as Aelfric's Colloquy (Swanton 1975, 107-15).

"The smith says 'Where does the ploughman get his plough-share or coulter or goad except by my craft? Where the fisherman his hook or the shoemaker his awl or the tailor his needle? Isn't it from my work?"

The other participants in the debate are not altogether convinced and later the following exchange takes place:

"Counsellor: 'What do you give us in your smithing but iron sparks and the noise of hammers beating and bellows blowing?'

Blacksmith: 'Oh.. why do you talk like that when you couldn't pierce even one hole without my craft..'"

Among the smiths the highest rank probably belonged to the weapon smiths whose products are frequently commemorated in Anglo-Saxon literature. Some of them are even known by name, including Wulfric known from the 10th century will of the Aetheling Aethelstan (Whitelock 1930, 57), and Biorthelm, whose name appears on the sax (scramasax or <u>seax</u>) from Sittingbourne (Wilson 1964a, 172-3, pl.30, 80).

Although men capable of blacksmithing probably formed something of a distinct social group, archaeological and documentary sources suggest that throughout the 9th-11th centuries some, at least, had skills in crafts other than ironworking and were general metal workers and even carpenters (Müller-Wille 1977a, 181-92). The Mästermyr tool chest, for example, suggests that rural smiths, at least, probably continued to operate in this way, but in towns and on royal sites, however, increased specialisation is likely (7.4). Aelfric's Colloquy appears to suggest a differentiation between iron, copper, silver and goldsmithing, and the Saga of Harold Harekyssni, dated c.1050, names specialist iron, silver, and goldsmiths at the court of Sven Estridsson (Müller-Wille 1977a, 127-8).

The social and economic role of the smith in the 9th-11th century should also be seen against the background of northern European mythology in which he was treated as a man of secret powers and this may reflect a special status in the social hierarchy. In the Norse religious pantheon Thor had the hammer as his emblem and there are two other mythical smiths both of whom were evidently well known to the inhabitants of northern England. In the Volsunga saga there is Regin the smith who forged the magical sword used by Sigurd the dragon slayer. This is the legend depicted on the cross at Halton and on stone carvings from York, Kirby Hill and Ripon, all North Yorkshire, and possibly Nunburnholme, Humberside (Bailey 1980, 116-7). The other legendary smith was Wayland, familiar in Britain before the Viking Age to judge by representations on the Franks casket dated c.700 (Bailey 1980, 104; Beckwith 1972, 117, pl.3), and in the 9th-10th century on a stone cross from Leeds (Bailey 1980, 104-5). Wayland's story contains an echo of the Greek smith Vulcan in that he was lamed by his king, presumably to prevent his escaping and taking his skills away. Finally one of the great heroes of the Norse sagas, Egil Skallagrimsson was, amongst other things, a smith and derived special powers thereby. These legends are echoed by the evidence for a distinct status for smiths presented by the Scandinavian practice of furnishing certain male graves with smiths' tools (Müller-Wille 1977a). The few examples of such graves from Britain, including those at Ballinaby, Islay (Shetelig 1945, 42) and Knoc-y-Doonee, Isle of Man (Kermode 1930a; 1930b), usually have other furnishings indicative of high social rank. Ethnographic evidence from contemporary Africa, where the practice continues, suggests that this may be symbolic of a connection between smithing and power in society and not merely an indication of the profession of the deceased (De Maret 1985, 73).

CHAPTER 2

CLASSIFICATION AND INTERPRETATION

2.1 Introduction to Classification

Archaeology is the study of the physical remains of the past with the aim of reconstructing human history and behaviour. These physical remains, or artefacts, may be entities of widely varying degrees of complexity. Buildings, streets and even towns may be considered as artefacts, but they are, of course, of a very different order to a pot sherd or iron nail. In whatever way an artefact exists, however, some form of description of its intrinsic properties, its form and composition, is required as a first step towards interpretation.

The description of an artefact immediately implies both comparison with other artefacts, and selection from what are, in theoretical terms, the almost infinite number of attributes it possesses. Both comparison and selection involve the archaeologist in judgements on the relative significance of attributes and so description cannot be a purely objective and value free process but will be, to a greater or lesser extent, affected by presuppositions of an interpretative nature. Similarly, comparison and selection will be employed as the basis of classification which may be defined as the grouping of artefacts to form classes by aggregating those which are in some way similar, whilst establishing boundaries between those which are, on the same basis, different. Depending on the judgements of relative significance employed in comparison and selection, the nature of classes and the location of boundaries between them will vary. This is especially likely if there is no strictly measurable basis for classification.

There are two basic forms of classification in archaeology; the 'monothetic' and the 'polythetic'. Doran and Hodson (1975, 160) define polythetic classes as those which '...have been defined because their members are similar... each member will share with each other member a large number of characteristics in common, but no one characteristic has to be possessed by all members, although of course it may be." Monothetic classes, by contrast: "...have been defined because their members possess given characteristics...each member must possess one or more characteristics..." The distinction between monothetic and polythetic is important because it has, for example by Doran and Hodson themselves, been associated with a distinction between 'artificial' and 'natural' classifications. A debate over the appropriateness of one or the other form for dealing with archaeological material in many ways underlies the theoretical basis of approaches not only to classification itself, but also to subsequent interpretation.

Because of the importance of the relationship between methods of classification and interpretation the discussion of the iron objects from 16-22 Coppergate is prefaced in this chapter by a brief review of archaeological approaches to these subjects as they have developed over the last 100 years or so.

One of the problems of reviewing approaches to classification is, however, the variable use of terminology. The principal source of confusion derives from the interchangeable use of the terms classification and typology, and class and type. Essentially, however, there are two basic processes involved in archaeological inference which require definition. One is the ordering of artefacts on the basis of their intrinsic properties and the other is the relation of this ordering to extrinsic variables such as time and space, with a view to forming predictive hypotheses about the past (Gardin 1980, 63). Classification usually refers to the first process, and classes refer to the object groups thus created which are usually defined in terms of practical function; typology usually refers to the second process and type to a group of objects defined on the basis of not only intrinsic similarity but also some relationship to an extrinsic variable.

Terminological problems may also arise because ordering can take place at many different levels of complexity so that, for example, the words class or type may refer to knives as a whole or to some particular subset of knives. For the sake of clarity I will avoid the use of the terms typology and type and use classification to refer to the ordering of artefacts defined in terms of mutually exclusive practical functions; classes are the groups thus created.

2.2 The Traditional or Culture Historical Approach

The origins of systematic archaeological classification may be dated to 1818 when Thomsen proposed his 'three age system' according to which antiquities were divided on the basis of their composition in either stone, bronze or iron (Klindt-Jensen 1975, 50-5). Thomsen also developed classification by form and attempted to isolate the characteristic features of artefacts and monuments. The development of classification was not substantially advanced, however, until the late 19th century with the work of scholars such as Montelius and Müller in Scandinavia (Klindt-Jensen 1974, 88-93) and Pitt-Rivers in Britain (Daniel 1964, 73-5) who made rigorous attempts to isolate the distinctive attributes which would characterise archaeological objects as typical of specific time periods, geographical areas and ancient communities.

The early archaeologists, whose approach can still be found in contemporary literature, used a polythetic form of classification but the artefact classes and boundaries between them were largely created on the basis of intuitive assessments of differences and similarities rather than strictly defined or measured criteria. The phylogenetic form of classification used in biology (Crowson 1970, 98) was also employed to create classes defined in terms of their remoteness from a common ancestor. This was the basis for proposing sequences of artefact development; distinctive examples were arranged in a time related 'type-series' where each object is slightly different from that thought to be immediately later or earlier than the next. The basic assumption here is that man-made objects evolve in a fashion similar to living things by a process of natural selection. Change in artefact form was therefore regarded as a progression from the simple to the complex, defined in terms either of greater functional efficiency or stylistic elaboration, style being a concept which, in this context, essentially refers to decoration or formal elements without an apparent practical function. The ontogenetic analogy is then extended to propose that every object class has a restricted life towards the end of which it starts to become redundant. Fewer and fewer examples are produced, they are progressively more poorly made and decoration becomes more and more simplified, or stylised, until ultimate extinction.

Because intuitive polythetic classifications can be shown to work in relating artefacts to spatial and temporal variables, it is assumed that classes created in this way have meaning in relation to human cognition which is why they are described as 'natural'. The combination of attributes which each artefact possesses is seen as the product of the adaptive responses of the craftsman's community moulded by its particular manufacturing traditions handed down from generation to generation. Man in this sense, as Childe (1936) put it: "makes himself." Artefact attributes, therefore, represent shared fossilised ideas, or what have become known in recent years as a template in the mind of the craftsman. Deetz (1967, 47) describes the mental template idea, using the example of an Indian basket, as follows:

> "The mental template for this basket was a combination of a number of attributes; these attributes were present for reasons which were traditional, functional, technological, a matter of innovation, or a function of the materials used. Although the reasons for the selection of the several attributes varied, the product of the template is a distinctive artifact very similar to others produced by similar templates, and illustrative of a set of ideas shared

by members of the Chumash culture."

The implication of the mental template idea is that there is a direct relationship between people and things. Distinctive objects may be used to define assemblages which in turn define cultural and social groups. Childe (1956, 15), for example, referred to a culture as a "recurrent assemblage of archaeological types." Those artefacts, or types, by which a culture can be recognised and distinguished from another are known as 'type-fossils' or 'index-fossils' (Hill and Evans 1972). Even if the archaeologist cannot understand the ancient psyche, he can identify the people who shared its concepts.

The archaeologist's aim in this scheme of things is to write culture history (Flannery 1967, 103). Pre- and proto-history is seen in terms of the rise and fall of distinct cultures whose members share common linguistic, religious, artistic and other traits. These cultures are located on the basis of sites producing their distinct artefact assemblages and are named either directly in terms of those artefacts (beaker, urnfield etc.), or given a modern site name (Moustère, Vendel etc.) which becomes known as the 'type-site'. Alternatively a name is produced from early literary sources which implies an ethnic or linguisitic homogeneity (Jute, Viking etc.).

Cultural change is, accordingly, indicated by change in the composition of artefact assemblages and, within assemblages, by change in artefact form and decoration. The phylogenetic analogy not only suggests that the diversification of artefacts is comparable to that of biological taxa, which continually branch from a common family tree, but that each branching is a unique event. In human culture, therefore, it is thought unlikely that identical developments or innovations can occur in more than one place or culture. If closely comparable developments, manifested as more or less parallel artefact type-series, are found in two separate areas, the implication must be that ideas have spread by what has come to be known as 'diffusion'. This may take place either through migration of peoples as a result of conquest (the 'biblical theory') or by influence as a result of trade or other forms of peaceful interaction or acculturation. The direction of interaction is indicated by relative chronology. Diffusionist assumptions can also create new cultural labels such as 'Anglo-Scandinavian' used by York's archaeologists to refer to the period c.850-1066, but carrying the implication of a mixture of material culture corresponding to historically recorded events.

In practice the assumption of a 'natural' artefact type-series and the weight given to diffusion as an agent of change, seems to place an emphasis on the search for the few key attributes, or attribute states, thought to define a type-fossil. The conceptual problems of holding a large quantity of data in the mind lead the archaeologist to abandon a truly polythetic classifcation based on an evaluation of all or, at least, a large number of an artefact's attributes. The key attributes will, moreover, usually be intuitively, if not arbitrarily, selected on the basis of the classifier's intuitive knowledge of the comparative material. He or she who has seen the largest number of examples is thought to be in the best position to get closest to the natural classification and to plot the evolutionary sequence. Furthermore, the archaeologist's definition of what constitutes elaboration or simplification is usually made on the basis of subjective aesthetic judgements of dubious validity.

Although intuitive polythetic classifications can have predictive value, they are often seriously weakened by lacking rigorous definition of attributes or any criteria of measurement. They may therefore provide no sound basis for the replication of the classification and it may be difficult either to incorporate new material into it or to test interpretations derived from the proposed classes or formal developments.

Examples of classification based on the assumptions of the culture history tradition are numerous, but because of the emphasis I have placed on the study of knives (3.30) I take as an example the work of Böhner (1958) on knives (ibid., 214-5) and saxes (ibid., 135-41) which has been widely followed in studies of English Anglo-Saxon material.

From material in graves in the Trier area Böhner created four classes of knives based on the form of the blade, especially its tip:

A) Back and cutting edge bent to some degree towards the tip.

B) Back straight or only slightly bent towards the tip.

C) Back strongly bent or'broken', cutting edge straight or only slightly bent towards the tip.

D) With sickle-shaped tip.

Although the attributes were presumably chosen for classification because of some intuitive relation to temporal and spatial factors, this is not made explicit and there is no indication of why the many other aspects of knife variability were rejected. The classes are not mutually exclusive and no criteria of measurement has been introduced to distinguish them. The states of two distinct attributes are combined without any consideration of whether they vary directly or independently. As I will show in 3.30, back form is generated in manufacture and cutting edge form may be a product of wear. This classification clearly forms a poor basis for creating well-defined, mutually exclusive classes or for the incorporation of new material. Versions of Böhner's approach can be seen in other studies of knives such as that of West in his work on the early Anglo-Saxon finds from West Stow (1985, 124). He creates four groups (A-D) on the basis of a combination of three variables: back form, cutting edge form and blade length. Again the variables are poorly defined and there is overlap between the groups.

Böhner's also failed to distinguish clearly between knives and saxes assuming, presumably, that the distinction is self-evident , although except in respect of dimensions there may be little difference. The classification of saxes does not, however have any direct relation to that of knives. There are three basic classes known as the 'small sax', 'wide sax', and 'long sax'. The difference between them rests substantially on the overall length, and length and width of blade measurements, although some overlap is allowed. A few formal features are considered, notably the relation of the blade tip to the top of the shoulder, when the sax is viewed horizontally, and the form of the junction between blade and tang. Again much of the variability in the material is ignored and since the classes are poorly defined the value of the many interpretations derived from Böhner's classifications must be dubious.

It may be noted, parenthetically, that I refer again to the problems of distinguishing knives and saxes in 2.4, 2.5, 3.30.9 and 7.7 and conclude that all single-edged, tanged blades should initially be considered as a group in terms of their dimensions and formal features before any sub-classes are proposed. Härke (1987) has gone some way to doing this in an analysis of the knives and saxes in the Finglesham Anglo-Saxon cemetery and creates monothetic classes on the basis of a clustering of lengths, although he has made no attempt to relate dimensions to aspects of form.

Apart from knives and weapons, most objects made of iron have received little detailed classificatory attention until recently because, I suggest, of the priorities of culture history. Its emphasis on the evolutionary type-series as a basis for interpretation has demanded that particular attention be paid to those artefact classes thought to have particular value for dating sites and identifying cultural groups. These classes are usually those which appear to have rapid and easily recognisable changes of form and so large numbers of potential 'type-fossils'. Swanton (1973, 1), for example, has commented that, until recently, "...Anglo-Saxon archaeology has been largely co-terminous with the archaeology of female ornament."

Iron objects have usually been regarded as having simple forms which do not change rapidly. A common view of iron tools is that once adaptation to a practical optimum has been reached there remains no further reason for change. Williams and Maxwell-Hyslop (1976, 286), for example, concluded that: "Tools were designed, as today, for a specific purpose and once the best shape has been found by the smith and the user was satisfied, provided the material was available and the technical knowledge existed, there would be no reason to alter the design..." A similar view has been adopted by Scott (1971, 87) who argued for metallographic research as an aid to object dating because ancient iron objects lack "characteristic shapes" and may remain fairly similar over long periods. Swanton (1973, 7), moreover, proposed that iron "by its nature" does not lend itself to "fashionable change" compared to many more "decoratively versatile materials." In view of such opinions it is not surprising that iron objects have usually been treated somewhat cursorily in archaeological publications (see 6.1). I aim to show, however, that while iron may not lend itsef to formal elaboration in the same way as non-ferrous metals, it can be decoratively versatile and the form of even simple tools and fittings may exhibit considerable variety. Research on certain classes of object, at least, may, moreover, produce useful dating tools.

Having criticised some of the detailed implications of the culture history approach, this section may be concluded with a brief critique of the evolutionary analogy which underlies it. The difference between the evolution of natural phenomena and change in man-made artefacts is, essentially, that the latter incorporates the decisions of men seeking a variety of goals which may have little to do with adaptation to their natural environment. Biological evolution by natural selection involves unconscious responses to environmental circumstances which usually occur over very long periods of time. The process of change in man-made artefacts is, however, often very rapid and although it may be apparent in the long term that there is a difference in adaptive efficiency between the earliest and latest artefacts in a series, it may not be so clear in what order and for what reason the small steps in between occurred. The direction of a great deal of formal development which is apparently redundant in practical terms is also likely to be unpredictable.

Analysis of man-made artefacts has ultimately to be related to the social context in which they were made and used if inferences on patterning in the archaeological record are to have interpretative value. The culture history approach, however, usually fails to incorporate any systematic consideration of the social institutions and structures, and instead embodies a pessimism about what archaeologists may know about the past beyond aspects of its technology and economy (Hawkes 1954). Other areas of human activity are usually explained in terms of ad hoc extrapolations from modern western man to his ancient forebears.

The phylogenetic aspect of evolution has also been shown to be inappropriate for man-made artefacts. Although the influence of diffusionist ideas remains strong, not least in the field of Viking Age studies, the notion of unique centres of innovation has proved inadequate and their explanatory power as a principle of cultural change has been weakened by the discrediting, largely through scientific dating methods, of many fundamental notions in European prehistory (Renfrew 1976, 273). This is not to deny that when very distinctive artefacts are found in two separate areas, such as may occur in England and Denmark during the 9th-10th centuries (see Chapter 6, especially 6.5), there is likely to have been close contact of a form which implies movement of peoples or ideas between the two. The mechanism by which this contact is reflected in material culture is, however, unlikely to have been as simple as culture history often implies. It is clear from the anthropology of living communities (e.g. Hodder 1982a; 1982b, 193-4) that the transmission of ideas about the manufacture and use of artefacts from one community to another is an extremely complex process.

2.3 Systems Theory

By the early 1960s there was a growing challenge to many traditional archaeological assumptions. The aspect of culture history which was most strongly criticised at this time was, however, not the use of the evolutionary analogy but the idea of the shared mental template and the implication that artefact assemblages may be equated with cultural groups sharing less archaeologically tangible social values or norms. The new view that members of a community participate in its culture to variable degrees, rather than share in it equally, is one of the bases of an approach to classification and interpretation which I will refer to as the systems theory approach, although other terms such as 'new archaeology', 'positivist' or 'processual' have also been used to describe much the same body of ideas.

In 1962 Lewis Binford criticised a normative view of culture as follows (p.218): "I suggest that this undifferentiated and unstructured view is inadequate, that artefacts having their primary functional context in different operational subsystems of the total cultural system will exhibit differences and similarities differentially in terms of the structure of the cultural system of which they were a part." His view is that human culture may be regarded as a system of relationships between many interacting sub-systems, such as subsistence, technology and social behaviour, which serve to adapt man to his environment. Following White (1959, 8) Binford defined culture as "man's extra-somatic means of adaption" (1962, 218).

The aim of the systems theorists is not to write culture history, but to describe and explain culture process or how culture adapts to its environment by processes of differentation and increasing complexity of organisation. This primarily involves looking at cultural change in the long-term perspective for which archaeological material is seen as peculiarly suitable. Instead of relying on single causal factors for explanation of archaeological patterning, systems theory invokes the operation of a whole range of interacting subsystems (Renfrew 1984, 248), although extra-systemic environmental perturbation is seen as the principal stimulus to change. Using a natural science paradigm, man is presented as analogous to other biological species, a creature who will respond in essentially the same way to given environmental stimuli through time and space. Systems theorists believe, therefore, that one of the principal objectives of archaeology is to use material culture patterning to make explicit generalisations on human behaviour in the past (Renfrew 1984, 15). Many, moreover, go further and believe valid explanation requires reference to universal laws of behaviour which they claim have superior explanatory power to intuitive judgements based on historical circumstances.

Emphasis on the predictive value of material culture patterning has led to a much more rigorous approach to the study of deposit formation processes (Schiffer 1972; 1976; 1987) and to artefact classification than had been undertaken previously. Since the form of individual artefacts is thought to vary according to the role of their producers in the different cultural sub-systems, it is proposed that there will be a correspondingly high degree of variability of both qualitative and quantitative attribute states within each artefact class. The implication of this is that every artefact, no matter how apparently simple in form, may be defined in terms of a large if not infinite number of ways (Clarke 1968, 136). Classification requires that all, or at least a large number, of these attributes be taken into account before those significant for interpretation can be determined (ibid., 138).

Systems theory departs from the culture history approach in its insistence that classifications are imposed on the material rather than emerging from it; there can be no one transcendentally correct 'natural' classification, corresponding to that of ancient man, towards which all analysis is directed. All classifications, whether monothetic or polythetic, are seen as 'artificial' and no assumption need be made about whether a particular feature of an ancient artefact is the product of conscious or unconscious behaviour. Key attributes or attribute states will be those chosen by the classifier because they appear to relate in a meaningful way to his hypotheses about human behaviour in the past. There can, in other words, be as many classifications as the archaeologist requires for his enquiries. The hypothetico-deductive method coupled with the natural science paradigm demands that classification be a form of scientific experiment involving clear definition of attributes and, where possible, measurement of the similarities and differences between artefacts in order to give results which permit replication and testing. Of particular importance to systems theory also is the study of correlations between measured variables. To manipulate the potentially vast quantities of data that this approach creates has required an increasing use of the statistical techniques of numerical taxonomy including various forms of multivariate analysis. Whatever failings systems theory has in other respects, the impetus it has given to the development of clear definition of attributes and to the use of statistics in archaeology is, I believe, of considerable importance.

Although classifications based on careful definition and measurement of attributes and attribute states represent a step forward from those based on intuitive lines, systems theory still assumes that the ontogenetic analogy of evolution towards functional efficiency has considerable explanatory value in respect of variability and of change in artefact form. As Clarke (1968, 205) has written: "Typology is in part purely taxonomy and classification and in part the ordering of artefact types and assemblages in increasing functional efficiency and in seriated sequence of affinity and matching attribute oscillations." Within the evolutionary paradigm artefacts in systems theory play a largely passive role; they are seen as the physical product of the adaptive responses of the various interlocking subsystems whether in relation to the "technomic" (i.e. technological and economic), "sociotechnic" (i.e. social) or "ideotechnic" (i.e. ideas related) spheres of human activity, to quote the well known, if unappealingly expressed, classification by Binford (1962, 219).

Residually cross-cutting these three categories are stylistic features defined as: "formal qualities that are not directly explicable in terms of the nature of the raw materials, technology of production, or variability in the structure of the technological and social subsystems of the cultural system" (Binford 1962, 220). This attitude means that systems theory finds it difficult to explain short-term variability in material culture since it cannot break out of a rigid distinction between practical function and style, the latter being thought of as some ill-defined channel along which information flows to promote social solidarity and identity. This view can be found in the so-called 'information exchange theory' (Plog 1980, 118-21) which has been invoked to explain the relationship between material culture and social interaction. It is proposed that in order to mediate stress in social interaction and ensure community survival non-verbal as well as verbal communication is required. Artefacts, such as dress, which are particularly visible when in use, will, through stylistic elaboration, communicate messages on social status, beliefs and affiliations. The targets for these messages will, however, be beyond the immediate family or residence group, although there comes a point where social distance is such that the messages lose their usefulness and cannot be decoded. Within certain limits, therefore, increasing artefact variability is said to reflect increasing social interaction, although not necessarily across the ethnic boundaries erected by culture history.

Although systems theory has focussed attention on the social processes behind material culture patterning in a way that archaeology had not done hitherto, it allows, in my view, too great an emphasis on cross-cultural generalisation derived from the observation of living societies. It is also over-confident in its assumption that human behaviour has always been rational in the sense in which we understand it today in modern western society. This is surely the implication of Binford's conclusions on his study of Nunamiut Eskimos (1978). He claims, for example, that "..the Nunamiut behave rationally in their treatment of animal foods" (ibid., 453) and that their "Judgements are the result of rational analysis; they are not synonymous with 'mental templates' or 'preprogrammed' designs for living." (ibid., 454). There is little scope in his view for the effects of any specific historical circumstances on cognition and behaviour and of ideological considerations which may influence the way the eskimo approaches his subsistence strategies. In 2.5 I believe, however, that it can be shown that adaptive advantage is only one consideration in man's existence as a social being and that, as a result, the ability of systems theory to explain cultural variability is very much reduced (Hodder 1986, 21-3) ; it is not enough, as Flannery put it (1967, 105), to describe the system behind the 'Indian'; the 'Indian' himself re-emerges as the focus of our attention.

I also suggest that it is doubtful if the natural and physical sciences, which systems theory sets out to imitate, remain the paradigms of the rational pursuit of knowledge claimed by Binford et al. Although systems theory requires a formalised relationship between data and theory which is lacking in traditional archaeology, it assumes that data are value free and subject only to the principles of mathematical analysis. The idea of empirical Newtonian certainties now, however, appears unacceptable even in the 'hardest' of the physical sciences. In atomic physics, for example, it is apparent that the particles of which matter may be composed cannot be isolated and their physical properties can only be proposed on the basis of observations which are essentially unrepeatable. I believe that as in physics so it is in archaeology, no 'facts' are independent of our theories about them and so no archaeological classification can be independent of the interpretation which will come from it.

2.4 Structuralist and Post-Structuralist Theory

In a search for alternatives to systems theory, a return has been made in recent years to an interest in theories which assume a priority of culture over nature as the principal context for human action and behaviour. The natural environment, regarded by systems theory as largely external to human culture, is itself now considered to be a form of cultural construct to be manipulated for social advantage. There has also been a new interest in ways to relate material culture to cognition which has led to both a re-examination of the idea that cultural artefacts are fossilised ideas, or the product of mental templates, and to attempts to achieve a congruence between the classifications made by the student of ancient artefacts and those of the original manufacturer (e.g. Richards 1987). These developments have taken place as a result of an appreciation of the significance of structuralist and, latterly, post-structuralist and neo-Marxist theory, especially as it has been applied to anthropology and sociology.

Structuralism emerged as an all embracing system for interpreting the world on the basis of a theory of the workings of the human mind which may be summarised as follows (after Leach 1970, 21). The phenomena we perceive have the characteristics we attribute to them because of the way our senses operate and the way the human brain is designed to order, or categorise, and interpret the stimuli which are fed into it. One important feature of this categorisation process is that we cut up, or structure, the continua of space and time surrounding us into segments so that we are predisposed to think of the world around us as consisting of a vast number of separate things belonging to named classes. When we construct artificial things, therefore, such as language or material items, we imitate our apprehension of the world and all cultural products are segmented and categorised in the same way as we perceive our environment. The implication of the structuralist thesis for archaeologists is that they may legitimately aim to discover how the principles of categorisation in the human mind are transformed into the material culture which lies at the centre of their discipline.

Structuralism originally developed from research into language , but has since been applied to the study of a wide variety of man's cultural products, or, to put it another way, the definition of what constitutes language, defined as a means of communication, has been expanded. Language is crucial to the structuralist enterprise as it is seen as the principal attribute that sets man apart from all other beings and allows him to formulate abstract concepts about his relations with the world. Saussure (1974), the founder of structural linguistics, proposed that language has an essentially binary nature consisting of a language system (langue) which lies behind and takes precedence over individual utterances (paroles) which in turn select from the system to convey meaning. He also identified two vital characteristics of language which are, first, that it is always shared since no individual can create new words and meanings on his own. Secondly, language is conventional, the relationship between that which signifies, 'the signifier', and the 'signified' is purely arbitrary. The essence of language, therefore, is that it is a system of differences; signification depends not on the particular positive properties of what is uttered, but on the formal difference between what is uttered and what is not uttered. The relationship between signifier and signified is embodied in the sign, which may be either a sound or material representation.

Although structuralism regards material culture as analogous to language, it is apparent that there are differences in the generation of the two modes of expression arising out of the very materiality of material culture which modifies its arbitrary nature. Whereas the relation of the letters K-N-I-F-E to the cutting tool can be accepted as arbitrary, the object itself, taken as a form of linguistic utterance, must fulfil certain basic requirements to relate to the signified as a cutting tool; in other words the form of the knife may be said to be, at least to some extent, motivated towards practical function. The problem now arises, however, of how this motivated aspect may be defined since there is no pure knife form to which an individual specimen can be compared. Without wishing to appear to ignore an important philosophical problem, it is, nevertheless, reasonable for the archaeologist to proceed with the analysis of artefacts with the hypothesis that some aspects of artefact form relate primarily to practical function whereas many others do not. It should be borne in mind, however, that the boundary between the practical and non-practical will rarely be clear cut and to some scholars the distinction is irrelevant. Miller (1985, 96) and Shanks and Tilley (1987, 94), for example, appear to regard all aspects of formal variability in material culture as contingent on the cognitive orientations of particular social groups. The very fact that a community uses iron knives would, therefore, primarily indicate a distinctive ideological response to the social environment rather than a harnessing of technological possibilities to a desire to survive.

In his structuralist anthropology, Levi-Strauss interprets culture as a system of communication (e.g. 1968, 67-80). He sees all cultural phenomena, no matter how apparently trivial, conveying coded messages at a series of different levels which serve to integrate individuals into society. These messages may only rarely be consciously or clearly apprehended by the individuals involved in the communication process but they become apparent to the anthropologist by wide-ranging cross-cultural research. In primitive communities Levi-Strauss observed that men set up artificial divisions amongst themselves which appeared to lack immediate adaptive purpose, but were required to create the exchange or communication mechanisms which allowed society to function. The symbols or totems used to emphasise abstract concepts relating to social divisions were not chosen because of their underlying economic value, but were simply considered categories arbitrarily chosen to create social value (Levi-Strauss 1964). These totemic symbols are, he concludes, "goods to think with" (Leach 1970, 34).

The discovery of the ability of primitive men to think in abstractions and to make sense of the world by reference to codes composed of things outside themselves, such as the attributes of animals, is probably one of Levi-Strauss' most important achievements. In The Savage Mind (1962) he shows that rather than using abstract signs, i.e. writing, non-literate peoples concentrate more markedly on a symbolism constructed of observed contrasts in the sensory qualities of their environment, such as male and female or raw and cooked, from which are generated other more abstract oppositions, such as the pure and the polluted. Levi-Strauss (ibid., 16-7) makes the comparison between primitive man as a handyman, or 'bricoleur', who creates systems of symbolic differences using whatever is available in his immediate environment, and modern man as an engineer who places more emphasis on the artificially manufactured sign system that is writing. Because he lacks writing, moreover, and must rely more on materially based differences, primitive man lays great emphasis on the boundaries between opposed spheres of meaning and seeks to maintain them with complex systems of taboos which may, in turn, have a complex forms of material expression.

Levi-Strauss sees culture dominating even man's most fundamental activities and he identified grids of communication related to, amongst other things, kinship, the treatment of food and production of artefacts. He found that all patterns of human behaviour may retain an adaptive component, but inextricably entwined with them, are components related to other levels of social organisation which are communicated by coded messages or symbols represented either by sounds, sequences of behaviour or material culture. The implication for the student of material culture is that he must discover the rules which govern communication for only then will he make sense of the system of differences he perceives.

In structuralist theory a coded message conveyed by symbolic representation may be analysed by considering it in two parts (Barthes 1967, 63; Leach

1970, 46-8). It will consist of a system, or combination, of elements which are not interchangeable so that, for example, to look ahead to Chapter 7, riding equipment, weapon and chest might indicate male possessions. In linguistics each element is usually referred to as a metonym and a chain of associated, or contiguous, elements as a syntagmatic chain. Secondly, just as utterance is a choice from the system of language, so symbolic meaning will also derive from a set of interchangeable variants of each of the metonyms which will be more specific to behavioural context so that to return to the example above: silver spurs, inlaid sax and chest with ornamental fittings might symbolise a high ranking male. In linguistics each element in such a chain is referred to as a metaphor and the chain as a paradigmatic chain. The elements in each type of chain are brought together not because they are similar in themselves but as a result of the structure of human communication. Metonyms and metaphors are not opposed in any way, there are always elements of both in any utterance or material representation, although there may be marked differences of emphasis.

Anthropologists are clearly able to discover the metonymic and metaphoric meanings symbolised by artefacts on the basis of the observation of living communities. Archaeologists seeking to take advantage of the structuralist method would appear to confront problems in the study of ancient artefacts since the syntagmatic and paradigmatic chains will be incomplete and behavioural sequences can only be inferred. The extent to which progress can be made would appear heavily dependent on how valid cross-cultural generalisations are considered to be. Although structuralism emphasises the role of the human mind in the creation of cultural phenomena, its approach is similar to that of systems theory in its search for a regular relationship between interlocking parts. Levi-Strauss clearly aims, by the study of particular instances, to derive rules governing human communication which would have universal cross-cultural validity. Levi-Strauss is also ahistorical in the sense that he believes in a collective human unconscious which will reveal itself in the choices made from an "ideal repertoire" of cultural manifestations in a way unrelated to time and space (1976, 229). It is legitimate to point out, therefore, that the individual remains passive in structuralist theory (Hodder 1986, 48). It is an inescapable implication of structuralism, however, that since language, and other forms of cultural utterance, are shared, the freedom of the individual to act or communicate autonomously is restricted. In recent developments of structuralist theory emphasis has been placed on showing that individuality is "..created and constructed in a social and symbolic field over which the subject has no immediate or direct degree of control or possibility for radical intervention" (Shanks and Tilley 1987, 98). Taken to its logical conclusion the only way the individual can influence his culture is through motor habit variation deriving from purely neurological idiosyncrasies.

A form of solution to the problem of the passive role of man, which is apparently imposed by the nature of language, is to stress the active and interactive role of social groups. Social theorists, such as Barthes, who may be referred to generically as post-structuralists have adapted aspects of the theories of Marx to propose that cultural reproduction is guided by ideology, a body of ideas about categorising the perceived world. Rather than being ideas actively disseminated by the ruling class, however, ideology is now seen as composed of concepts which are taken for granted and operate beneath consciousness, but are no less powerful in naturalising the hegemony of that class (Hebdige 1979, 11-2; Harland 1987, 48). Since cultural reproduction includes the material as well as the immaterial, artefacts form part of ideology, and will actively influence the reproductive process through time and so a historical element is introduced into structuralist theory.

In post-structuralist theory social relations are characterised by a constant struggle between different groups to legitimate their claim to social power and thus gain access to social resources whether material or non-material. These groups may be defined largely in terms of their economic role but only become significant when energised by a shared ideology. The struggle need, however, have little to do with the rational pursuit of adaptive advantage as envisaged in systems theory and in this sense, I suggest, post-structuralism derives as much from Nietzsche as from Marx. I refer in particular to Chapter 13 of Beyond Good and Evil (1973, 26) where Nietzsche claims that: " A living thing desires above all to vent its strength- life as such is will to power" - self preservation is only one of the most frequent consequences of it."

A theory of the way that intra-societal power struggles are manifested in material culture today is discussed by Barthes in Mythologies (1973, 109-59). By the concept of myth he means, as Hawkes has written (1977, 131), "...the complex system of images and beliefs which society constructs in order to sustain and authenticate its sense of its own being..." Barthes shows that throughout everyday life today material culture serves to 'mythologise' the ideology of the ruling class, in the sense of making it appear as part of the natural order and thus legitimate. Although oriented to the modern world, these ideas are applicable to ancient societies and I will return to them in Chapter 7 where I suggest that aspects of the archaeology of Anglo-Scandinavian and late Anglo-Saxon England imply strategies of legitimation by both the smiths and other groups in contemporary society. The idea of competing intra-societal strategies can also be used to understand the vexed archaeological problem of the differential geographical movement of cultural features. As a result of his work in Africa, for example, Hodder concluded that : "Ethnographic and historical evidence soon demonstrated that the boundaries of material culture and social units did not always coincide, material units sometimes correlate with linguistic divisions but in many other cases material cultures are comprised of many non-coincident distributions and the correlations with social units are difficult to identify" (1982b, 193). Although Hodder proposes a generalised direct relationship between the distinctiveness of cultural boundaries and the extent of economic competition between social units (1982b, 194), he also stresses that it is necessary to take account of the particular historical context in which boundary maintenance is chosen as a social strategy.

Within the context of the recent theoretical developments on archaeoogical inference, the determination of artefact meaning has clearly come under increasing scrutiny. Analysis begins with the premise that no artefact has inherent meaning but can only receive it from the human mind; all artefacts are therefore symbols in the sense that they stand for something else, or more accurately, represent some area of cognitive classification, both in their original context and in the modern archaeological context; the problem lies in achieving some reconciliation of the two. In the sphere of practical function the meaning of ancient artefacts in a modern context is, on the whole, more likely to be clear than in the sphere of more abstract functions; one can claim that a knife is a knife is a cutting tool in anyone's language. Determination of an object's practical function may, of course, pose problems if no documented analogy exists, and it should also be pointed out that there are occasions where classification boundaries will inevitably remain blurred, or fuzzy (Miller 1985, 8). There is, for example, no indisputable measurable or formal criterion for distinguishing a domestic or craft knife from a single-edged weapon or 'sax', although many archaeologists claim to know one from another when they see it (see below 7.7). The distinction between knife and the sax was, however, probably somewhat blurred in the Anglo-Saxon period. Traditional structuralist method, with its privileged role for verbal testimony, would suggest greater precision in classification might be possible if it were possible to interview knife and sax users, but other evidence suggests that there may have been an irreducible element of ambiguity in meaning which could not be resolved. In his study of the manufacture and use of pottery in contemporary India, Miller (1985, 198) found that informants may not necessarily give a better or clearer picture of artefact meaning than forms of non-verbal communication which operate below the level of conscious designation and is just as valid in denoting cognitive processes.

Similar problems to those which occur in determining the practical function of artefacts arise in more complex form where their more abstract functions are concerned. Hebdige (1979), for example, shows that the modern 'punks' could provide little verbal explanation of the symbolic significance of objects they used to define themselves, although as an outsider he could detect distinct and meaningful patterning. It is clear from the studies of both Hebdige (1979) and Miller (1985) that a clear symbolic meaning in respect of non-practical function, rarely attaches either to an individual material item or to sets of items There is both an ambiguous and polysemic character to much symbolic meaning because the boundaries of categorisation which generate artefacts are themselves blurred. This is not to suggest, however, that the relationship of abstract meaning to artefact form is necessarily always arbitrary. Certain aspects of representation may operate consistently in certain spheres of meaning over considerable periods of time and ultimately derive from a close relationship with practical function; although aspects of that meaning may change, they will refer back to previous function (Hodder 1982b, 207; 1986, 49). This property of symbolism forms one assumption of my analysis of selected artefacts in Chapter 7.5 - 7.8.

Nevertheless, the implications of post-structuralist theory are that, since there is a continual dialectical, or interactive, process in cultural reproduction in which artefacts not only reflect human categorisation of the world but also aid in its constitution, their meaning is likely to be continually changing and cross-cultural and cross-temporal generalisation must be treated with caution. Understanding artefact variability therefore relies on understanding the specific historical and cognitive factors which have affected the differentiation processes in manufacture. For archaeologists the importance of relating artefacts to their contexts should assume an even greater importance since they may be considered not only as passive components of the physical record but potentially as active creative force in the constitution of that record.

There are, in brief, two principal problems of interpreting an archaeological context. One is to establish how it is has been created. In the case of structural remains this is often relatively well understood, but the majority of iron and other small artefacts come from deposits whose origin is usually much more uncertain. This problem is in part mineralogical and biological, but as crucial is the strictly archaeological aspect since it is principally cultural material that can for example, demonstrate whether a deposit consists entirely of material deposited in the spot where it was excavated and excludes redeposited components. In Chapter 5 there is an extended discussion of deposit 'status' with regard to its origins and the techniques which may be used to define it.

The second problem of context interpretation is to determine the status of the people responsible for its creation which may in turn have considerable bearing on the social role of any artefacts contained in it. In some cases the status of excavated structures, and thus at least some of their inhabitants, may be known from documentary sources referring to them or to analogous examples. On most occupation sites of pre- or proto-historic periods, however, determining the relationship of deposits to their creators is more difficult. Even if they are adjacent to a structure of known status, the nature of the relationship between structure and artefactual material is often unclear. Is, for example, the refuse in a castle ditch from the lord's table or the servants'?

In contrast to occupation-derived deposits, the advantage of burials is that they are primary contexts which may allow a direct relation of artefacts to people whose status, especially in terms of age, sex and rank, can with varying degrees of reliability be determined. Nevertheless some caution is required since the picture of social relations presented by burials is likely to be idealised and created to naturalise a particular ideological point of view. In her study of two Anglo-Saxon inhumation cemteries Pader (1982) rejected almost any possibility of cross-cultural inference and adopted a somewhat pessimistic point of view on decoding either the symbolic significance of burial attributes or the nature of the controlling ideology.

In the same way that it is generally easier to understand the symbolic significance of artefacts if they can be observed in the context of living societies, it is potentially easier to understand them if there is contemporary documentary material to set against the archaeological evidence. In _In Small Things Forgotten_, for example, Deetz (1977) attempts to relate variability in a series of cultural phenomena, including houses, pottery and rubbish pits, to documented changes in the American world view between the 17th and early 19th centuries.

As a result of his consideration of a wide spread of data, both archaeological and non-archaeological, Deetz presents an explanation of changes in American society in terms of the change in the way people perceived their social role as they moved from a communal to an individual ethic in the mid 18th century.

Although Deetz's analysis is persuasive, the existence of clear links between artefact variability and the structures of human cognition are still difficult to verify in non-historic or proto-historic periods (Hodder 1986, 49). The meaning of artefacts beyond their purely practical function remains hard to penetrate.

What is clear , however, is that if archaeolgists are to approach an understanding of the full range of symbolic messages encoded in artefacts they must start with the rigorous identification of patterning in material remains; as Shanks and Tilley (1987, 104) point out: "Material culture may be regarded as revealing its structure and the principles which underlie it through repetition."

2.5 Classification of ironwork

This chapter is concluded by a discussion of the approach to classification I have adopted for the ironwork from 16-22 Coppergate. Some of the themes of the previous sections will recur here, others will be taken up again in subsequent chapters.

2.5.1 Classification by form and function

Studies of the way the human mind categorises perceived phenomena indicate that although this does not usually involve the creation of clear boundaries, the principle referred to by Rosch (1978, 35) as "cognitive economy" dictates that there is a preference for clear cut categories. The implication of this is that monothetic classifications are easier to apprehend than the polythetic. It is an entirely satisfactory procedure, therefore, to approach archaeological data initially on the basis of monothetic classification and, moreover, to do this within the context of the ascription of practical function. As I pointed out in the previous section, it can be assumed that artefacts are motivated in a way that the linguistic sign and signifier are not since some aspects of their form and composition are related to practical function. Analysing ancient artefacts is therefore somewhat akin to learning a foreign, but not unrelated, language in which certain words, at least, are familiar. Identification of mutually exclusive classes based on practical functions therefore forms a good basis for the classification of artefacts from which further analysis, whether on a monothetic or polythetic basis, may proceed. This is the case even if the form of the object only refers to a practical function that it never actually performed as is case with, for example, toys or objects used solely in ritual practices.

Strictly speaking, ascription of practical function to an artefact is a form of interpretation of the patterning in its form and composition. In the study of archaeological artefacts, however, some sort of connection between, on the one hand, form and composition, and, on the other, practical function can usually be made without great difficulty on the basis of analogues of various sorts. It would, theoretically, have been possible to create a classification of formal features in the 16-22 Coppergate ironwork and then used polythetic analysis to derive clusters of attributes which could then have been assigned functional meanings. This would, however, not only have been a tedious exercise, but it would not, I suggest, have corresponded to the way in which the artefacts were made. The principle of motivation in artefact production dictates that, as Gombrich (1960, 85) has written "...making will come before matching, creation before reference."

In other words, the impulse to create the knife comes before working out how it is to be done.

The ascription of function to an artefact is, essentially, based on analogy and there are three areas from which analogical information on ancient artefacts may be derived: 1) the daily environment of the archaeologist; 2) living societies elsewhere in the world; 3) documentation, which may be either contemporary with the period from which the artefacts derive or from others which appear relevant. I take documentation to include, first of all, written and illustrative sources. As far as the Coppergate Anglo-Scandinavian ironwork is concerned there is little that is contemporary, but a certain amount of useful material derives from the recording of 'traditional crafts' in the post-medieval and modern periods. Secondly, documentation can include artefacts, discovered in archaeological contexts or surviving unburied from the past. The deciding factor here is that the artefact used as an analogue has a function clearly defined by the nature of its context or by physical examination, for example, by metallography or wear pattern analysis. What is not included under the definition of documented analogy is an object whose context is not demonstrably specific. This includes the majority of archaeological contexts although, as will be discussed in Chapter 5, there may be techniques of analysis for understanding their meaning more fully.

In spite of the availability of analogues, some ancient artefacts will always elude identification of function, perhaps because they are the product of peculiar environmental or cultural circumstances. Others will only be ascribable to a range of functions. A number of simple tapering iron objects from Coppergate, referred to as awls and tanged punches (3.24 - 3.25), could, for example, have been used in a number of crafts or activities. Problems will also arise when dealing with broken objects, incomplete objects which formed an integral part of an object made of more than one material, and part-made objects whose final form has not been fully realised and so may appear completely idiosyncratic. Numerous objects from 16-22 Coppergate and most other sites fall into one or more of these groups.

Once analogical references have been exhausted, consideration may be given to the nature of the context in which the artefact was recovered which may lead to identification of function or, at least, tip the balance of probability towards one option against others. This involves analysis of the deposit or structure itself and of other artefacts and ecofacts found in it. Reliability of artefact identification on this basis, however, depends on the ability to determine the status of the context in respect of the original circumstances of its creation or deposition which, as I have already noted, is a topic I will discuss in Chapter 5.

The level of aggregation at which classification takes place will depend to some extent on the nature of the material and the questions to be asked of it, but the natural propensities of categorisation in the human mind (Rosch 1978, 30) appear to lead us to a level of abstraction at which the most detailed division into mutually exclusive classes can be made. I have already pointed out that the creation of classes essentially involves some comprehension of similarity and difference, but developing criteria for measuring these qualities in respect of features other than those of size and nature of material composition, and those amenable to presence/absence analysis, is bound to retain a subjective and intuitive element. The problems of measurement, I suggest, become much more important with classification within functional groups, and I have not paid much attention to them in the initial functional classifcation of the ironwork. In making this I have adopted the procedure of attempting to ascribe to each object a function, on the basis of analogues known to me, and then created classes of objects which perform the same function. This is essentially a monothetic classification and the objects in these classes will usually share a number of common attributes but on occasions sub-classes have been created if there are two or more distinct forms of objects with the same function.

I recognise that strict measurement can play a part in classification on the basis of practical function, but imposing an artificial discontinuity on continuous variables is always problematic. By way of an example reference may once again be made to the difficulty of distinguishing between single-edged tools and weapons, i.e. knives and saxes (see also 2.2; 2.4). Clearly a functional difference is related to dimensions, particularly length, but there is no analogical basis for establishing a specific length to divide one class from the other. It is more satisfactory, therefore, to consider all single-edged blades as a single class and use polythetic cluster analysis of the group to create a more meaningful division than simply nominating a length value arbitrarily. A similar problem is involved in the classification of iron rings. Some may have been part of chains, others parts of handles and others the cheek pieces of horse bits, but it is not possible to use size alone as the determining factor in identification.

A rather different situation prevails in respect of measurement of metallographic properties since particular values of chemical content and hardness may be correlated with metal structures which have functional implications. For example, the punch 2206 (3.4) bore some resemblance to tapering strips of bar iron (3.1), but metallographic analysis confirmed the identification as an edged tool.

There are very few objects for which either no, or only a very vague, identification of function can be proposed. The small vessels (3.40) and tubular object (3.62) are perhaps among the most problematic. I am willing to admit, however, that some objects which appeared so formally idiosyncratic and incapable of performing a practical function that I considered them to be incomplete forgings (3.1) may have been wrongly assigned.

Although it is not measurable in the strictest sense, the degree of internal coherence in terms of formal similarity and functional adaptation within the classes clearly varies. Examples of well-defined and coherent classes such as augers, needles and spurs, may be contrasted with those which are less well-defined and coherent such as awls, tanged punches and fittings. The difference may reflect the extent of relevant analogies, or in the case of fittings, the fact that only the iron part of a composite object survives, but it may also reveal areas where contemporary classification was blurred. In other words similar objects might have been used for many purposes both in a practical sense and, as I suggest in Chapter 7, other less practical senses.

Once mutually exclusive classes defined on the basis of practical function have been established, it is possible to move in either of two directions: towards either aggregation, to create classes with only a broad functional similarity; or towards disaggregation, to create further subdivisions of the classes or sub-classes. Both operations may be seen as creating classifications at a different level of economy which will be appropriate for different forms of interpretation; the former, perhaps, for evaluation of the overall structure of assemblages (6.2), and the latter for the identification of areas of functional specialisation both of a practical and non-practical nature. The creation of classes at both higher and lower levels will usually require a more polythetic approach since it will be difficult to find characteristics which are possessed by all members, and a close relationship between form and practical function is less likely to operate. Within classes, moreover, where there is an element of close formal similarity, the creation of sub-sets will demand greater emphasis on measurement of similarity and difference. In the discussion of knives (3.30 and 6.3.30), one of the largest and most varied classes in the Coppergate ironwork, I have used some very basic statistical techniques to identify aspects of patterning in the data.

The classes I have created have been assigned names which in themselves constitute a layer of interpretation. The equation of groups of artefacts with a descriptive name is a form of interpretation in itself. Since no word has meaning in itself but only inasmuch as it is attached to things or concepts. It can, therefore, never be free of a range of associations and constraints on meaning imposed by the cultural environment in which it operates. Meaning may, moreover, change over time and according to the word's use by different social groups. It is perhaps not surprising, therefore, that the terminology used to describe artefacts is a subject which generates considerable, if often sterile, debate in archaeology. There is, of course, the proper need for intersubjective agreement between archaeologists, but there is often a misunderstanding of the fact that words in relation to objects are simply labels without intrinsic meaning. In naming or labelling the classes described in Chapter 3 I have tried to combine a clarity of definition based on relevant sources with a congruence with names already in use in the archaeological literature.

These comments on terminology are also relevant to the use of analogy in archaeological classification and interpretation, and specifically to analogy derived from documentation rather than direct observation. Although we believe that the functional classes we create had meaning in past societies, this does not imply a congruence of terminology can be established unless accompanied by considerable descriptive and illustrative material. In general terms it would appear that congruence is harder to establish the further back in time one goes since language changes over time, or in strict terms, the way in which the human mind categorises the world changes. Using documentary references from the 9th-11th centuries, when a language which was related, but not closely, to modern English was current therefore requires care. Translations, moreover, may be far from accurate and there need be no criteria for deeming one version better than another. Every time meaning is taken from one context and placed in another something will inevitably be lost.

An example of the problem, to which I will return in Chapter 7.7, is the Old English word "handseax" which occurs, for example, in wills such as that of Aelfheah (Whitelock 1930, 23). It is usually translated as "short sword" which conveys the modern meaning of a weapon but the term has little meaning when related to archaeological material and it is equally likely that "handseax" refers to the archaeologist's sax, an object which is, however, unlike the sword, no longer part of contemporary culture (Seitz 1963).

2.5.2 Other criteria for formal classification

Although artefact production is usually motivated towards practical function which allows classification of artefacts on this basis to assume primacy in archaeological work, there are other bases for the classification of artefacts which will be important for understanding the methods by which and contexts in which they were made. They will cut across classification based on practical function, and can suggest links between objects and the spheres of activity in which they functioned not apparent from the classification based on practical function. As far as the 16-22 Coppergate ironwork is concerned, Chapter 4 will consider classification of: 1) the form of artefact components; 2) surface relief work; and 3) composition. All of these supplementary classifications are of importance in understanding how iron artefacts were manufactured and, to use term employed by Gombrich (1960, 85) again, the process of "matching" them to human cognition and intention took place.

CHAPTER 3

THE IRON OBJECTS FROM 16-22 COPPERGATE - A CLASSIFICATION AND DESCRIPTION

Note: 1. I have used the Catalogue numbers from the York Archaeological Trust sequence which appear in AY 17/6. On occasions, however, I have not discussed the objects in the same order for reasons which will be made apparent at the relevant points.

2. Drawings of the objects are to be found in Volume 2 in Catalogue Figures (Cat. Figs.) 1-41.

3. The geographical location of sites other than 16-22 Coppergate will be found in Appendix 3.

4. The summaries of metallographic data are derived from McDonnell forthcoming in AY17/6. For the definition of technical terms see 1.7.

5. Classification on the basis of formal features which cut across the classification in this chapter will be found in Chapter 4.

3.1 Bar iron, blanks and other scrap (Cat. Figs.1-8)

This class consists of over 650 objects for which there appears to be no practical function. In many cases their form is extremely simple, in other cases it is more complex, but at the same time irregular or idiosyncratic. Reference to recent smithing practice and to descriptions of archaeologically known smithing sites, such as 6-7th century Helgö (Lamm and Lundström

1978) and medieval Waltham Abbey (Huggins and Huggins 1973), where a similar range of artefacts has been found, suggests that these objects should be identified as iron discarded during the smithing process either unworked or during working. I accept, however, that a few may be broken pieces of finished artefacts.

For the purposes of description I have divided the material into two sub-classes according to the ratio between their width and thickness: 1) strips and bars, and 2) plates. Within each sub-class there are further divisions.

3.1.1 Strips and bars

There are some 440 objects which may be described as strips or, in the case of a few which are markedly wider and thicker than the others, bars. Both strips and bars may be characterised as having a maximum width to maximum thickness ratio of less than 4:1, and a relatively constant cross-section size and form, although many taper or narrow slightly. Evidence for working is largely confined to the results of cutting or breaking at the ends and to localised areas of flattening, widening or twisting.

The vast majority of strips are relatively straight overall, but a small number have 'L', 'S', 'U' or other less regular shapes. There are also a few with looped ends (e.g 1727, 2006, 2166).

As few strips are of uniform width and thickness it is difficult to present more than a general impression of the extent of variation in these dimensions. At one end of the scale there are some very thin strips with a maximum width and thickness of 1-3mm (e.g. 1754, 1995, 2029) and at the other there are eight objects, the product of whose maximum width and thickness is c.300 sq. mm or more (1471-4, 1654, 1893, 1894, 1974). Since they are markedly thicker than the rest of the strips I have described them as bars.

Although a rectangular cross-section is usual, a few strips have rounded or rounded rectangular (i.e rectangular with rounded corners) cross-sections. Two strips (1505, 1655) have a D-shaped cross-section and two (1535, 1700) have a diamond-shaped cross-section.

The length of strips varies considerably. There are two (1509, 1519) with lengths of 346 and 303mm respectively which are much longer than the rest and a few others exceed 150mm, but the vast majority are 20 - 85mm long.

The ends of many strips suggest the method by which they were cut or otherwise severed. The usual procedure was probably, after heating, to cut the strip on an anvil with a hammer and either a chisel or a punch with a wedge-shaped tip (e.g. 2208; 3.4). This might create a clean cut but there are also strips with stepped or 'bearded' ends where the chisel or punch has not cut the strip completely and the final break has been made by the smith manually breaking or twisting it (e.g. 1634, 1657, 1793, 1903). A smith might prefer to do this as it would prevent the punch or chisel dulling its tip on the anvil. It is also possible that on occasion tools were not used at all; the metallographic analysis of 2018 suggested that it had been simply heated and severed by tearing.

Although most of the strips and bars have fairly smooth surfaces, a few appear to have been extensively hammered and this has often resulted in a high degree of irregularity. Good examples include 1756, 1986, 2017, 2032. These may be strips which have been discarded in the early stages of manufacturing an object or may result from the unfinished manufacture of the strip itself.

Metallographic analysis (3.1.4) shows that the production of some strips (e.g. 1634 and 1930) involved the welding together of several strips, and 1624 is of particular interest in this context as it appears to be three strips in the process of being amalgamated. Since wrought iron from the bloomery often has an extremely heterogeneous structure (1.5), it would have been necessary to fold, twist and then weld strips together repeatedly to create a piece which had a relatively homogeneous structure (1.8).

3.1.2 Plates

Plates are defined as pieces of iron which usually have a maximum thickness of 6mm or less and a ratio of maximum width to thickness greater than 4:1. Evidence for working is again largely confined to marks indicating cutting and to localised flattening or bending, although a few pieces are more comprehensively distorted. These are probably scrap discarded during the manufacture of other objects or the breaking up of objects for recycling.

3.1.3 Hybrid strips and plates

There are six objects (1574, 1599, 1600, 1877, 1963, 2100) which under the terms of the definition above are part strip and part plate.

3.1.4 Metallography

One bar and 23 strips were analysed (Appendix 2). The strips displayed the same range of micro-structures observed in the finished artefacts: 1) ferritic iron, 2) iron with a phosphor content, 3) all steel, 4) piled structures, usually bands of high and low carbon iron, but also bands of ferritic and phosphoric iron.

Table 3.1 shows that the majority of strips were ferritic and/or steel and most strips were heterogeneous in composition. Only three strips (1513, 1712, 2018) could be considered wholly steel and of these only 1712 appeared to have been quenched. Six strips had piled structures of which one was ferritic, phosphoric and steel, two were ferritic and phosphoric, and three were ferritic and steel. These structures probably arose from the smith's attempt to reduce the heterogeneity of a piece or pieces of iron (1.8).

Table 3.1
Summary of micro-structures in bar and strips

(Note: on examination three objects were shown to consist of more than one strip)

Microstructure	Nos. of examples
Ferritic iron only	2
Ferritic and phosphoric iron	4
Ferritic iron and steel	12
Ferritic iron, phosphoric iron and steel	3
Phoshoric iron and steel	1
Phosphoric iron only	2
Steel only	3
Total containing ferritic iron	21
Total containing phosphoric iron	10
Total containing steel	16
Total containing piled structures	6

Three of the strips (1505, 1624, 1930) were shown to be the result of welding together one or more strips.1505 had a D-shaped cross-section and both strips had the same ferritic composition. 1624 was manufactured from two ferritic strips and one ferrite and steel strip and welding had not been completed. 1930 was a ferritic strip welded to a steel one.

Since the micro-structures match those found in the finished objects it is clearly likely that the strips were used for a wide range of artefacts.

3.1.5 Use of bar iron blanks and scrap

Determining the products into which the bar iron, blanks and scrap were made is difficult because they usually lack diagnostic features. It is clear, however, that little additional work would have been required on many of the strips to convert them into common objects such as awls, wool comb teeth, needles, nails and staples since their lengths, widths and thicknesses are closely comparable.

There are some relatively certain part-made objects from the site which will be referred to under the relevant headings. Other items may have been discarded while in the process of being formed into complete objects and they are discussed here.

Many strips exhibit such signs of working as areas of flattening or tapering, but a few may be objects a little nearer finishing than most, although the intended final form can only be conjectured. 1574 is likely to be an incomplete tool. It consists of a neatly formed elongated plate of which the sides are, at one end, folded in to form a short strip of rounded cross-section. 1997 and 2143 are tapering strips which are flattened and widened at the thicker end which suggests part-made tanged tools of some sort. 1902 is a slightly irregular strip with a well-formed hook at one end and 2019 has a rounded cross-section over half its length and is slightly wider with a rectangular cross-section over the other half which is finished with a straight chisel cut; both objects may have been tools in the making.

Two of the hybrid strip/plates (1877, 1963) are of interest because their strip parts, especially that of 1877, resemble knife tangs and their plates have roughly the dimensions of small blades. Although neither of them has a recognisable shoulder between strip and plate, it is possible that they are knife blanks.

3.1.6 Plated Blanks and Scrap (Cat. Fig.8)

There are ten objects which are plated with non-ferrous metal. Some may be fragments of broken objects, others, such as 2191 and 2199, may perhaps have been trial pieces or waste from the iron tinning operation.

TOOLS of TRADES and CRAFTS

Metalworking Tools

3.2 Anvil (Cat. Fig.8)

2200 is a small L-shaped anvil Towards the junction with the shank the working arm has three shallow transverse grooves, or swages, cut into it.

When in use an anvil of this form would have been set in a wooden anvil block and small objects of iron or non-ferrous metal could have been manufactured on it. The swages might have been of use in the production of wire or needles.

3.2.1 Metallography

Two sections showed the anvil had been manufactured from iron with both a ferritic and phosphoric micro-structure, but there was no evidence for steeling.

3.3 Hammer Heads (Cat. Fig.8)

2201 is a large smithing hammer weighing 658g, it would have been used in welding, in the drawing out of bars and strips, or for striking other tools such as punches and chisels.

2202-3 are much smaller hammer heads. 2203 has one wedge-shaped arm and one with a rounded cross-section and circular face. 2202 is badly corroded but one arm is similar to the wedge-shaped arm of 2203; the other is incomplete. These hammer heads were probably used for light metalworking in iron or non- ferrous metal.

3.4 Punches (Cat. Figs.8-9)

Twenty-two objects have been identified as metalworking punches, although in the case of incomplete objects this is not always certain.

A punch would either have been held in the hand or, if this was not possible because of the heat of the metal, gripped by rods or tongs and then struck on the thicker end or head. The necks which can be seen towards the tops of three punches (2204, 2223-4) probably provided a seating for the rods or for the tips of the tong arms.

The larger punches in this group would probably have been used for making holes in hot iron. Those which have wedge-shaped tips (2206, 2208) could also have been used for cutting up metal strips and plates or for making the decorative grooves which can be seen on many iron objects from Coppergate. The smaller punches, such as 2209, 2210, 2218-9, 2226, were probably used for working non-ferrous metal. 2219 has flecks of copper alloy adhering to it.

3.4.1 Metallography

2206 had a banded structure of four steel strips (max hardness 306 HV). 2213 had been manufactured from a ferritic iron core sheathed with low carbon steel (max. hardness 163 HV). 2220 had been manufactured from four rods each of a different micro-structure, one of which was a hard,tempered martensite (max. hardness 536 HV).

3.5 Chisel (Cat. Fig.9)

There is one chisel (2245). As a metalworking tool it could not have been hand-held to cut hot iron, but would have been satisfactory for cutting non-ferrous metal.

3.6 Files (Cat. Fig.9)

There are three files (2246-8). 2248 has four to five teeth per cm, 2247 has seven to eight and 2246 has twelve. The fineness of their teeth indicates that 2246 and 2247 were probably used in metalworking and 2246 had some fragments of copper alloy lodged in the teeth which could be the result of, for example, removing the flashing left on an object after casting. 2248 may also have been used in metalworking but the relatively wide spacing of its teeth would allow it to have been a wood or bone working tool since fine teeth easily clog up on organic material.

3.6.1 Metallography

2247 was shown to have been manufactured from two banded ferritic and phosphoric strips welded together (or a single folded and welded). It is probable that the teeth were cut in before the file was carburised and quenched. (Max. hardness 782 HV).

3.7 Clippers (Cat. Fig.9)

2249, the clippers, or plate shears would have been suitable for cutting iron or non-ferrous metal plate.

3.8 Mould (Cat. Fig.9)

The iron mould (2250) is now incomplete, but was probably used for making small copper alloy strap-ends with very simple animal head terminals.

3.9 Coin Dies (Cat. Fig.9)

Note: The two iron coin dies were catalogued by York Archaeological Trust in the numismatica series (Nos. 43 and 49; Pirie 1986, 33-7, 54, 56). I refer to them by their original small find numbers.

Sf9351 is the pile, or lower element, of a pair of dies and survives complete with tang which would have been set in a block of wood. Sf13393 is also presumably a pile although the lower part of the die and tang is missing. To strike coins the blank was placed between the face of the pile and the upper die whose head was struck with a hammer.

Woodworking Tools

3.10 **Axes** (Cat. Fig.10)

There is one near complete axe (2253) and, in addition, two incomplete pieces of neck and socket (2254, 2256) and part of a blade (2255).

2253 has a broad blade whose faces widen markedly away from the neck and is symmetrical in cross-section. Although the socket is largely missing, it may be suggested that there was a pointed projection from it which ran along the handle.

Although broad or 'bearded' axes were used as weapons in the Anglo-Scandinavian period, there is no reason why 2253 should not have been a woodman's or carpenter's tool. Goodman (1964, 27, fig.18) points out that many medieval illustrations show a broad axe in use for felling and preparing timber.

2254 and 2256 both consist of one half of a socket and neck which has been split vertically. The pronounced yet slender form indicates that they come from so-called T-shaped axes which have narrow elongated blades suitable for trimming and shaping timbers.

3.10.1 Metallography

2255 was manufactured by inserting a steel core into a ferritic body making a form of sandwich (max. hardness 363 HV)

3.11 Wedge (Cat. Fig.10)

2257 is probably a wedge used for splitting large timbers.

3.11.1 Metallography

The wedge had been manufactured by welding a steel strip, forming the the cutting edge (max. hardness 212 HV), to a phosphoric iron back.

3.12 Socketed chisel (Cat. Fig.10)

2258 is an object identified as a socketed chisel with a blade which widens away from the socket and is slightly curved.

A number of objects which are similar in form and size to 2258 are known from 9th-11th century contexts, the most closely comparable being examples from Skerne, North Humberside (unpublished) and Hedeby (Jankuhn 1943, 123, Abb.50). Their function does not, however, appear to be universally agreed upon since they have been identified both as woodworking and as agricultural tools.

McGrail (1977) discusses a number of tools with blades which widen out from a socket. He prefers to use the term "slice", defining it as "...a broad flat chisel used by shipwrights and boatbuilders and potentially of use in other woodworking trades" (ibid., 62) and he cites Salaman (1975, 43), who states that a slice "...is generally used for trimming timber and for removing waste where the adze cannot reach." In this case, McGrail concludes, it would be used with a "...planing or pushing action", although it would seem equally possible to use a downward chopping action on vertical timbers.

In a number of Scandinavian sources socketed blades similar to 2258 are identified as agricultural tools. Petersen (1951), for example, refers to a group of four (517, figs.93-6), one of which (fig. 93) appears closely comparable to 2258, as "celts" for breaking or tilling the ground. It is of interest, however, that a replica of one of Petersen's celts was used successfully as a woodworking slice at the Moesgård Institute of Archaeology (McGrail 1977, 64).

3.13 Shave (Cat. Fig.11)

2259 is a drawknife or shave comparable to those which still form part of the traditional carpenter's or cooper's tool kit (Kilby 1977, 20) and would usually have been used for shaping the staves for vessels such as buckets and barrels.

3.14 Augers (Cat. Fig.11)

There are three complete and five incomplete spoon augers or spoon bits (2260-6/8) and one twist auger fragment (2267).

The handles rarely survive on early augers, but they were probably winged and fitted transversely on to the tang (Goodman 1964, fig.165). The use of a rather different form of handle which allowed the auger to be braced against the chest is also known, however, and an example of a 'breast auger' is shown in use in the Bayeux Tapestry (Stenton 1957, fig.38). With whatever form of handle, however, the auger was basically used for boring or enlarging holes in wood.

2267 may be the tip of a twist auger or gimlet which would have been used for starting holes in wood.

3.14.1 Metallography

A cross-section through the blade of 2265 showed it had been manufactured with a steel core (max. hardness 420 HV) around which was a sheath of a predominantly piled structure. Subsequent use and re-sharpening had caused the steel to be exposed towards the base of the blade leaving the softer piled material on the cutting edge. This may account for the discard of the object.

3.15 Small gouges (Cat. Fig.12)

Small gouges like 2269-70 could have been used for such delicate jobs as making rebates and mortices such as, for example, that around the base of stave-built vessel 3055 (Cat. Fig. 23).

Textile working tools

3.16 Wool Comb (Cat. Fig.12)

2273 comprises two pieces of a wool comb. Itoriginally consisted of a rectangular wooden board with two rows of not less than sixteen iron teeth projecting vertically from one face. A binding sheet of iron had then been wrapped around the block and attached to it with small nails. The comb would originally have had a wooden handle made in one piece with the board. The identification as a wool comb was confirmed when wool fibres were found around the base of the teeth (Walton 1989, 315). 2272 is probably a piece of binding plate from another comb.

Wool combs were used to prepare wool for textile production. After cleaning, the raw wool was combed to remove foreign matter and short fibres, and to align the other fibres in parallel formation. The combs were probably used in pairs, one holding the wool and the other drawing it out. In order for the combing to be effective the wool had to be greased and the comb teeth had to be heated to allow them to pass through the fibres easily. When the combed fibres were spun they lay flat and close to one another, creating a smooth hard yarn.

It is also possible that similar tools were used for the preparation of flax. An object very similar to 2273 from Århus (Andersen et al. 1971, 138-9, ELA) is referred to as a flax heckle; it was found in a Grübenhaus where there was apparently other evidence for flax preparation. Hoffman (1964, 285), however, comments that many of the objects referred to as flax heckles in Scandinavian publications are probably wool combs since their distribution does not, on the whole, correspond to areas where flax can be cultivated.

3.17 Wool Comb Teeth (Cat. Fig.12)

There are 185 spikes over 65mm in length from the site which are similar in form and thickness (maximum 5-8mm) to those found in the wool comb 2273 and the vast majority, if not all, are probably wool comb teeth.

The teeth may be divided into two groups of roughly equal size on the basis of their cross-section. One group has rounded or rounded rectangular cross-sections, akin to those in 2273, and the other has rectangular or square cross-sections. There is a marked concentration of lengths (c.90%) between 75 and 115mm (Fig. 3.1).

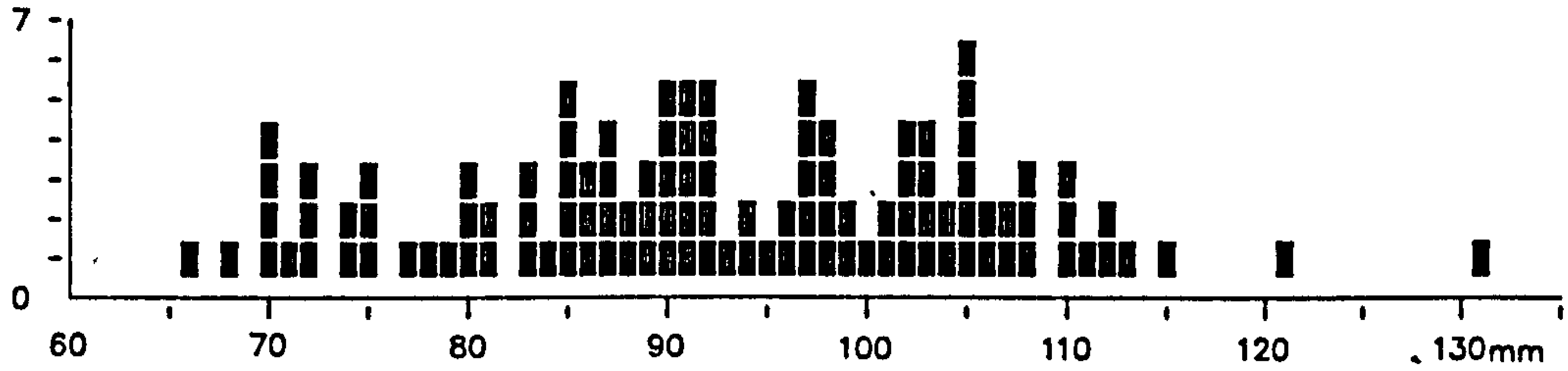


Fig.3.1 Length of unbroken wool comb teeth

3.18 Needles (Cat. Fig.12-3)

There are 150 needles and in addition, 70 objects which are probably needle shanks from which the head has broken off. There are eight possible part-made needles.

Needles may be divided into two groups according to the way in which the heads were made. One group has heads formed by flattening the end of the shank and then punching an eye into it. There are probably 93 needles with punched eyes, 65% of those whose head form can be determined.

There are 51 needles in the second group, 35% of those whose head form can be determined. They are known as "Y-eyed" by Rollins (1981, 7-8). In view of the way the shank of 2529 has split (Cat. Fig.13), their heads were probably formed by welding two very thin strips together leaving the area of the eye unwelded except at the top. The result is that the eye and head of a Y-eyed needle is usually lentoid.

The length of the complete needles varies between 23mm and 73mm but 57 (72%) are between 40mm and 60mm long (Fig. 3.2).

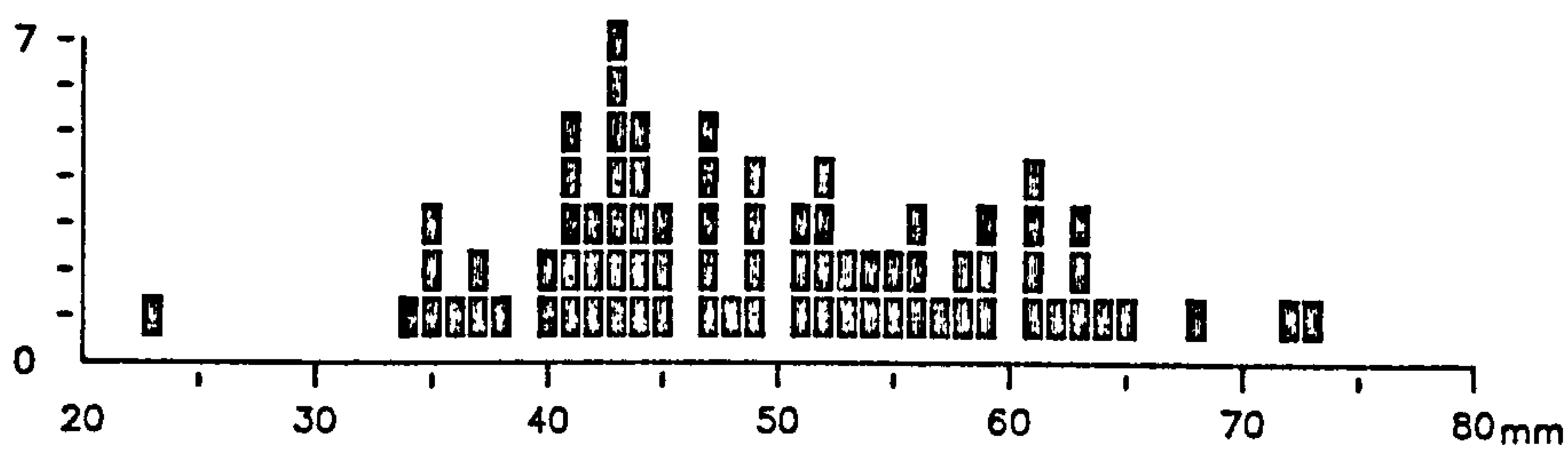


Fig.3.2 Length of unbroken needles

The Coppergate needles were clearly intended for a wide variety of sewing needs. The shorter, thinner needles might have been used for sewing thin materials, not only woollen cloth, but also linen and silk, whereas longer and thicker needles would probably have been used for sewing several layers of cloth together or for thick materials such as sacking, sail cloth or leather. All of these materials were found on the 16-22 Coppergate site (Walton 1989). The advantage of sewing with a Y-eyed needle, with its relatively elongated eye, is that it is possible to use a greater thickness of thread for a given eye width since a thick thread can always be flattened to pass through the eye; it is not necessary, therefore, to make as large a hole in the fabric when sewing as would be created by using a punched-eye needle.

The eight objects (2680-7) which I suggest are part-made needles are thin tapering strips of rounded cross-section whose heads have been flattened, but not pierced.

3.18.1 Metallography

2488 and 2609 had hot-worked and quenched tips (max. hardnesses 488 and 126 HV) while 2464 had been cold-worked (max. hardness 297 HV)

3.19 Shears (Cat. Figs.13-4)

The only complete pair of shears is 2688, but the original form and dimensions of 2689, 2690-1 and 2696 can be determined from what remains.

The shears' bows are all slightly looped. The shoulders are at right angles to the stem, slope a little, or are concave. Most distinctive, however, are the shoulders on 2689 and 2690, which have one and two steps respectively.

The longest pair of shears whose complete length can be determined is 2689 (188mm), but blade 2697 must have come from a rather longer pair. These large shears may have been used for shearing sheep. The majority of the Coppergate shears were probably used in weaving and sewing cloth or in leatherwork, but small shears, such as the pair from which 2693 comes, may have been personal toilet items.

3.19.1 Metallography

Examination of the blade of 2694 showed it had a hard quenched and tempered steel cutting edge (max. hardness 726 HV) butt-welded to a back of lower carbon content.

3.20 Tweezers (Cat. Fig.14)

There are four pairs of tweezers (2701-4). They may have been used in cloth preparation for removing extraneous particles after weaving, although the three smaller examples (2701, 2703-4) may have been used in personal toilet.

The arms of 2702 are flat strips which have pointed tips and are riveted and crudely welded together at the head. The head is then flattened into what may have been a bowl-like feature, but it is unfortunately largely incomplete. There is also a flattened, but again broken, projection above the point where the arms of 2703 are welded together. These projections at the head may perhaps have developed into pierced terminals which allowed the tweezers to be carried on a belt.

3.22 Harbick (Cat. Fig.14)

Note : at the time of compiling AY17/6 3410 was assigned to spirally-twisted strips and fittings (3.49) and not recognised as a harbick, hence its catalogue number.

Harbicks were used to attach woollen cloth to a shearboard on which the nap would be raised and sheared to give a soft finish. They can be seen in medieval illustrations including a misericord from the church at Brampton, Huntingdonshire (Carus-Wilson 1957, pl.15C) which shows the process taking place.

Leatherworking Tools

3.22 Leatherworker's awls (Cat. Fig.14)

There are eighteen objects (2712-3, 2718-26, 2731-2/4-6/8, 2743) which I have identified as leatherworkers' awls because they have arms, or an arm, of diamond-shaped cros-section. Awls of this form pierce leather without tearing it (Attwater 1961, 28); and they are still used today.

3.23 Creasers (Cat. Fig.14)

There are four objects (2744-7) which are probably double-armed leather creasers. They each have a tapering tang which would have been set in a wooden handle, and two arms which curve forward near the tip.

Creasers were used for finishing leather products. The arms were heated and run along the surface of the leather at its edge. One arm compressed the leather just inside the edge to prevent fraying and at the same time made a dark shiny line which was also considered decorative. The other arm regulated the distance of the crease line from the edge (Attwater 1961, 5; Salaman 1986, 247).

Other Awls and Tanged Punches

(Note: The awls are catalogued in AY17/6 the same sequence and discussed under the same heading as the leatherworkers awls, and tanged punches were catalogued as metalworking tools. In both cases the catalogue numbers remain unchanged here.)

There are 37 objects which have two tapering arms for which no specific craft function can be readily assigned. Their form suggests, however, that they were used for piercing or making impressions, one arm being the tang seated in a handle and the other the working arm.

These objects may be divided into two groups depending principally on whether the arms are of equal or unequal length. I have described the former as awls and the latter as tanged punches, except in the case of a few items with arms of equal length, but which are larger and more robust than the rest of the awls which have also been described as tanged punches.

3.24 Awls (Cat. Fig.15)

There are twenty awls, including a few incomplete single tapering arms. Eleven have a rectangular cross-section on both arms, the others have one or both arms of rounded cross-section.

3.25 Tanged Punches (Cat. Fig.15)

There are seventeen objects which I have classified as tanged punches, three of which (2232, 2237-8) have arms of roughly equal length.

The tangs all taper to pointed or wedge-shaped tips and are also, with one exception (2231), shorter than their working arms, usually making up between a quarter and a third of the object's length.

2244 is an object for which there are no obvious parallels. It consists of a small block of rounded cross-section which has a short thin strip projecting from one face. It is possible to interpret the strip as a tang which was set in a wooden handle leaving the head to serve as a form of punch.

3.25.1 Metallography

A section from the tip of 2237 showed it had been manufactured from a rod consisting of three bands, the two outer were phosphoric and the central one, originally forming the tip was a mixture of ferrite and pearlite and, therefore, harder.

Agricultural Tools

3.26 Spade Iron (Cat. Fig.15)

2748 is the sheathing fitted to the base of a wooden spade blade.

The sides are peculiar in that they slope inwards which seems to suggest a blade which was at its widest at the tip. This is, however, probably an irregularity and a blade with straight parallel sides is likely.

3.27 Sickle (Cat. Fig.15)

2749 is a relatively wide blade with a markedly curving back and rounded tip which is probably part of a sickle.

3.28 Pitchfork (Cat. Fig.15)

2750 is the robust prong of a two-pronged fork, probably a pitchfork .

3.29 Bells (Cat. Fig.15)

There are two small bells (2752-3) which are similar to those still used for cattle and sheep in many parts of the world. They are virtually identical in size and form and were made from a single sheet of iron which narrowed inwards to a central waist (as shown in Cat. Fig.15). This sheet was folded over at the waist and the seams were brazed together. The tops of the bells had two small holes punched in them and a ring was inserted which served both as a handle and mount for the clapper.

3.30 Knives (Cat. Figs.16-20)

3.30.1 Introduction (see Fig. 3.3 for descriptive terms)

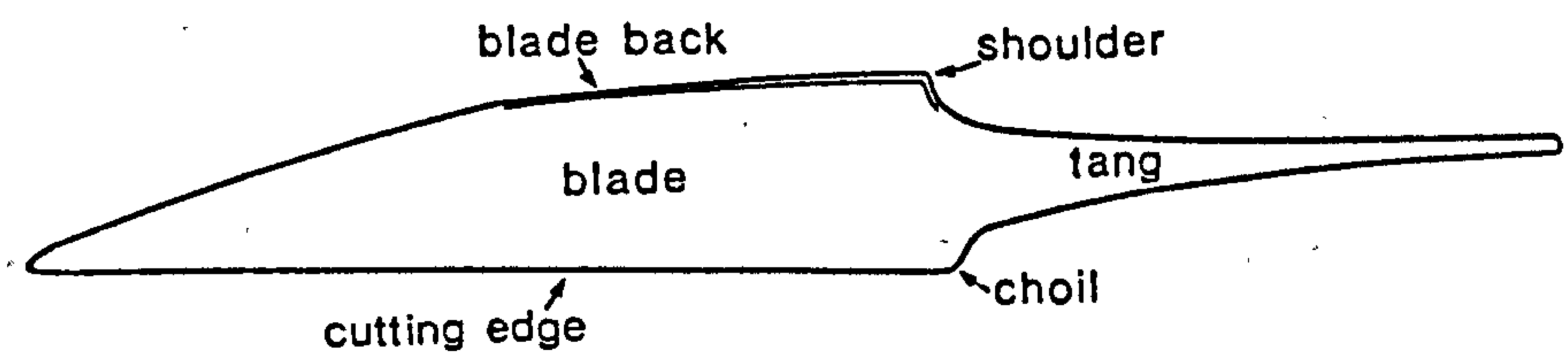


Fig.3.3 Descriptive terms used for knives

There are 211 knives which have, or had, a simple tapering, or whittle tang. Seventy-nine have both their blades and tangs surviving apparently unbroken and a further 49 have blades which are unbroken, although their tangs are incomplete.

The size and diversity of the assemblage provides an opportunity to put into practice some of the methods of classification advocated in Chapter 2 as improvements on more intuitive approaches.

A combination of the formal attributes of shape and dimensions has been used for the classification of knives. The former include aspects of both overall blade shape and more localised surface features. Appendix 4 gives details of all the knife attributes analysed.

One of the problems of classifying knives is to assess the extent to which original form has been changed by wear and sharpening. This has clearly occurred on many knives, but to different degrees and is difficult to measure. I, therefore, began by looking at the form of the blade back since it is not only one of the most distinct features of a knife but unlikely to have been greatly affected by use except perhaps towards the tip. Five back form groups were identified, A-E, two of which, A and C, have been further divided into three sub-groups and one of which, B, divided into two sub-groups.

A blade's back form was determined first of all by placing it against a straight edge to establish whether it had two straight parts meeting at an angle (back form A), a straight rear and curved front part (concave, back form B, or convex, back form C), a wholly curved back (back form D), or a wholly straight back (form E). Secondly, any knife which had a blade back which was wholly straight or had a straight rear part (all forms except D) was placed on a horizontal line between the tip of the blade and the mid-point of the tip of the tang to determine whether the rear part of the back sloped up, down or was horizontal. The position of the blade and tang tip of some of the incomplete or bent knives could be satisfactorily estimated, although 34 knives were either too incomplete or too corroded for any assessment of their back form to be possible (they are referred to as back form I in all tables below). The position of the blade tips was also noted. When the knife was placed horizontally, as described above, the tip might be below the mid-point between shoulder and cutting edge, opposite that mid-point, or slightly above it at roughly one third of the way down from the shoulder.

Cutting edge form was also considered at this stage and, although difficult to describe, six forms (a-f) have been defined.

Finally, the classification of overall knife form was completed with an analysis of measurements as follows: total length, length of blade, maximum width of blade, and maximum thickness of blade. Three ratios were also calculated to give some impression of the knives' proportions: the ratio between overall length and the length of blade; the ratio between the length of blade and width of blade; and the ratio between the length of blade and the distance from the shoulder to the point where the back appears to curve or slope downwards to the tip (back form D excepted).

3.30.2 Description of knives by blade back form

Back form A

There are 34 knives with blades which may be described as having 'angle-backs' because at some point between the shoulder and the tip there is a relatively abrupt change of line.

The rear part of the back may be either horizontal and therefore roughly parallel to the cutting edge (form A1) or, much more commonly, upward sloping (form A2). There is also one knife blade (2810) the rear part of which is slightly downward sloping (form A3). Three are too corroded to assign to a particular variant (form Ai). Knives, such as 2799, 2809 and 2951, where the front part of the blade is slightly concave, are referred to below with a 'c' suffix, e.g. A1c.

Back form B

Two knives, 2800 and 2811, have blade backs with a straight rear part, which is horizontal (form B1) on 2800 and upward sloping (form B2) on 2811, and an elongated concave front part. Although a few angle-back knife blades (e.g 2809) are very slightly concave at the front, the feature is much more pronounced on these form B blades.

Back form C

In addition to the knives in back form groups A and B, there are another 98 whose backs run straight or very nearly so from the shoulder, but they then become convex and curve downwards to the tip.

Eighty-three of these knives are sufficiently complete to be divided into three sub-groups: C1, in which the blade backs are straight and horizontal before curving down to the tip (43 examples), C2, where they are straight and upward sloping (ten examples) and C3, where they slope downwards (30 examples). The difference between knives assigned to the three sub-groups may, to a large extent, be due to differential wear of the cutting edges. For example, this may have caused a once horizontal back to appear to slope downwards; and, it may be noted, many of the blades in groups C1 and C2 have cutting edges which are straight, or only curve upwards slightly at the tip, whereas a high proportion of knives in group C3 have the elongated S-shaped cutting edge which probably results from prolonged wear (3.30.3). It should also be noted that the blades of C2 knives are quite similar in proportion as well as in form to the angle-back blade form A2. Those blades which cannot be ascribed to a particular sub-group will be referred to as form Ci.

Back form D

There are 43 knives in group D with blades whose backs are slightly convex and curve downwards from the shoulder to the tip, although in other respects they are often very similar to blades in groups C1 and C3.

Back form E

There is one knife (2939) with a blade back which is unique in being more or less straight and horizontal from shoulder to tip.

3.30.3 Cutting edges

The form of the knives' cutting edges is difficult to classify because of the irregularities created by wear and sharpening. It is, nonetheless, possible to distinguish, to some extent, between worn and unworn cutting edges and identify six relatively distinct forms (a-f). As originally manufactured it is likely that there was either a slight step down at the choil from the tang to the cutting edge or, less commonly, the line of the tang and cutting edge was continuous (e.g. 2804). The cutting edge itself would have been either slightly convex (form a), or straight for its whole length (form e). Amongst the Coppergate knife blades there are about 30 which are slightly convex (e.g. 2820, 2895). There are only thirteen cutting edges which are straight from choil to tip (e.g. 2767), but another 32 or so are straight and curve upwards slightly at the tip (form f; e.g. 2761, 2822). Wear and sharpening of a cutting edge often appears to give it an elongated S-shape or something similar (form c; 74 examples). This feature is usually quite slight but may, on occasions, be more pronounced (form d; e.g. 2827, 2913, 2928, 2957). These cutting edge forms occur relatively frequently on knives in all the major back form groups except, as noted, on C3 blades where the majority are S-shaped. In addition to the S-shape the effect of wear can be to create a concave cutting edge (form b, 7 examples; e.g. 2954) or more irregular forms.

3.30.4 Dimensional patterns

Among the seventy-nine knives which appear to survive unbroken there is a considerable difference between the shortest (2858), 81mm long, and the longest (2756) 230mm long, but 50 are between 80 and 120mm. The data on knife length is summarised in Fig.3.4.
Of the 128 blades which appear to survive unbroken the shortest belong to 2912 and 2938 (37 and 39mm long respectively), while the longest belongs to 2811 which

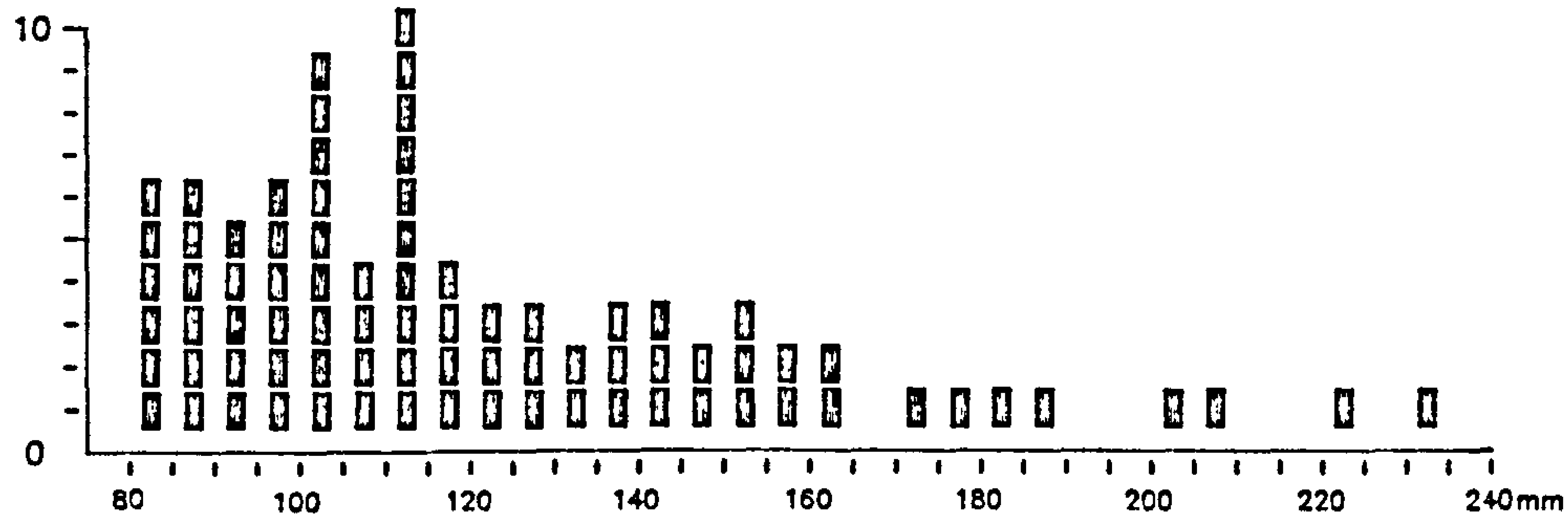


Fig.3.4 Length of unbroken knives (intervals at 5mm) Average: 121.25mm

at 191mm is substantially longer than the next longest blades, 2939 (150mm) and 2809 (148mm). Between the shortest and longest there is a concentration of lengths between 45 and 85mm. One hundred and fourteen (89% of the sample) fall within this range (Fig.3.5).

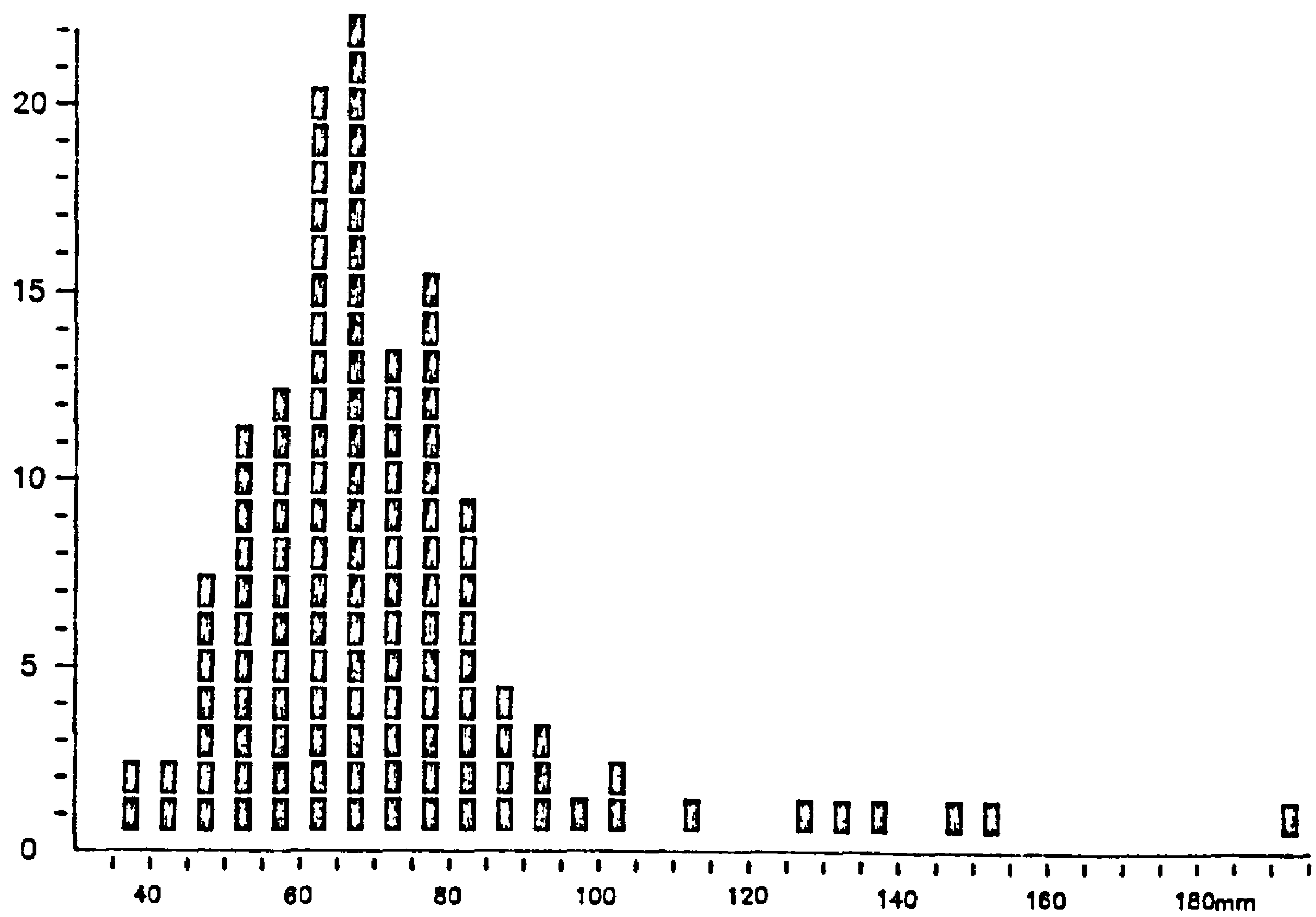


Fig.3.5 Length of unbroken knife blades (intervals at 5mm) Average: 71mm

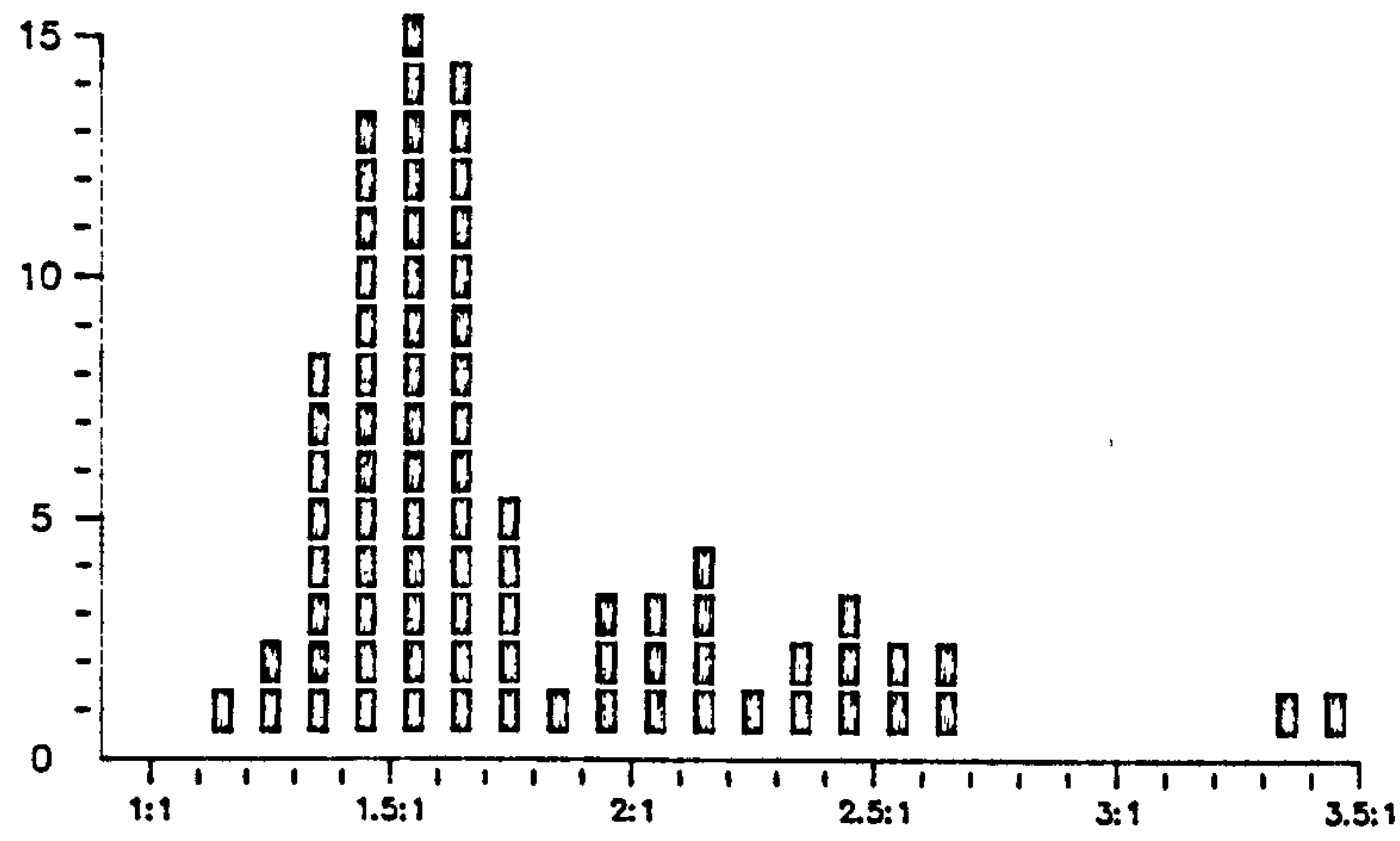


Fig.3.6 Ratio of knife length to knife blade length (.10:1 intervals) Average: 1.75:1; Average for blade back form A: 1.59:1

With regard to variation in the ratio of total length to blade length for unbroken knives, the majority (63%) are between 1.30:1 and 1.69:1, i.e. the blades occupy between 58 and 77% of the knife's length. There are also 18 unbroken knives, in addition to nine now incomplete knives, which have, or clearly had, ratios over 2:1, indicating that their tangs were longer than their blades. Fig.3.6 suggests, moreover, that there is an element of bi- modality in the data and the possibility of a sub-group within the knives based on this ratio is discussed further below (see also Fig.3.10)

The relative width of the blades is difficult to assess because it may vary considerably over their length, but Fig.3.7 shows the extent of variation in that of unbroken blades. Of the nine blades with widths of 20mm or more all but two (2811 and 2916) have back form A.

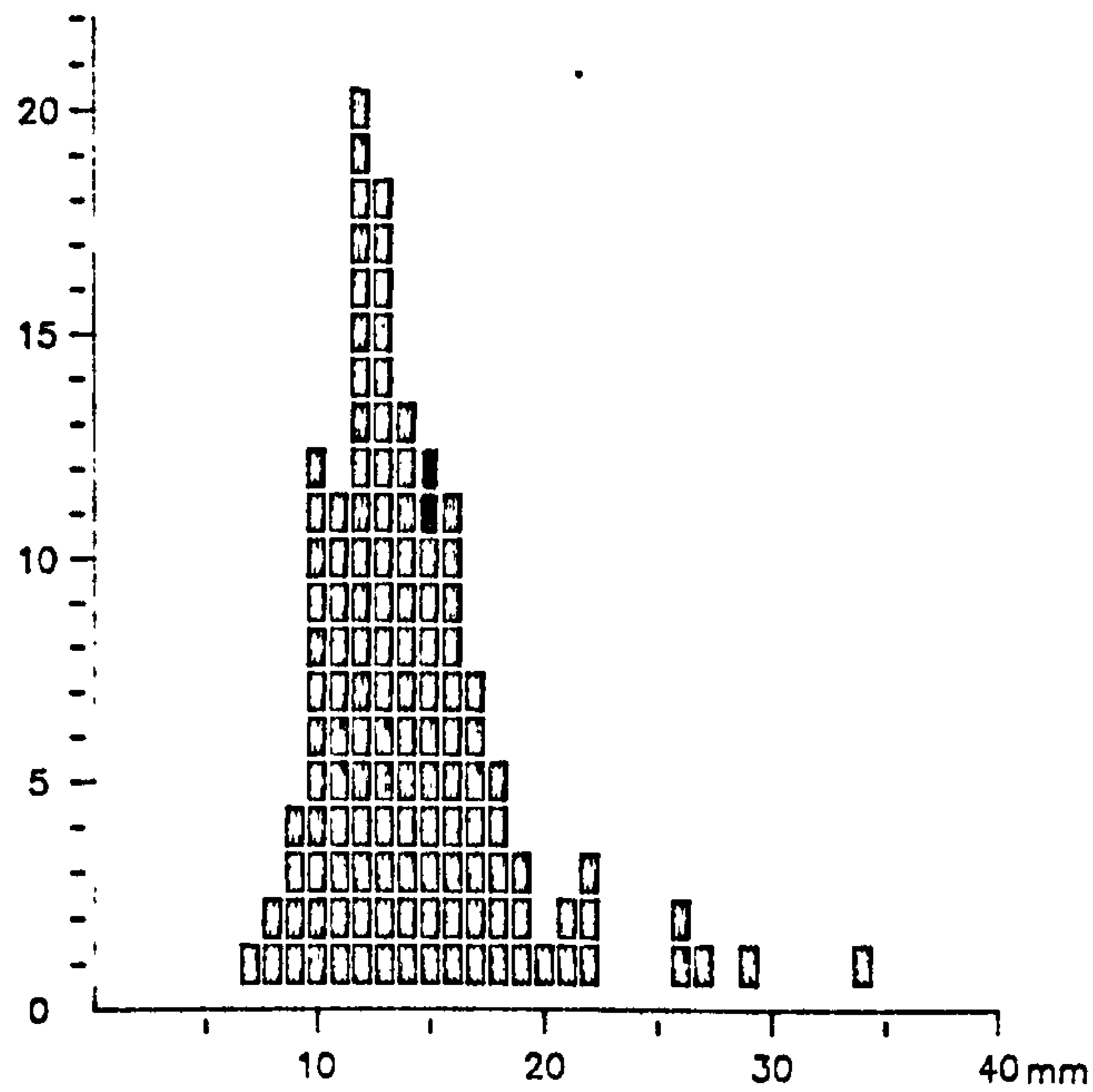


Fig.3.7 Maximum width of (unbroken) knife blades
Average: 14mm; Average for blade back form A: 18.25mm

Fig.3.8 shows the range of variation in ratio of blade length to blade width. Blades with back form A have a distinctly lower average ratio than the rest.

It is difficult to measure accurately the distance from the blade shoulder to the points where the blade back of knives in groups A, B and C change line and begin to slope or curve downwards, but an impression, at least, of the variation in the ratio between overall blade length and this distance is given by Fig.3.9.

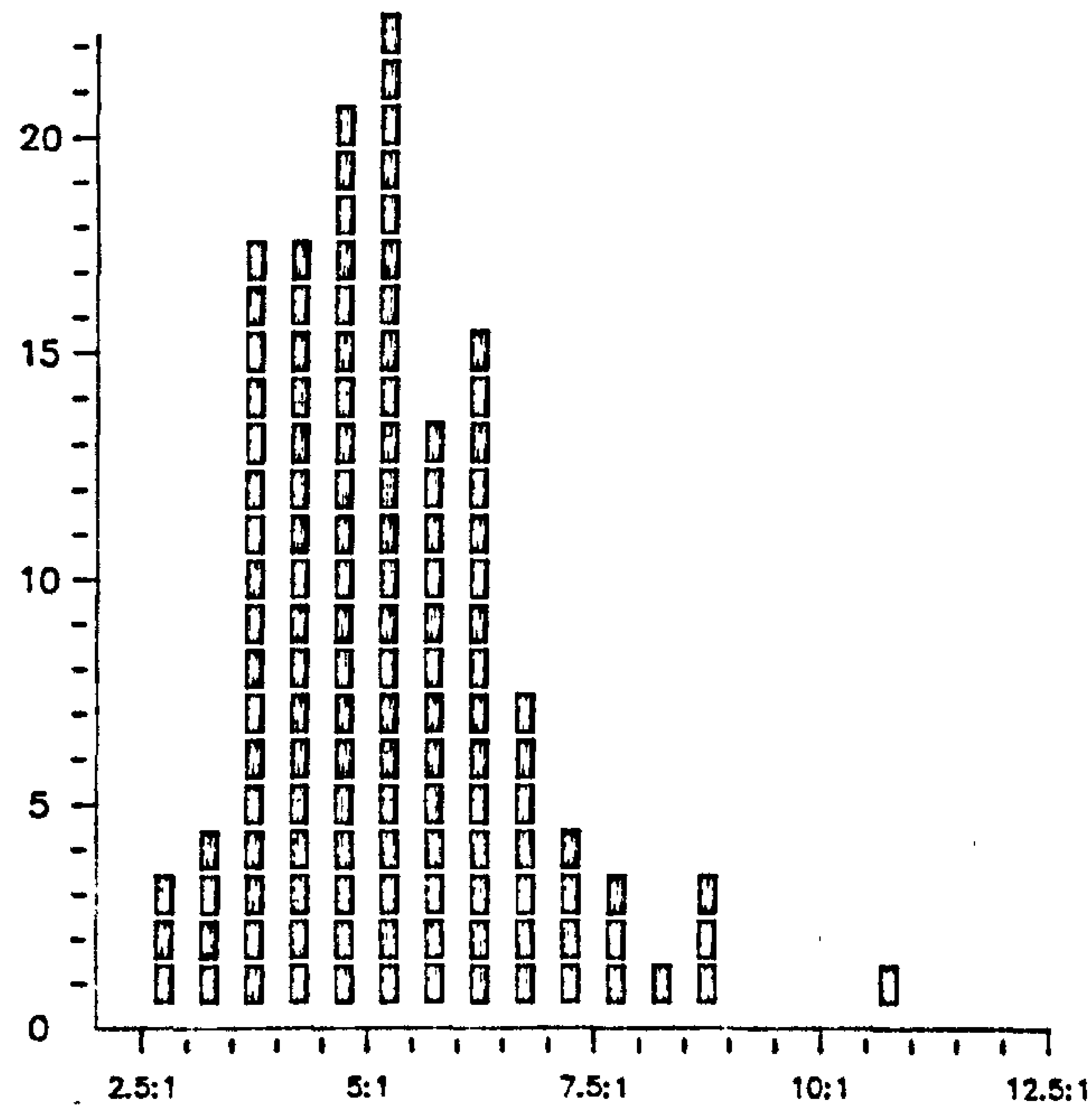


Fig.3.8 Ratio of length of blade to width of blade (intervals of .50:1) Average: 5.21:1; Average for blade back form A: 4.37:1

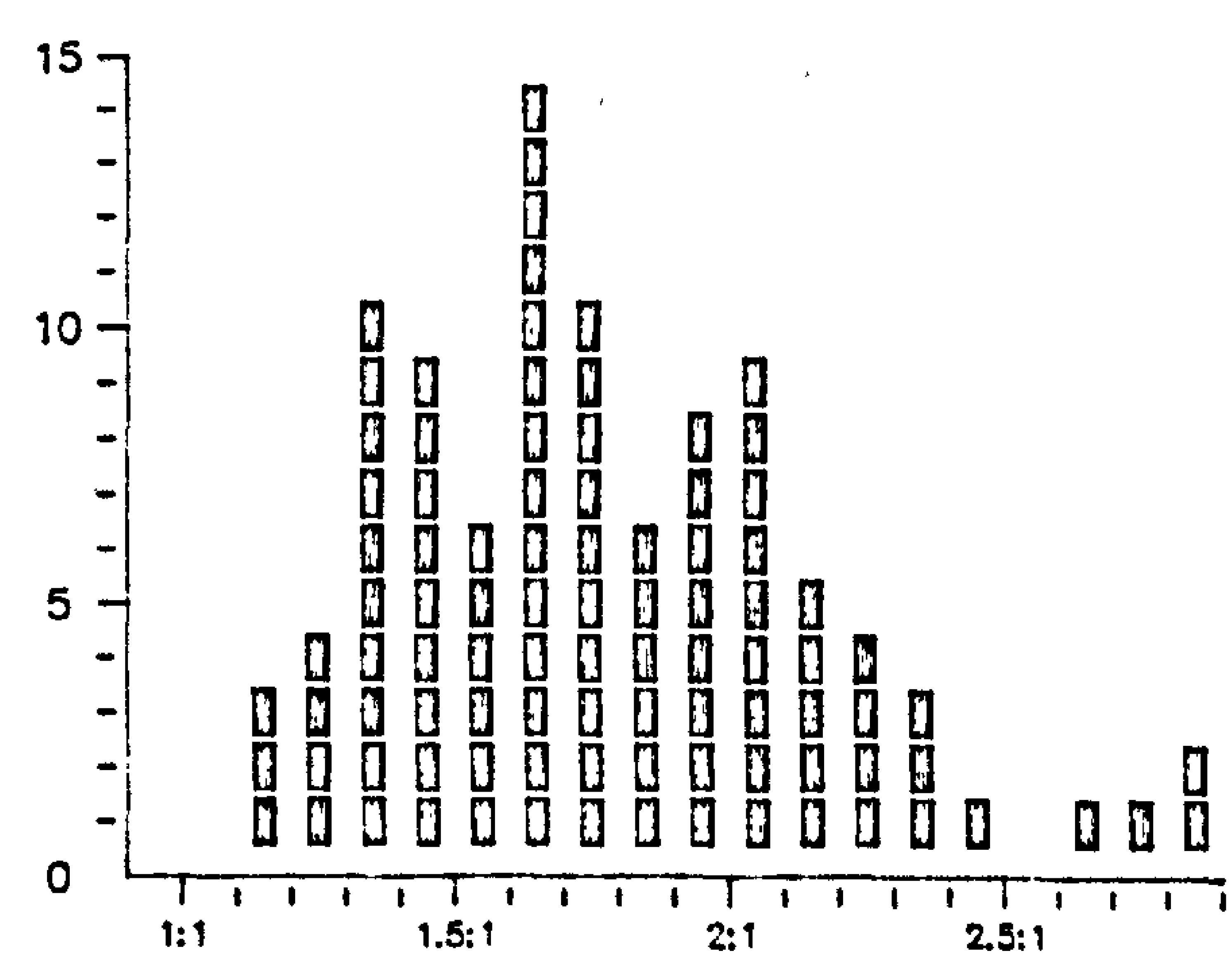


Fig.3.9 Ratio of length of blade to length from shoulder to point where line changes (blades with back forms A, B, C) (.10:1 intervals) Average: 1.74:1; Average for blade back form A: 1.99:1

There is a wide variation but 48 (51%) of unbroken blades have ratios between 1.30:1 and 1.80:1, i.e. the rear part of the blade forms c.56-77% of it. It is also the case that a knife blade with the angle-back form is rather more likely to change line at around half the blade's length than a knife with back form C.

The patterning in knife dimensions may also be expressed by scattergrams showing the extent of correlation between the principal variables. Fig.3.10 shows the relationship between overall length and length of blade and suggests the presence of two groups in each of which correlation is good throughout the greater part of the range of the two variables. Knives with a length to length of blade ratio of over 2:1 are, however, separated from the remainder of the knives by a gap in which few points are present and it is the size of this gap which provides further evidence to add to that suggested by Fig.3.6 above for a distinct sub-class of knives based on the length to length of blade ratio.

KEY

Open circles = knives of all back forms except A

Closed circles = knives with back form A

Triangles = Knives with ratio of length to length of blade greater than 2:1

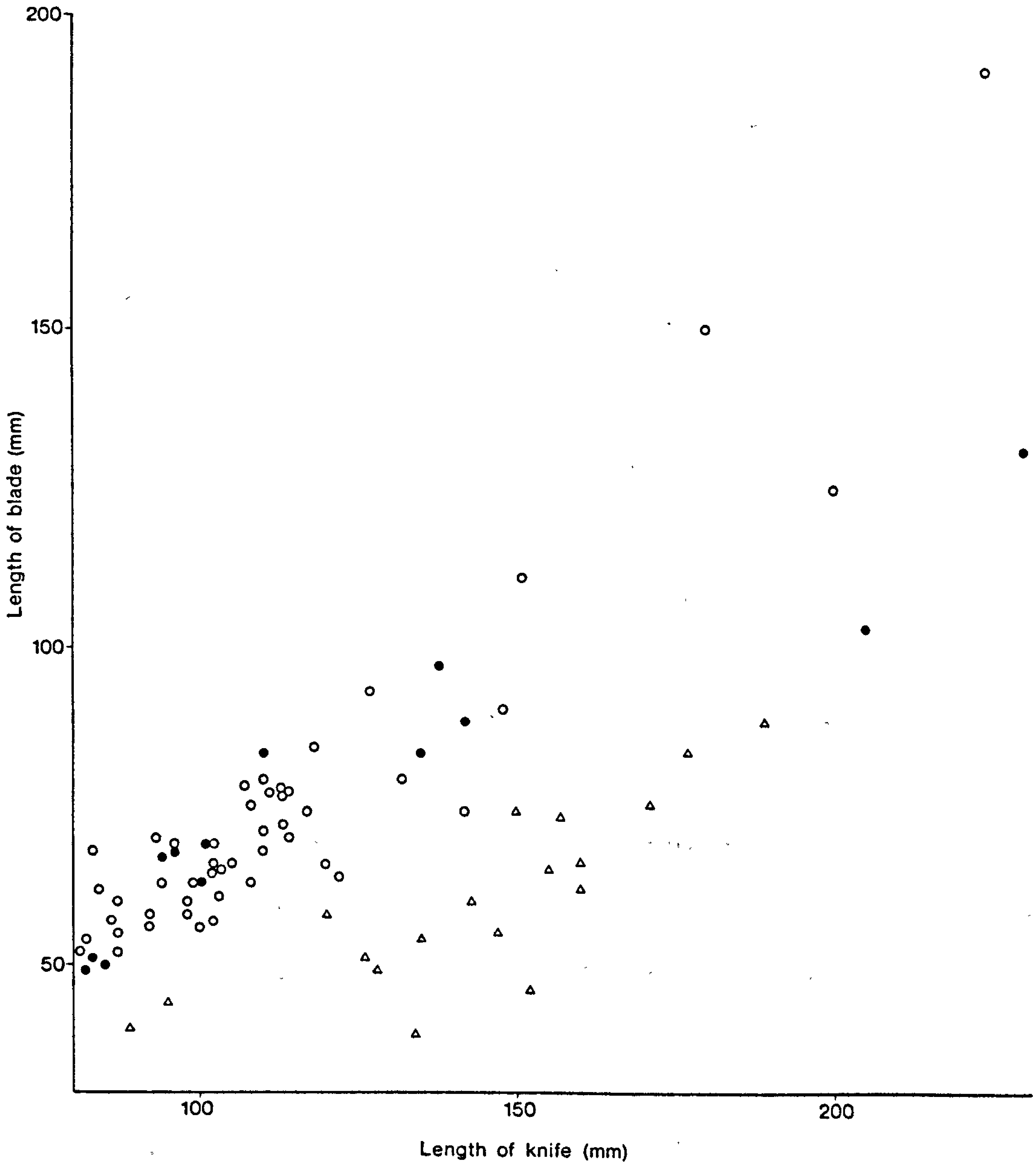
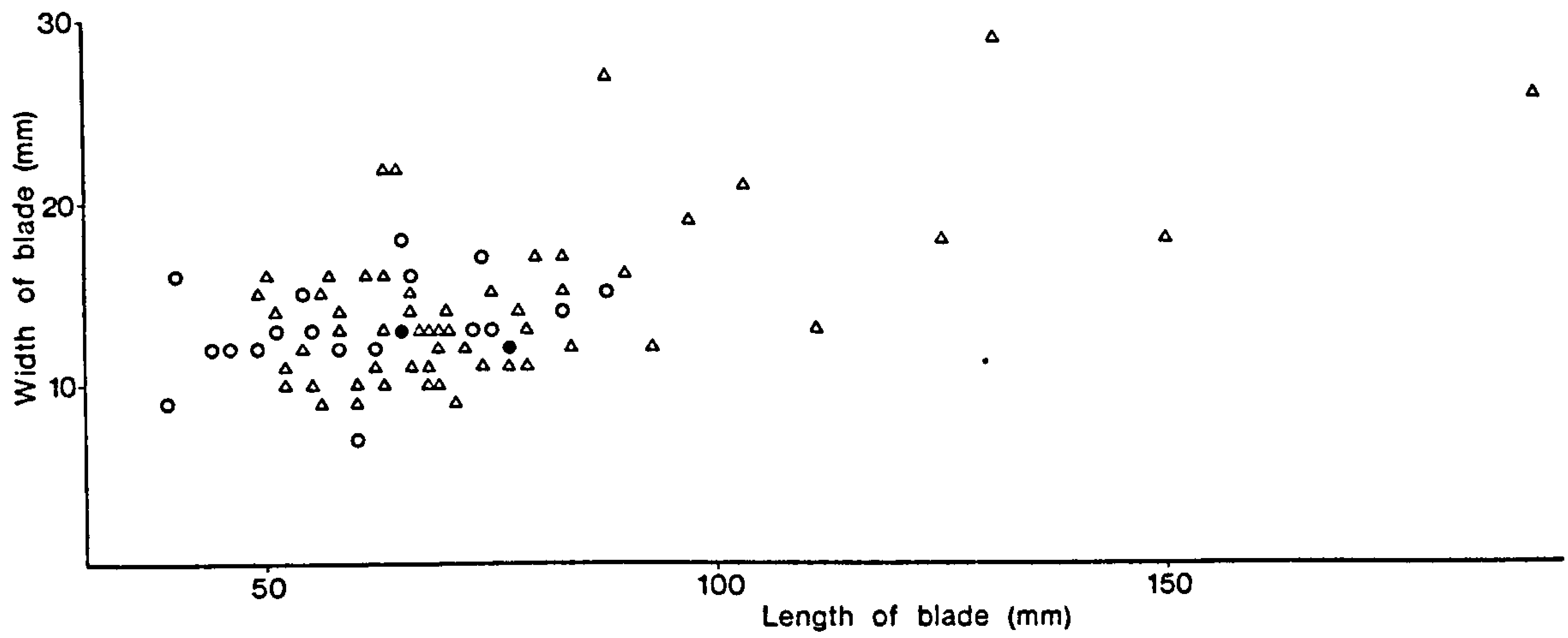


Fig.3.10 Scattergram showing the correlation between length of knives and length of blades



KEY

Triangles = knives of all back forms except A

Circles = knives with back form A (closed circles = 2 examples)

Fig.3.11 Scattergram showing the correlation between length of blades and width of blades

Fig. 3.11 shows that there is some correlation between length of blade and width of blade, although width increases to a relatively small extent as length increases. There does not appear to be evidence for any variant sub-groups in the scattergram, although knives with back form A are largely in the upper part of the distribution. In Fig.3.12, however, which shows the relationship between length and the length to width of blade ratio, blades with back form A are concentrated in the lower part of the distribution and, as noted above, this suggests that they are somewhat distinct group from the rest of the knives.

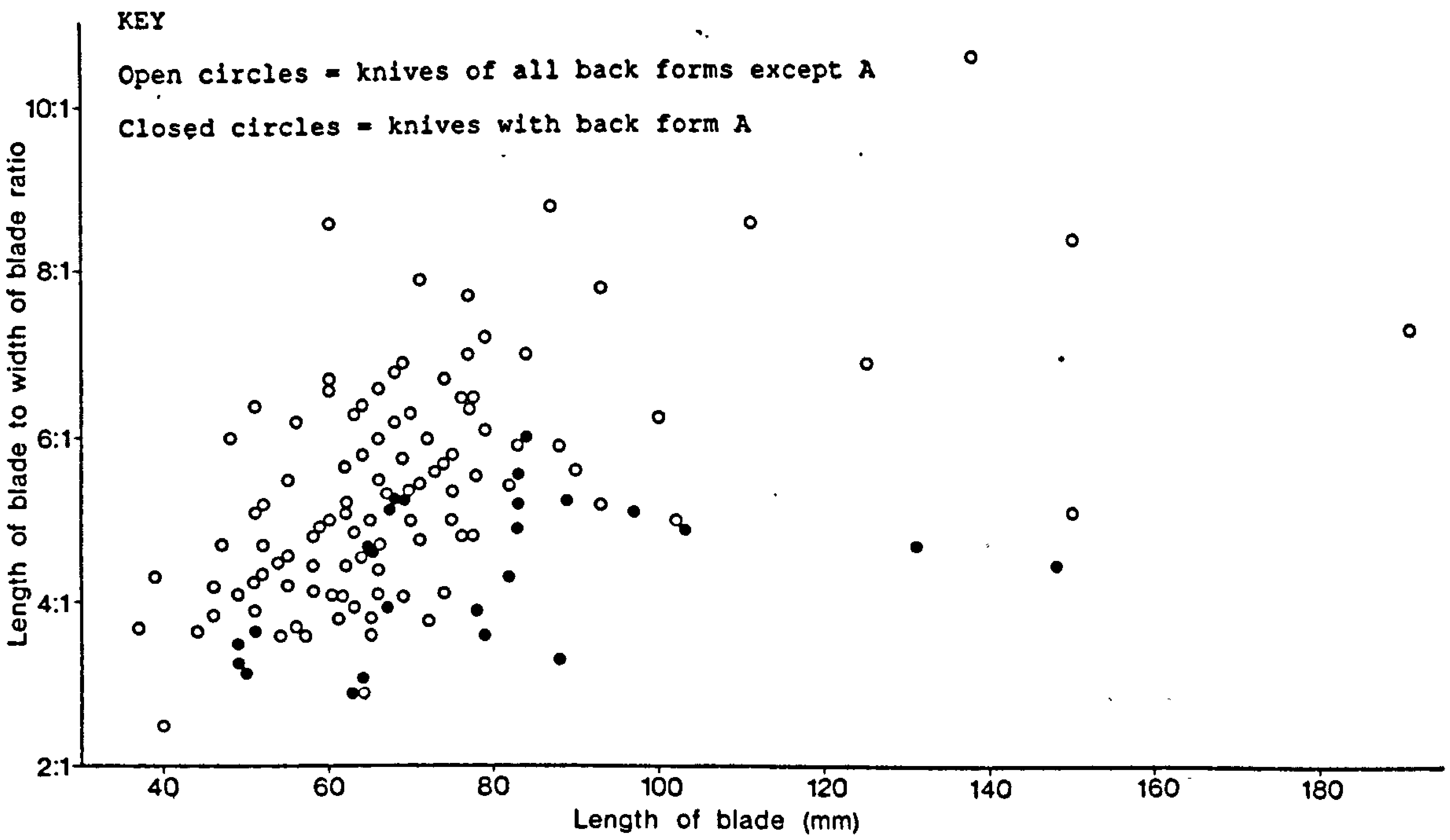


Fig.3.12 Scattergram showing the correlation between length of blade and length of blade to width of blade ratio

3.30.5 Formal analysis conclusion

Although the sample on which the analysis of knife form is based is small, certain trends in the formal data outlined above suggest the existence of sub-sets in the knives. Two in particular may be proposed: one whose members share back form A and the other whose members share a ratio of length to length of blade of greater than 2.00:1. It may be noted with reference to the discussion in Chapter 2 that these are sub-sets based on monothetic classification in the sense that members must share one attribute, but the full significance of patterning only emerges when a polythetic analysis is undertaken. This demonstrates the point made in 2.5.1 that polythetic classification is usually more valuable at sub-class than at class level.

Apart from their distinctive form, knives with the back form A may also be distinguished by the following features: 1) a maximum blade width on average greater than that of knives in the other back form groups (Fig.3.7); 2) blades on average wider in relation to their length (Fig.3.8); 3) the correlation between length of blade and the length to width of blade ratio shows a different pattern from the rest of the blades (Fig.3.12); 4) the distance along the back at which a change of line occurs is on average slightly shorter than that on knives in back form group C (Fig.3.9) ; 5) they include no knives whose tangs are longer than their blades. (See also 3.30.6 below for further evidence).

The slight evidence for a distinct group of knives with tangs over twice the length of blades shown in Fig.3.6 appears to be confirmed by the scattergram in Fig.3.10. There are 27 knives which have or clearly had the feature and they have blade back forms C1, C3 and D, but not A or C2. In general they have relatively narrow blades and also appear to have relatively heavily worn cutting edges; twenty of the group have the S-shaped form.

3.30.6 Blade surface features

Sixty-five knife blades (31% of the total) exhibit unusual surface features which may be divided into two basic groups. One includes features which modify the usual triangular blade cross-section shape, the other includes features which have been cut into the blades.

Some blade cross-sections are other than triangular because one or both faces run vertically downwards at right-angles to the back before sloping inwards to the cutting edge e.g. 2854, 2927). This creates a slight ridge which usually runs diagonally across the blade face.

Two blades have faces which slope outwards slightly before converging on the cutting edge (e.g. 2811) and one blade has one face with this feature (2820).

Another group of blades are concave below the back as a result of shallow channels running across their faces (e.g. 2801).

Table 3.2 Summary of the occurrence of knife blade surface features

Key: A:Blade faces run vertically downwards before converging on cutting edge.

B:As A, but one face.

C:Blade faces slope outwards slightly before converging on cutting edge.

D:As C, but one face.

E:Blade faces concave before converging on cutting edge.

F:As E, but one face.

G:Chamfered back edges.

H:As G, one edge only.

J:Blade back triangular in cross-section.

K:Grooves cut into both blade faces.

L:As K, one face only.

M:Notches cut in blade back.

N:Relief panels cut into back

	Blade back form									
	A1	A2	B	C1	C2	C3	Ci	D	I	Total
Feature										
A	-	-	-	1	-	2	1	5	1	10
B	-	-	-	2	-	2	-	-	-	4
C	-	-	1	-	-	1	-	-	-	2
D	-	-	-	1	-	-	-	-	-	1
E	-	-	-	2	-	3	1	2	1	9
F	-	-	-	-	-	1	-	1	-	2
G	-	2	-	3	3	-	-	-	1	9
H	-	-	-	1	-	-	-	-	-	1
J	-	-	-	4	-	3	1	2	-	10
K	1	8	-	4	1	-	-	3	-	17
L	-	-	-	1	-	-	-	1	1	3
M	-	2	-	4	1	-	-	3	-	10
N	-	-	-	1	-	-	-	-	-	1
Total	1	12	1	24	5	12	3	17	4	79

Finally, the edges of the back may be chamfered, leaving the top flat. There are eight blades where this occurs on both edges (e.g. 2822) and one where it occurs on one edge (2818).

The blade back edges may also be chamfered to make the top triangular in cross-section. There are ten examples (e.g. 2837).

The second group of surface features includes, first of all, the narrow grooves which run along the blade faces just below the back. There are twenty knives which have them in one form or another, including twelve which have one groove on each face (e.g. 2757). 2809 is unusual because it has two grooves on each blade face, the lower ones being inlaid with copper wire.

Transverse notches cut into the back occur on ten blades and they are most commonly located at the shoulder (e.g. 2818, 2809). 2973 is unusual in having a notch at the shoulder and then eight V-shaped notches cut at regular intervals along both edges of the back.

Finally, the back of 2876 is unique in having low relief work along the back.

To summarise, although the sample is small, there is some patterning in the features discussed in this section which can be related to other aspects of formal patterning. In particular the suggestion of a somewhat distinct sub-set based on back form A, is, perhaps, supported, firstly, by a higher percentage (29.5%) of those knives having grooves along the back than the knives in the other major back form groups (6% in C and 9% in D) and, secondly, by the near absence of examples of other features.

The function of the surface features discussed in this section is hard to determine, although they are probably all to a large extent decorative. The notches and grooves in particular may represent simpler versions of the very elaborate patterns of inlaid panels on some of the large sax blades of the 9th-10th centuries (see Chapter 7.7 for further discussion of this point).

3.30.7 Tangs and handles

The vast majority of tangs taper away from the shoulder and come to either a pointed or wedge-shaped tip. A few also thicken slightly in the centre (e.g. 2761 and 2960).

Most of the handles for which evidence survives are wooden and that on 2812 is decorated with inlaid brass strips. 2833 has two bone tubes around its tang which formed part of a handle, the rest of which is lost. Many handles were probably horn and remains preserved in corrosion products were found on the tangs of 2760 and 2855.

3.30.8 Metallography

47 Knives were examined metallographically of which 44 were tanged; one (2976) was a pivoting knife (3.31), one (2982) a blade originally pierced at both ends (3.33) and one (2985) a blade of indeterminate but probably unusual form (3.35).

The metallographic macro-structure of the blades indicates the way in which the principal metal components were welded together. It may be summarily described according to the following formal classification (Fig 3.13; after Tylecote and Gilmour 1986, 2-3, fig.1):

0 : No surviving steel cutting edge
1 : Steel-cored or 'sandwich-welded' (four variants including 1d the 'half sandwich')
2 : Scarf- (2a) or butt- (2b) welded steel cutting edge (The distinction between them is not always easy to determine, hence shown simply as '2')
3 : Piled steel and ferritic iron
4 : Wrap round steel sheath
5 : All steel

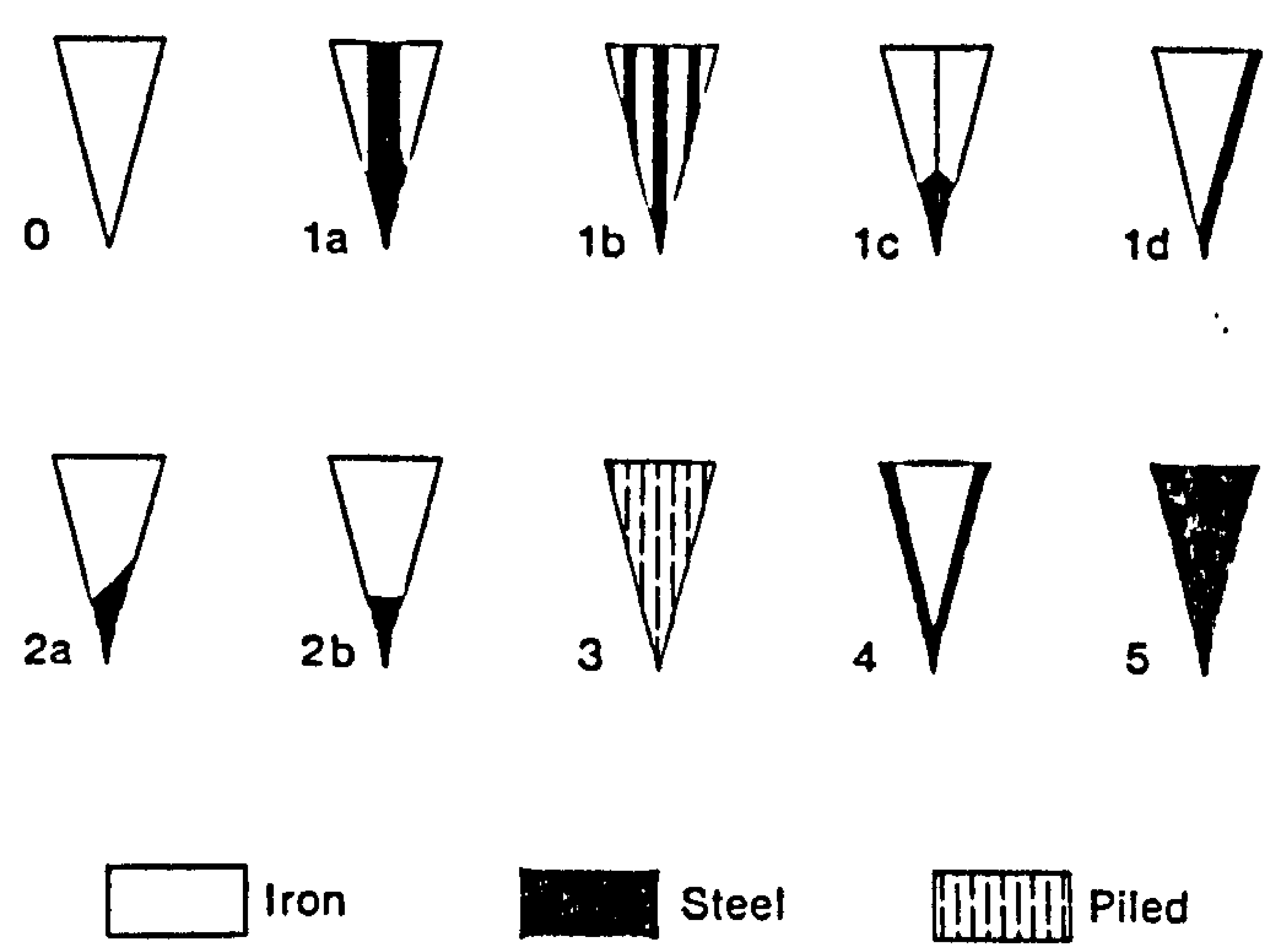


Fig. 3.13 Simplified cross-sections through blades of the principal macro-structural forms.

Table 3.3 Knives examined metallographically from 16-22 Coppergate

(Vicker's hardness is maximum recorded)

* = pattern-welded

No.	Macro-structure	Back Form	Vicker's hardness (HV)
2756	2*	A1	n.av.
2757	2a	A2	874
2765	2a	A2	927
2767	2a	C1	244
2771	2b	C1	841
2777	2	C2	655
2778	1a	C3	402
2795	4?	I	n.av. (corroded)
2798	2	A2	660
2800	2	B	321
2801	1a	C3	501
2805	3	A1	289
2808	2b	A2	874
2810	1c	A3	480
2815	0	C1	178
2820	1c	C1	378
2821	3	C1	487
2824	4	C1	276
2826	4	C1	426
2828	2	C2	210
2829	2a	C2	603
2831	2	C2	985
2840	0	C3	313
2841	1a	C3	841
2842	1a	C3	482
2851	1a	D	223
2860	1a	D	482
2877	1c	C1	780
2882	1d	D	197
2892	2*	A2	572
2899	1d	C1	157
2913	1a	C3	126
2914	1d	C3	n.av.
2920	1c	Ci	487
2926	0	D	204
2927	1a	D	139
2929	1c	D	276
2951	2b	A2	613
2954	1a	D	169
2957	3	A2	216
2958	1a	C1	689

Table 3.3 continued

No.	Macro-structure	Back form	Vicker's Hardness
2960	0	C1	110
2963	1d	D	252
2974	1c	Ci	120
Pivoting knife			
2976	2	na	560
Blade with pierced ends			
2982	3	na	425
Other blade			
2985	2	na	660

Table 3.4 Summary of knife blade metallographic macro-structure in relation to form (blade back for tanged knives).

	Macro-structure form					
	0	1	2	3	4	Total
Back Form						
A1	-	-	3	1	-	4
A2	-	-	4	1	-	5
A3	-	1	-	-	-	1
B	-	-	1	-	-	1
C1	2	4	2	1	2	11
C2	-	-	4	-	-	4
C3	1	6	-	-	-	7
Ci	-	1	-	-	-	1
D	1	7	-	-	-	8
I	-	1	-	-	1	2
Other knives	-	-	2	1	-	3
Total	4	20	16	4	3	47

Table 3.3 gives brief details of the results of the metallographic analysis. It shows that the majority of the 16-22 Coppergate knife blades were of form 1 or form 2 (20 and 16 examples respectively). Although form 0 knives have no steeled cutting edge it is likely that a number had been manufactured as form 2 knives which have subsequently lost their cutting edges through either wear or corrosion. The table also suggests that in terms of hardness the form 2 butt-welded blades were usually of better metal quality than those manufactured by other methods.

It is difficult, on the basis of a small sample to demonstrate significant patterning in the data, but Tables 3.3 and 3.4 suggest that:

1) Knives with back form A1, A2, and C2 were more commonly manufactured with the butt- or scarf- welded technique (form 2) and were of better metal quality than those in other back form groups.

2) Macro-structure form 1, steel-cored, tends to predominate in blades of back forms other than A and C2, especially forms C3 and D which, it should be noted, also have a high proportion of S-shaped or otherwise heavily worn cutting edges. The steel-cored structures (especially 1a-b, d) permit prolonged wear on the cutting edge as it will remain hard no matter how thin the blade itself becomes.

Both these conclusions suggest that the form of the blade, as discovered in the ground, may, to some extent, be directly related to metallographic structure. The existence of the sub-set of knives defined principally by having a ratio of length to length of blade greater than c.2:1 (3.30.5) may be due to deliberate manufacture. It may also, however, be the result of the heavy wear which is possible on blades of metallographic macro-structure form 1. Knife 2963 which falls, and 2860 which probably fell into this group, were, for example, examined and had form 1 blades. Conversely, aspects of the distinctiveness of the knives with back form A, such as general lack of heavily worn cutting edges and a relatively low blade length to width ratio, may reflect a metallographic structure, i.e. the butt- or scarf-weld which did not allow heavy wear, although this may have been compensated for by a better quality metal in the cutting edge.

3.30.9 Use of knives

Assigning specific practical functions to any of the 16-22 Coppergate knives is difficult. Contemporary documents refer, on occasions, to knives and contemporary illustrations (reviewed in 7.7) show knives in use indicating, in particular, that they were used for eating and also for hunting. These sources, however, give scant details of knife form which can be related to archaeological artefacts.

Practical function was probably related as much to a knife's size and proportions as to its shape. On the one hand, the knives tend to cluster within fairly narrow limits in respect of all the dimensions and ratios between them. This may imply that the majority were used for a wide variety of domestic and craft tasks; in other words, they were to a large extent multi-purpose. On the other hand, Figures 3.4 - 3.12 all suggest that some knives are clearly anomalous in one or more respects and so may have been intended for some more specific purpose.

There are some exceptionally large, wide and generally robust blades (e.g. 2756, 2799, 2809, 2811). They could have been used in butchery for which the evidence from 16-22 Copppergate is discussed by O'Connor (1989, 154-9) and could also have been weapons or hunting knives.

Although I have not done any detailed work on the clustering of knife and sax dimensions, I suggest that in the light of the references to the distinction between knives and saxes in 2.2, 2.4 and 2.5 a length division of 250mm may be used for the purposes of further discussion. This has the effect of consigning all the single-edged blades from Coppergate to the knives class while leaving as saxes all those blades usually referred to by that name.

The knives which have unusually long tangs and relatively slim and short blades may have been made as specialist tools for a particular range of tasks, perhaps involving careful work which required controlled downward pressure on resistant materials such as wood, bone, or leather.

Finally, one knife (2805) seems to have been re-used for a purpose other than that for which it was originally intended. It has a lump of tin attached to the tip and the blade is also bent in the middle and worn in a most unusual mannner. Since the tinning of iron objects was probably undertaken on the site (5.6), this knife may have been adapted for some part of the process.

Other Knife Forms

3.31 Pivoting Knives (Cat. Fig.20)

There are four knives (2975-8) which have, or in the case of 2975 had, two blades, one each side of a slightly off-centre pivot. The way that these blades worked is shown in Fig.3.14. When a blade was in use the notch on the opposite side of the pivot rested on a rivet which was also one of two holding the two sides of the handle-cum-case together. This rivet counteracted the upward pressure on the blade.

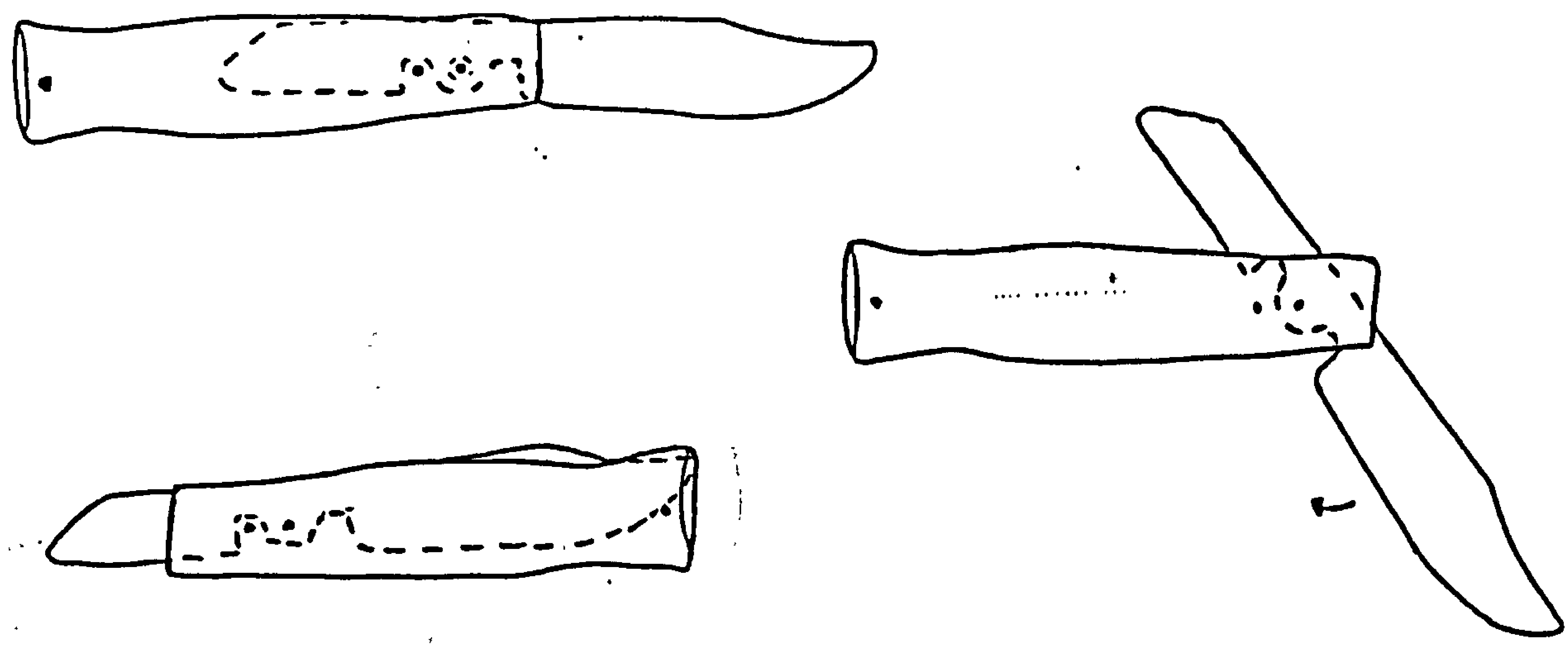


Fig.3.14 Diagram to show the operation of the pivoting knife

The function of these knives is hard to determine but they were presumably for some specialist purpose requiring frequent alternation of two sizes and forms of blade.

(For reference to the metallography of 2976 see 3.30.8.)

3.32 Folding Knives (Cat. Fig.20)

There is one complete folding knife (2979) which has a case with a projecting spike. 2981 is clearly the case of a similar but slightly larger knife and 2980 is a folding knife blade.

These knives were probably specialist tools for some craft activity, but it is not possible to say what this might have been, although the spikes are similar to a number of the awl or smaller tanged punch arms (3.24, 3.25).

3.33 Blade with Pierced Ends (Cat. Fig.21)

The surviving end of 2982 is rounded off and pierced and this was probably matched by the other end to judge by surviving comparable blades (6.3.33). There is again no evidence to indicate the use of these blades.

(For reference to the metallography see 3.30.8.)

3.34 Knife with Serrated Cutting Edge (Cat. Fig.21)

The cutting edge of 2983 is has small serrations running along its length. There are 13-14 per cm.

This is clearly a specialist tool which would have been used to cut durable materials with a sawing action. Its most likely use was perhaps in antler or bone working as many of the bone combs and other objects from York display what appear to be the marks of a saw (MacGregor 1982, 93).

3.35 Other Blades (Cat. Fig.21)

Blade 2984

2984 is a largely incomplete blade with a looped terminal. Its function is unclear but it may have been part of a draw-knife.

Blade 2985

2985 is a slim blade whose cutting edge is interrupted by a concave notch. Metallography (3.30.8) shows that this was a good quality blade but its original form and the purpose of the notch cannot be determined.

Blades 2986-7

2986-7 appear to be parts of very large, but now incomplete blades.

Blade 2988

2988 is possibly part of a draw knife which has been bent out of shape.

Other Tools and Implements

3.36 Forks (Cat. Fig.21)

2989 is a socketed fork whose function is difficult to determine, but I have followed Goodall's identification of a similar object from Thetford (1984, 95, fig.133, 196) as a flesh fork used for holding meat over a fire during cooking or removing it from cooking vessels.

2990 is probably a prong from a small fork which has a curved tip and is broken where it joined with other prongs and a tang.

3.37 Fish Hooks (Cat. Fig.21)

There are seven fish hooks (2991-7) which are very similar in size. They were probably used in sea fishing, in particular for cod, plaice or sole (A.K.G. Jones Pers. Comm.)

3.38 Spoons (Cat. Fig.21)

There are six tin-plated iron spoons (2998-3003). It is likely that originally all had a bowl at each end, although in two cases only one survives.

The function of these spoons cannot now be determined, but in view of their fragility and decorative finish, it seems unlikely that they were used for mundane domestic tasks. The spatulate nature of their bowls indicates that they were unsuitable for liquids, but probably held viscous or solid materials which might include ointments, or spices. The difference in the size of the bowls on the spoons where both have survived might imply a measuring function.

3.39 Cooking pan (Cat. Fig.22)

3004 is a large pan which originally had a handle attached to one side but was otherwise made from a single sheet of iron. The handle survives only as two terminal plates which are nailed side by side on to the pan's inner surface.

3.40 Vessels (Cat. Fig.23)

Note: in AY17/6 2252-3 were assumed to be metalworking tools hence their catalogue numbers.

2252-3 are two small 'boat-shaped' vessels whose function is difficult to determine. It is possible, however, that they are soldering lamps used in working non-ferrous metals. This is the identification given to a similar, but rather larger, object (105mm long and c.20mm wide) from a 12th century context in Lund (Mårtensson 1976, 202, fig.144). Such a vessel would have been filled with tallow and the flame from a wick directed with a blow-pipe to the point to be soldered. The holes in the base of 2251 do not occur on the Lund object, but it is possible that they were for the attachment of some form of handle.

There are five other possible vessel fragments.

3.41 Scale Pan (Cat. Fig.23)

3008 may be an iron scale pan. It is comparable in size and form to those from 16-22 Coppergate made of copper alloy (Hall 1984, 108-9, fig.128), although it does not have the usual holes around the edge to allow suspension from a balance arm. 3008 was, however, coated with a brazing wash which would have rendered it otherwise similar in appearance to the copper alloy examples.

3.42 Perforated Disc (Cat. Fig.23)

3009 is a small, slightly concave disc which has a number of small holes and indentations punched in it. It may have come from some form of censer or strainer.

3.43 Styluses (Cat. Fig.23)

3010 is a stylus with a wide V-shaped head similar to those shown in Anglo-Saxon illustrations such as the 10th century Benedictional of St Ethelwold (British Library additional MS 49598). 3011 may also be a stylus with a smaller V-shaped head.

STRUCTURAL IRONWORK and FITTINGS

3.44 Nails and Tacks (Cat. Fig.23)

Note: except for plated nails which are catalogued individually, catalogue numbers have been assigned to nails by period groups rather than individually. A description of each nail is available from the York Archaeological Trust.

There are nearly 2200 nails and tacks. This includes some 1300 nails with flat or roughly flat heads and some 700 headless shanks. The form of these nails is basically very similar and reflects a standard method of manufacture. The shanks, with few exceptions, have a square or near square cross-section and their tips are usually slightly wedge-shaped.

A nail head would have been formed by striking the top of a tapered shank which would have either been held in a hole in the upper face of the anvil or in a special nailing iron (Coghlan 1956, 70-1).

The heads are usually roughly rounded but there are a few nails with heads which are very neatly rounded. They had evidently been carefully formed and their edges may have been filed smooth. These nails usually have straight shanks and often appear unused. By contrast, some nails have heads which are far from regular, suggesting a rather casual approach to manufacture, although some irregularity including bent over and rough edges and a slight convexity in the centre are all probably the result of their being hammered into place.

Analysis of size shows that the majority of nails fall within a fairly narrow range (Fig.3.15) and c. 200 complete nails (c.65% of all complete nails) and c.400 nails whose tips are missing (79% of all nails whose tips are missing) are 30-65mm long.

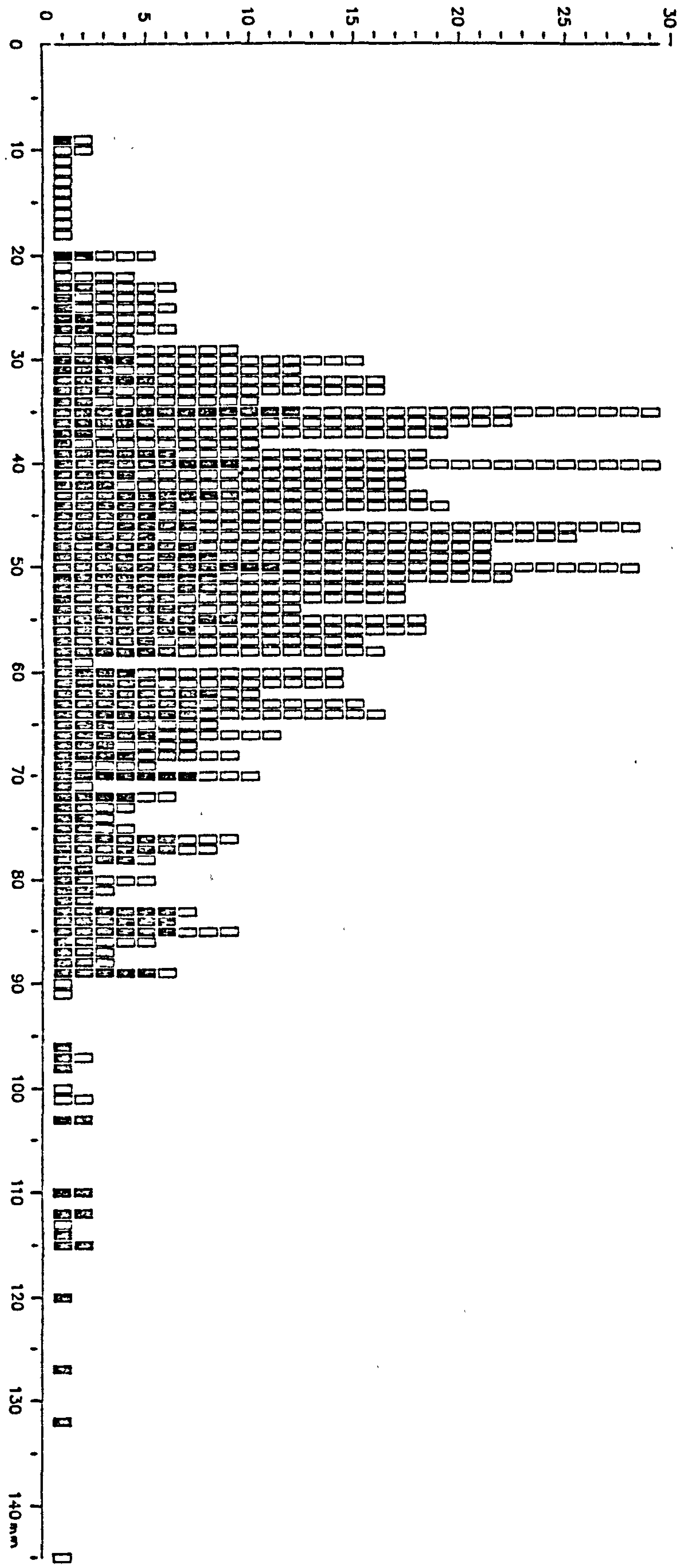


Fig.3.15 Length of nails (solid = complete length survives; open = tip missing)

There are five large nails with pronounced domed heads and there are 135 dome-headed tacks (most of which may be residual Roman hobnails; 5.5).

Plated nails

There are 44 nails or tacks with tin-plated heads. They are always neatly rounded and usually slightly domed. The heads were probably made separately and then welded onto the shanks.

Six plated nails were found associated with part of a small wooden stave-built vessel (3033; Cat. Fig.23), two had held Y-shaped strips (3393 and 3395) in place and four remain in situ. One nail (3032) was found in a wooden bowl turning core re-used as a top, the shank tip forms its rotation point.

3065 is unusual in having a slightly domed head with grooves cut into the edge of the upper surface.

3.44.1 The use of nails

Simple flat-headed nails were clearly in common use in the 9th-11th centuries for a wide variety of purposes. It is not easy to determine what these were, however, since few have been found in situ in structural timbers or wooden artefacts from 16-22 Coppergate or other sites. It is clear, however, that size bore some relation to function.

Nails were evidently not used for joining the timbers in 9th-11th century buildings at 16-22 Coppergate or elsewhere, but some must have been used in building-related carpentry, especially for doors whose hinge straps would usually have been nailed on. Some of the larger U-eyed hinges, including 3460-1 and 3470 (3.50.3), from Coppergate, which could have been used for doors, have nails in situ. At lengths of 40, 44 and 66mm respectively, they are a little longer than was strictly necessary to fix the hinge to the wood, but their tips are clenched over to give an extra grip.

The majority of the nails from Coppergate and elsewhere were probably used for furniture. Chests and boxes of the 9th-11th century that survive (see Chapter 7.8) were usually part nailed and part jointed, but their lock plates, hinge fittings, corner brackets and other bindings were nailed on. The smaller nails from Coppergate were probably used for small boxes and caskets, rather than chests, and for other small wooden objects. The gaming board from Coppergate has an edging strip secured with nails c.25mm long with clenched tips (Hall 1984, 114, fig.137).

Tinned nails would have been in part decorative, as in the case of those associated with stave-built vessel 3033. Dome-headed examples are also known holding the lock on a coffin from Winchester (Biddle and

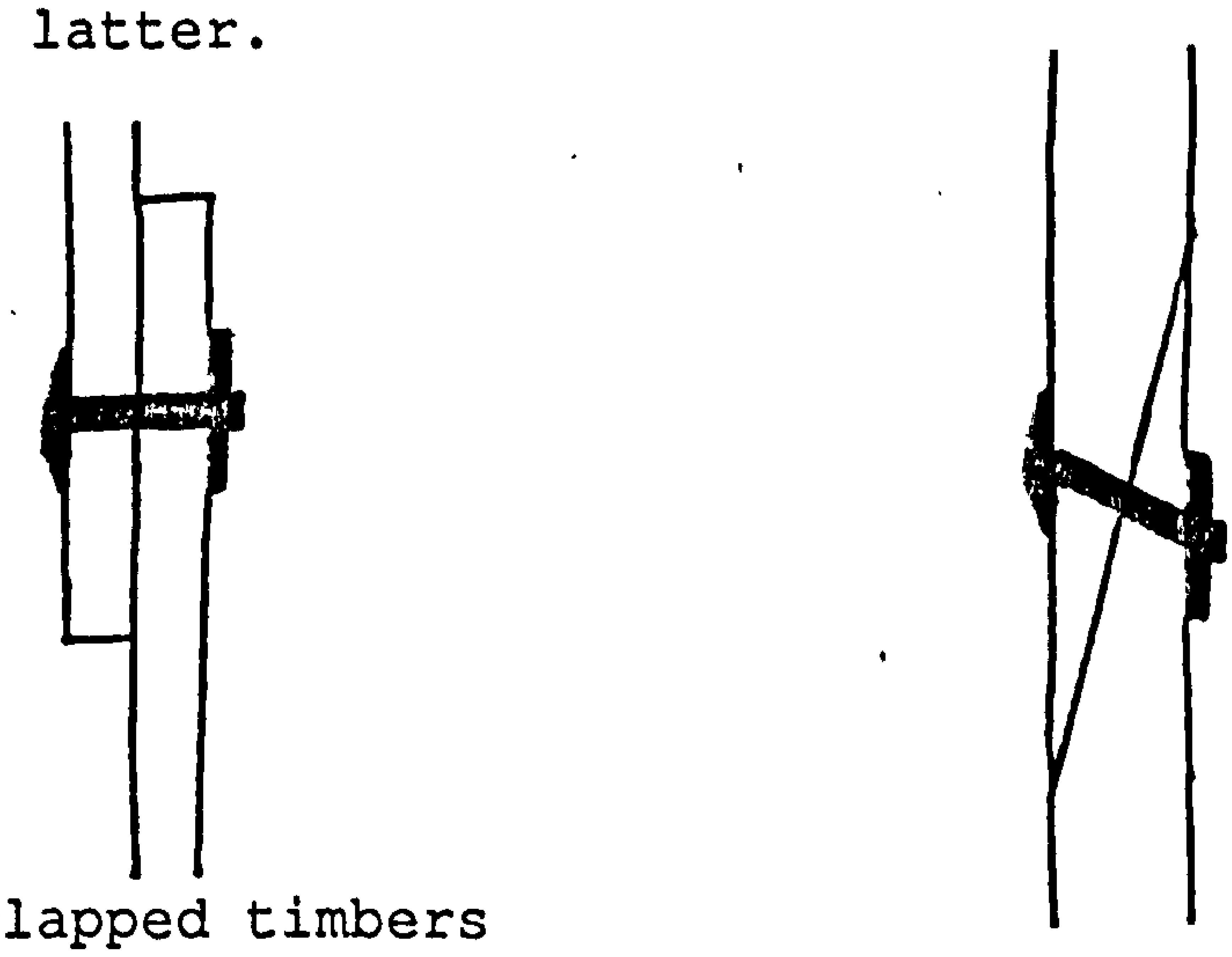
Kjølbye-Biddle forthcoming (no.3686), on items in the Oseberg Ship, including one of the sledges and two chests (Grieg 1927-8, 121-3, 200; figs.17, 34, 132, 134), and on caskets in graves at Fyrkat (Roesdahl 1977, 96, figs.125-6, 129) and nearby Sønder Onsild (Roesdahl 1976, 32).

3.45 Clench Bolts (Cat. Fig.24)

There are 55 clench bolts and a further 31 roves. A clench bolt was used for joining timbers, and consists of a nail which, once passed through the timbers to be joined, had a small pierced plate, the rove, set over its tip. The tip was then burred or hammered over (i.e. clenched) to hold the bolt in position.

The Coppergate roves are either diamond-shaped (28 examples) or rectangular (some 52 examples).
The overall length of the more or less intact clench bolts varies from 14mm (3116) to 107mm (3123), but the majority are 27-45mm long.

It is difficult to establish conclusively the thickness of timbers being joined by these bolts, however, since it is not possible to tell whether when in use they passed through the thickness of two pieces of wood or through the thickness of only one as in the case of a scarf joint (Fig. 3.16). A clench bolt with its shank at a marked angle to the head might, however, suggest the latter.



overlapped timbers

scarf-jointed timbers

Fig. 3.16 Diagrammatic cross-sections to show how clench bolts held timbers together

3.45.1 The use of clench bolts

One of the principal uses of clench bolts was for holding the strakes of clinker-built ships. Although there is considerable variation in the length of their bolts, the majority of 9th-11th century examples are within the range of those found at Coppergate, which could, therefore, have come from the timbers of craft sailing up the rivers Foss and Ouse. Clench bolts have also been found in a number of the cart bodies, constructed in a similar fashion to ships, from Scandinavian burials of the 9th-10th centuries including, for example, Oseberg (Grieg 1927-8, planche 1) and Fyrkat (Roesdahl 1977, figs. 109, a-d; 110).

Clench bolts were also used in buildings, especially for doors. The 11th century church door of St Botolph's, Hadstock, Essex has clench bolts holding battens which keep the main timbers in place (Hewitt 1980, 21). There is, finally, evidence that coffins were constructed of overlapping timbers held in place with clench bolts. Five 9th century examples are recorded from Barton-on-Humber, South Humberside (Rodwell and Rodwell 1982, 290-2, fig.5).

3.46 Staples (Cat. Figs.24-5)

There are some 151 staples and four objects very similar to staples which have been described as collars (3.46.1).

There are probably 98 rectangular and 27 U-shaped staples, including those surviving only as single arms. A few have the wider faces of the arm lying in the same plane as the staple itself (e.g. 3185, 3189, 3194) rather than at 90 degrees to it as is normal. These staples tend to be among the largest and most robust.

A number of staples have had their arms inturned, usually at roughly 90 degrees, and in a few cases the tips are also clenched (i.e. bent upwards). This was presumably done once they had been driven into wood in order to fix them more securely.

3190 is unusual in having one arm pierced twice just above the point where it is inturned. Small rivets through these holes presumably held it in place. The arms of 3296 pass through a small rectangular plate before being bent roughly outwards. The two interlinked staples (3288) are similar to 3296 and their arms are also set in rectangular plates.

There is a large U-shaped staple set in the rim of a soapstone bowl, sf7565/7723, which served as a suspension loop.

Fifteen small staples have straight or slightly curved heads and arms which curve in under the head to lie roughly parallel with it (e.g. 3174, 3241).

There are seven looped staples which have arms which come together in the middle, leaving a loop at the head (e.g. 3226). The tips of the arms are usually turned outwards in use. Three of these staples are attached to hasps: 3490-2.

3.46.1 Collars

The four collars are similar to staples but their arms overlap each other to make a form of ring. Two are rectangular (3176, 3181) and two are oval (3177, 3228).

3.46.2 The use of staples

Smaller staples were usually fittings in boxes, chests or other items of furniture and examples include those from 16- 22 Coppergate which were found in association with hasps or stapled hasps (3.52).

On the chests used as coffins in the 8th-9th century Thwing cemetery small U-shaped staples were used to hold hasps and lock bolts in place and in at least one instance to secure a hinge strap. Small U-shaped staples were found holding the handle of a box from Fyrkat (Roesdahl 1977, 122, fig.197) and at Sønder Onsild small U-shaped staples were found holding a stapled hasp and a casket ring-handle in place (Roesdahl 1976, fig 10d, 11c).

Smaller staples or collars, might be used for repairing wooden objects, such as the bowls from Hungate, York (Richardson 1959, 86, fig.20) or Midland Bank, York (Tweddle 1986, 234-5, fig.105, 970).

The staples whose arms curve directly inwards from the head may have been fitted to very thin pieces of wood, but it is also possible that they were belt fittings, simpler versions of the strap guides (3.69). This was indicated by two objects of this form found at the waist of a skeleton excavated at Yeavering (Hope-Taylor 1977, 183, fig.87).

The large U-shaped staple set in soapstone bowl 7565/7723 indicates that other staples whose tips are bent forward and clenched may have been used as suspension loops. (See also vessel suspension fittings, 3.57)

Small collars were used in much the same way as an ordinary staple for attaching hasps, handles, and other box fittings. An example comes from Birka where it secured a stapled hasp (Arbman 1940, Taf.271, 2).

3.46.3 Metallography

3197 and 3199 were sectioned. The coarse banded macro-structure and very low carbon content suggests 3197 was manufactured from scrap iron. 3199 was manufactured from a low phosphorous iron; the presence of large slag inclusions indicated crude workmanship.

3.47 Fittings (Cat. Figs. 25-6)

There are 101 objects which I have classified under the general heading of fittings (not including disc fittings, 3.48 or spirally-twisted fittings, 3.49) They are of widely varying sizes and forms but in 80 cases share the characteristic of being pierced for attachment to wooden objects. The 21 strips and plates which are not pierced were also probably parts of fittings of which the pierced section is missing or were held in place by means which did not require piercing.

The larger fittings were probably used on chests, buckets and the like and the smaller on boxes and caskets. A number of the latter including 3303, 3304, 3306, 3319, 3324, 3367 and 3404 bear simple relief work and are tin-plated (see Appendices 4-5 for further details), but of particular interest, perhaps are 3322-

3, which incorporate simplified animal head terminals. Also unusual are two small Y-shaped fittings (3393 and 3395) which were fittings on a wooden stave-built vessel with four dome-headed plated tacks still set in it (3033; Cat. Fig.23).

3.47.1 Metallography

3396 was examined in attempt, which was unsuccessful, to learn more about the tinning process. The plate itself had a banded structure.

3.48 Disc fittings (Cat. Fig.27)

3408-9 are two very similar discs both of which have a large circular central hole and punched decoration on one face. It is likely that they are fittings for small chests or caskets. The Franks Casket, dated c.700 (Beckwith 1972, 117, pl.3), clearly had a disc fitted to one face which probably had a central hole. Discs of non-ferrous metal with central holes can also be seen on reliquary cases of the early Christian period in Ireland. The Lough Erne shrine, for example, has a saucer-shaped disc on the lid with a central hole in which a jewel is set (Mahr 1932, pl.9).

3.49 Spirally-Twisted Strips and Fittings (Cat. Fig.27)

Spirally-twisted components can be found on objects in a number of different classes at Coppergate

(4.3), but there are twelve objects with this feature for which no clear function is identifiable. Because of the frequent use of spiral twisting on fittings such as corner brackets and hinges in the 9th-11th centuries, I suggest the objects under this heading were probably attached to boxes or chests, but only 3413 and 3414 exhibit any means of attachment.

3.50 Hinge Fittings (Cat. Figs.27-30)

3.50.1 Hinge Straps (Cat. Figs.27-8)

Note: In preparation of AY17/6 hinge straps were considered as a sub-group of fittings (3.47) hence their catalogue numbers. 3419 was considered to be a spirally-twisted fitting (3.49).

There are nine hinge straps (3300, 3307, 3332- 3, 3345, 3383, 3386, 3419). Surviving hinges from chests of the 9th-11th century indicate that lids were usually attached with a simple linked hinge. The strap on the lid had a U-shaped loop at the end which engaged in a closed loop or punched hole at the head of the strap attached to the back of the chest. 3345 and 3419 are probably lids, although their links are largely missing. The other straps are from chest backs, including 3386 from the Coppergate Watching Brief, which is attached to a large flat piece of wood.

3.50.2 Hinge Pivots (Cat. Fig.28)

There are 37 hinge pivots which were probably used for hanging doors, gates or shutters. The shank was driven into the jamb, frame, or wall and the guide arm fitted into the eye of a hinge strap.

3.50.3 Hinges with U-shaped eyes (Cat. Figs.29-30)

There are nineteen hinge fittings with U-shaped eyes which have, or had, opposing pierced straps or a strap and a terminal. Fourteen of them are plain and five are decorated.

The larger hinges probably come largely from doors, where they would have been employed with hinge pivots (3.50.2). Examples of late Anglo-Saxon date can still be seen in situ on the church door at Hadstock, Essex.

Small decorative hinges with U-shaped eyes

There are five U-eyed hinge fittings (3474-8) which may be distinguished from the larger plain examples by the unusual form of their straps and by their decorative surface treatment. They include 3475 and 3478 which are tin-plated and have simplified animal head bosses.

3.50.4 Small hinges with looped eyes (Cat. Fig. 30)

There are two objects 3479-80 which are probably smaller versions of the hinges described in 3.50.1 and came from caskets. Both have surface relief work and are tinned.

The identification of 3481 as a similar hinge fitting is not entirely certain.

3.50.5 Pinned hinge fitting (Cat. Fig.30)

There is one small pinned hinge fitting (3482). It consists of three strips folded around a central pin. The strips were presumably hammered into the lid and sides of a box.

3.50.6 Handle hinge fittings (Cat. Fig.30)

There are three small fittings (3483-5) which were probably used for holding drop handles (3.53) in place on box or casket lids.

3.50.7 Metallography

The body of hinge strap 3307 was shown to be ferritic iron and the loop was either a low carbon steel or had been carburised after manufacture. The variation in micro-structure probably indicates the use of scrap iron.

U-eyed hinge 3460 was sectioned and shown to be manufactured from phosphoric iron.

3.51 Corner Brackets (Cat. Fig.30)

There are three corner brackets but parts of others may survive as incomplete fittings (3.47; 3.49). 3487-8 probably came from chests. 3486 is less carefully formed than 3487-8, its function is unclear.

3.52 Hasps (Cat. Figs.30-1)

There appear to have been three forms of hasp used in Anglo-Scandinavian York. Comparative material suggests they were primarily used for securing chest lids. One form (3489) incorporates a looped terminal by which the hasp would be held in place, and a link which would fit over a staple set in the front of the chest where it could be secured by a lynch pin or padlock.

The second and related form of hasp (3490-3) is a composite fitting which incorporates a central link often indistinguishable from a chain link. At one end it was attached to the lid by a staple and would have another small loop attached to the other end which fitted over a staple fixed into the chest side.

The third form of hasp is known as a stapled hasp (3495-8) ; at the head it was attached to the lid of a chest and towards the base it had a staple fixed to it which fitted into a slot in the front of a chest where it was held in place by a lock bolt.

3496 has a very simplified animal head terminal.

3.53.Handles (Cat. Fig.31)

There are only nine objects which can be identified as handles, although this apparently small number may to some extent reflect the frequent use of rings as handles on boxes, chests or doors (3.55). Five were made from spirally-twisted strips. They were probably used on small wooden or metal vessels. 3504 is a simple drop-handle and 3507 is a smaller example with a rolled tip on the surviving arm. These handles were used on small boxes and caskets.

3.54 Chain Links (Cat. Fig.31)

There are five small figure 8-shaped chain links (3508, 3512, 3514, 3516-7) and two groups of small S-shaped links. One group of three is attached to a lynch pin (3572; 3.59), and the other group (3515) consists of two links which are tinned. A comparable chain can be found on a box padlock from Hungate, York (Richardson 1959, 81-2, fig.18, 4) and probably served to secure it to a box or chest.

3.55 Rings (Cat. Figs.31-2)

There are 27 rings, two of which are part of ring and strap fittings (3.56).

The varying sizes of the 16-22 Coppergate rings doubtless reflect their different functions, although these are now difficult to determine. Three rings stand out because they are substantially larger than the rest. 3519, 3525, and 3535 have diameters of 76, 77 and 74mm respectively and their size would have made them suitable as handles.

The majority of the 16-22 Coppergate rings have diameters between 25 and 50mm. Reference to complete snaffle bits from other sites suggests that some rings may be the cheekpieces. There is a number of mouthpiece links from the site (3.78), but none of them is now associated with cheek pieces. Small rings (diameter c.40mm) have also been found as box fittings, presumably handles, for example, at Birka (Arbman 1940, Tafn. 269, 1; 272, 1). Finally, rings of all sizes were used as chain links.

3.56 Ring and Strap Fittings (Cat. Fig.32)

3545 consists of a strap which is looped over to hold a ring at one end. It was probably a suspension fitting from a bucket or other vessel.

3546 consists of a fitting with two straps joined by a looped eye which has a ring engaged in it. This may be the handle suspension fitting for a bucket or other vessel in which case the straps would have gripped the side of the vessel and the handle terminal would have been looped around the ring. Alternatively the object could have been a horse's bit cheekpiece linked to a bridle strap fitting (see 3.78).

3.57 Vessel Suspension Fittings (Cat. Fig.32)

There are six objects which are probably fittings for suspending the handles of vessels such as buckets or cauldrons. They all incorporate a U-shaped loop, except for 3552, a crude U-shaped plate.

3.58 Hooks (Cat. Fig.32)

3.58.1 Wall Hooks

There are four L-shaped objects (3553, 3557-9) on which the longer arms taper to a point. They are probably simple wall hooks. 3554 may be an incomplete hook with one curved arm.

3.58.2 S-hooks

There are two complete S-hooks (3561, 3567). 3567 is simple in form, but 3561 is more elaborate since its shank was made from two parallel, spirally twisted strips, which at each end merge to form the hooks, one is slightly longer than the other. This type of hook was often part of the suspension gear for hanging a cauldron or similar vessel.

The shank of 3563 curves over at the top in such a way as to suggest that it is about to form the bend in the middle of an S-shape, but it is then broken.

3.58.3 Other Hooks

3562 is a large hook, 174mm long, which has a spirally-twisted shank and a looped head and it may have been part of vessel suspension gear. 3565 was probably a pot hook also, but of different form.

Both 3568 and 3571 may have formed part of suspension gear, but there are no close analogies to demonstrate this. Two small probable hooks (3564, 3570) resemble modern cup hooks. 3569 is a small hook set in a looped eye.

3566 is only 28mm long and consists of a small hook on the end of a conical socket which has a small hole in its side presumably for attachment to a wooden shank. Its function is unclear.

3.58.4 Metallography

A section was cut from the centre of the shank of 3556 which showed it was probably manufactured from scrap iron.

3.59 Lynch Pins (Cat. Fig.33)

There are two lynch pins (3572-3) which are very similar in form and size and were probably used as parts of door or gate fastenings.

3.60 Ferrules (Cat. Fig.33)

There are seven ferrules (3575-6, 3581-2, 3585-7) made from an iron plate folded over to form a roughly conical tube which is closed at one end.

These objects were probably all fitted onto the ends of wooden shafts and 3576 and 3587 are pierced for attachment. The function of the ferrules cannot be conclusively determined, but they may simply have protected the bases of wooden poles or staffs from wear. A particular use of iron-shod poles, however, may have been in skating. In the 12th century William Fitz Stephen refers to the inhabitants of London using them for propulsion when skating on the frozen Moorfields (MacGregor 1978, 61-3).

3.60.1 Metallography

A section was cut through 3575 and it was shown to be made from a single plate of phosphoric iron.

3.61 Tubes (Cat. Fig.33)

In addition to the ferrules, there are eleven tubes (3574/7-80/3-4/8-91) of unknown function.

3.62 Tubular object (Cat. Fig.33)

3592 is one of the most puzzling iron objects from the site and it is one of the few for which I can find no analogues. One possibility is that it was a purely decorative terminal, perhaps for a ceremonial staff which served, perhaps, as a symbol of office or part of religious regalia. Another possibility is that 3592 was part of a handle, in which case the head would have functioned as a suspension ring.

Locks and Keys

3.63 Locks (Cat. Figs.33-4)

There were two classes of lock, the fixed lock, which formed an integral part of the object it locked, and the padlock, which was portable. Each class can be divided into a number of sub-classes which will be discussed in turn.

Fixed Locks

There are two forms of fixed lock employing a sliding bolt: in one the bolt was usually held in place by a tumbler and operated by a key which was twisted (3.63.1; 3.64.1); in the other the bolt, when in the locked position, was held secure by springs and its movement was effected by a 'slide key' (3.63.2; 3.64.2).

3.63.1 Sliding bolts from locks with tumblers (Cat. Fig.33)

There are twelve bolts of this form; two (3594, 3599) have tumblers attached to them and one (3595) had a tumbler (3596) found with it. The way that locks using these bolts functioned is shown in Fig.3.17 (after MacGregor 1982, 82-3, fig.42, 431; fig.43).

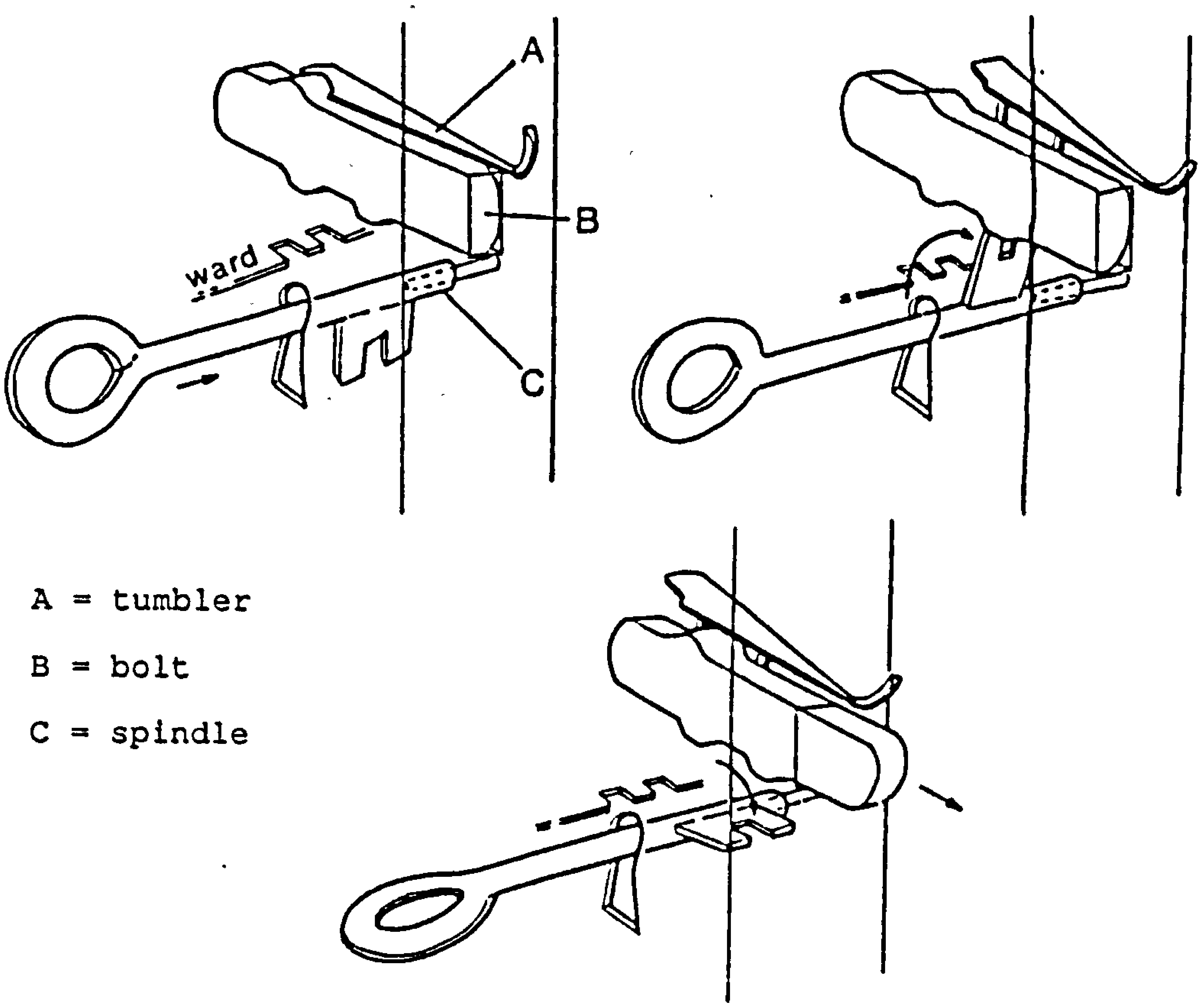


Fig.3.17 Operation of lock with sliding bolt and tumbler

The first diagram shows the locked position. Unlocking required a key which either had a hollow stem (3.64.1) which fitted over a spindle projecting from the back of the lock (as shown) or, more rarely, a key with a solid stem whose tip fitted into a socket at the back of the lock. On insertion the key was turned and, after passing the projecting wards inside the lock chamber, released the tumbler which was engaged in a notch in the upper edge of the bolt keeping it firmly in place. The key then encountered one of the projections from the lower edge of the bolt and propelled it forwards.

Locks with these bolts could have been used on either doors or chests. In the latter case the bolt would have secured the lid with the aid of a stapled hasp (3.52). 3598, however, has the end of one arm curved back on itself which implies that it held two stapled hasps in place in a chest lock.

3.63.2 Sliding bolts from locks with springs (Cat. Fig.33)

There are two bolts, 3606-7, which were used in locks with leaf springs and operated as shown in Fig. 3.18. They would have been used to secure the lid on boxes and chests. Large chests might have had two or three.

Fig. 3.18 shows that the bolt was set behind the front of the chest body so that the convex face faced the interior of the chest. When the lock was engaged, one of the projecting spikes passed through the staple

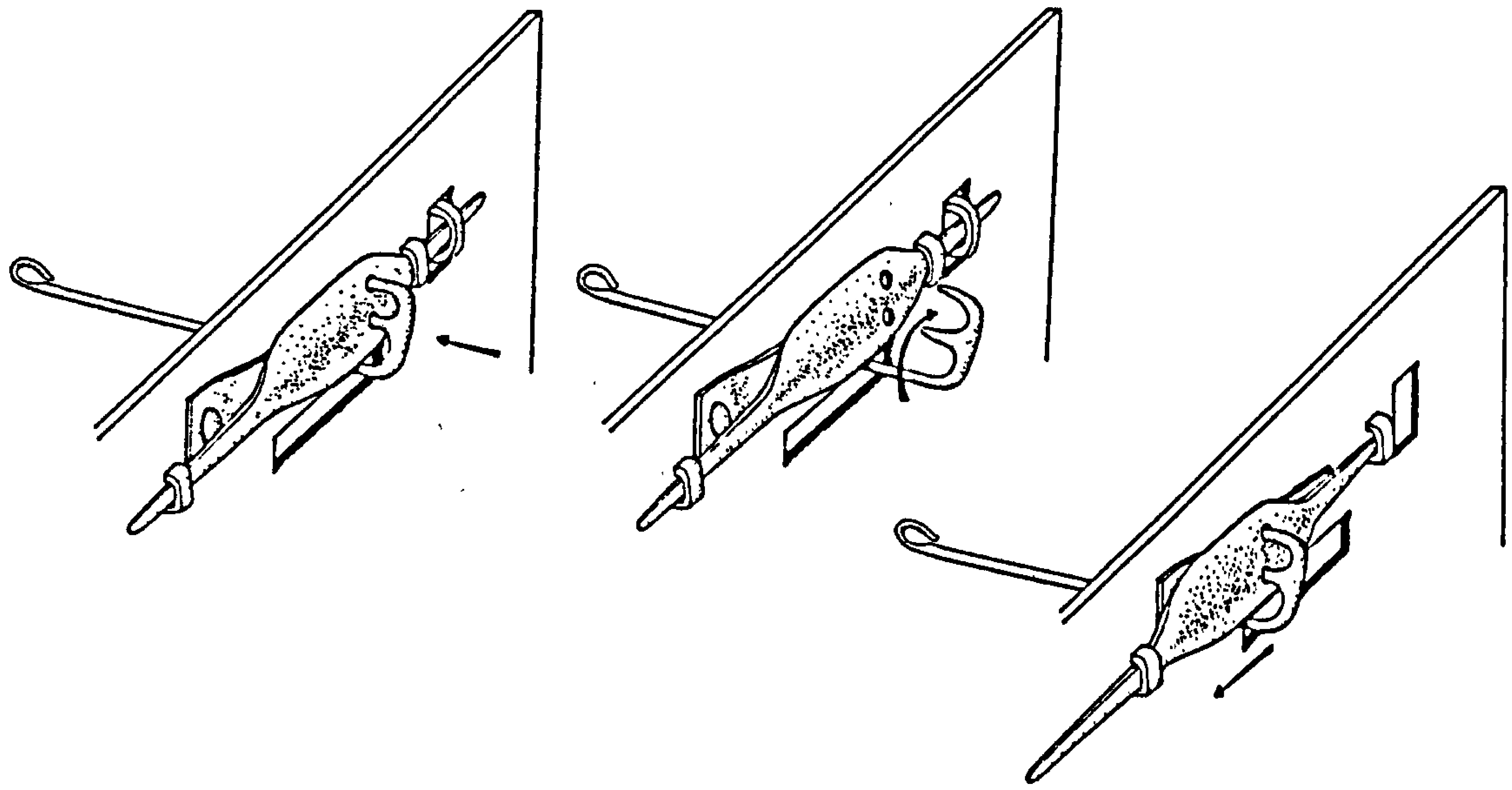


Fig.3.18 Operation of lock with sliding bolt and springs

of a stapled hasp. The bolt was held in place by the springs attached at one end to the inner face of the front of the chest and, at the other, resting against the ridge at one end of the concave face of the bolt. The lock was operated by inserting a key through a horizontal key hole below the bolt and twisting it at 90 degrees so that the teeth were pulled back through the holes in the bolt. This released the springs and the bolt could then be slid back to release the hasp.

Another variant of this form of lock is indicated by bolt sf5088 (Cat. Fig.33) from Coppergate which is from a medieval context. It has a central slot which means that it was used with a T-shaped slide key. The key was passed through the key hole and through the slot in the centre of the bolt.

3.63.3 Lock bolt with attached spring (Cat. Fig.33)

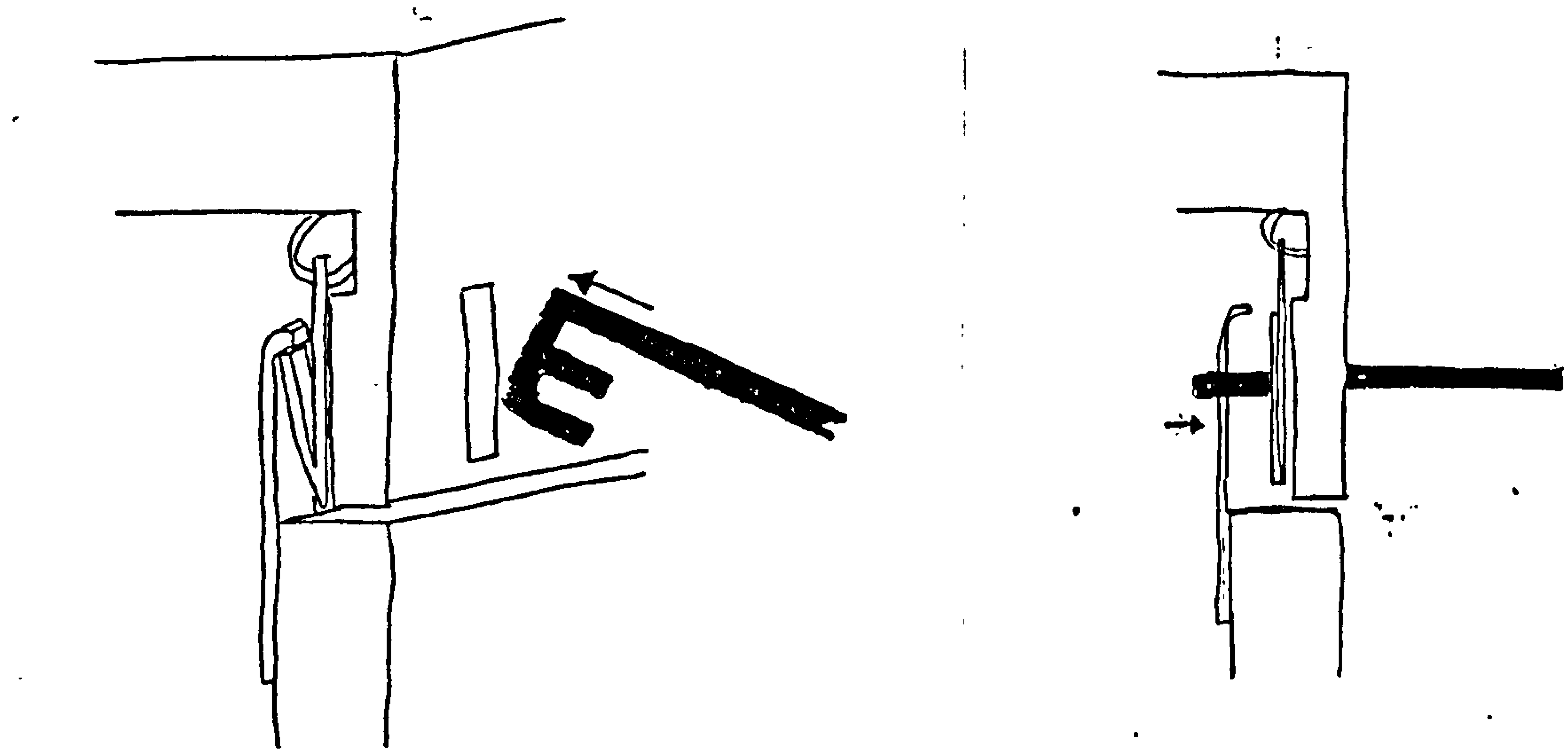


Fig.3.19 Operation of lock with bolt and attached spring

3608 is a small lock bolt with attached leaf spring and part of a suspension loop. The way such a lock worked is shown in Fig. 3.19 (after Ypey 1964, Abb.4). When locked, the spring engaged on a ridge at the top of the lock chamber and the box lid was held closed. It was opened by inserting the key through a vertical key hole and then twisting it through 90 degrees so that the teeth of the bit fitted into slots at the back of the lock chamber. The key was then pulled so that the teeth compressed the spring allowing the bolt to be drawn upwards and the lid opened. A variant on this procedure which involves a crank-shaped key (3.64.3) is shown in Fig. 3.23.

3.63.4 Padlocks (Cat. Figs.33-4)

One padlock case (3610), two case fragments (3609, 3612) and a bolt fragment (3611) were found.

Two forms of padlock were in use in the 9th-11th centuries: the barrel padlock and the box padlock, but they employed basically the same operating principle (Figs. 3.20-1).

Barrel padlocks may be divided into two forms. One form, represented by 3610, has a key hole at one end of the case. Fig. 3.20 shows how it would have worked: when locked the U-shaped bolt was held in place by the leaf springs, attached to the base of one arm, which pressed outwards against the end of the case. The other, or free, arm sat in the tube attached to one side of the chamber. In order to open the lock a key, in this instance with its bit at an angle to the stem, was inserted through the key hole at the opposite end of the case to the bolt and the bit slid over the leaf springs causing them to lie flat against the spine. The bolt could then be withdrawn through the bolt hole.

The other form of barrel padlock had a T-shaped key hole in the side of the case and would have worked as shown in Fig. 3.21. There is one key (3666) from Coppergate suitable for this form of padlock (3.64.4).

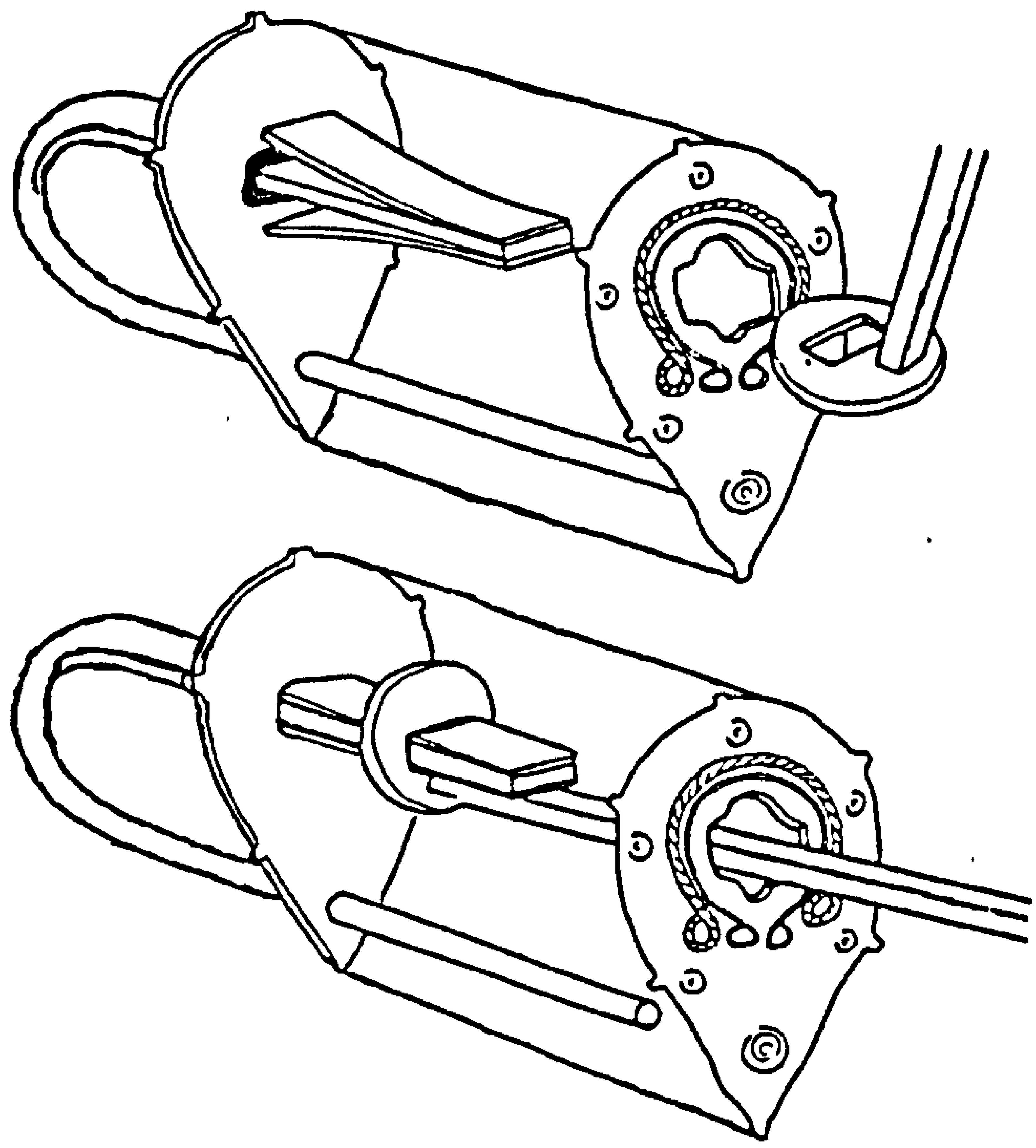


Fig.3.20 Operation of padlock with end key hole

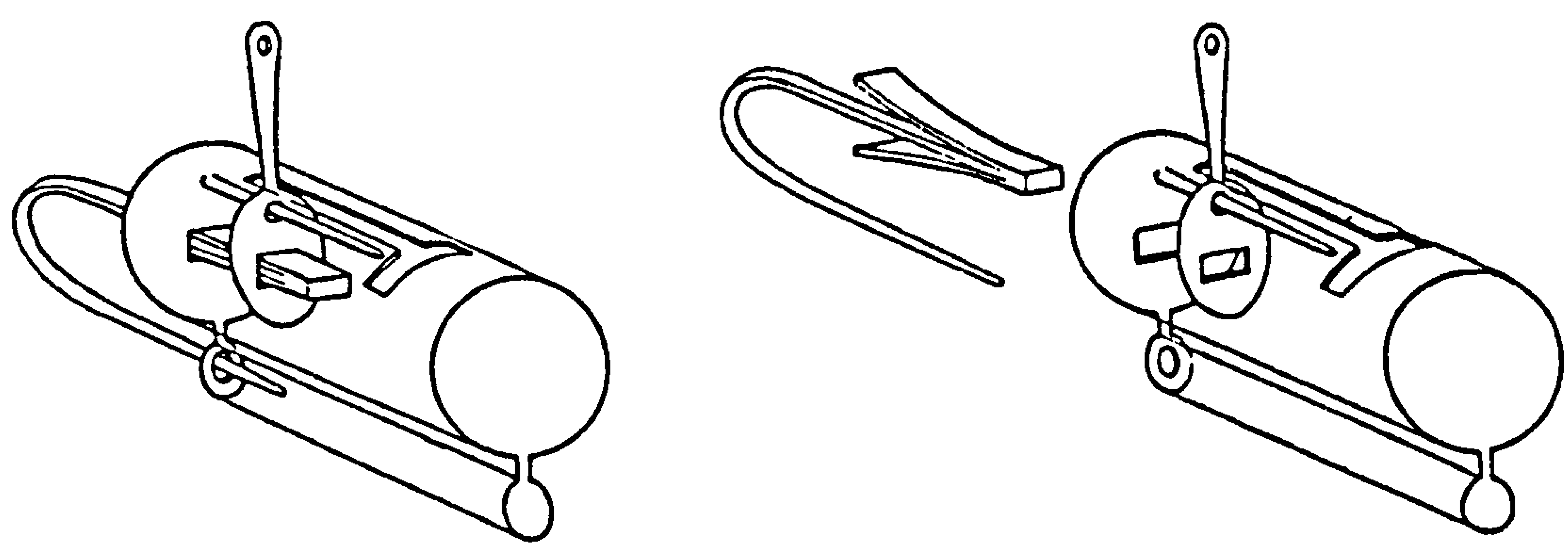


Fig.3.21 Operation of padlock with T-shaped key hole

Although there are no box padlocks from 16-22 Coppergate, there are three box padlock keys (3.64.4). The box padlock has a cuboid case, but otherwise usually resembles barrel padlocks of the second form in having a T-shaped key hole.

3.64 Keys (Cat. Figs.34-5)

3.64.1 Keys for locks with sliding bolts and tumblers

There are 51 keys, or parts of keys, for locks with sliding bolts. 43 of them were used in locks which required the key to be twisted to move the bolt. All but two of the keys have hollow stems

Hollow stem keys

The hollow stem keys are remarkably similar in form. The bits are all basically rectangular, except for those on 3620 and 3648 which are C-shaped. Their ward-cuts may be quite simple: 3617, 3622 and 3625, for example, have a single rectangular cut in the bit's outer side. Others are much more complex, 3641, for example, has five ward-cuts in all, including two with double chambers.

The form of the stems is fairly standard, although six (3613-4, 3621, 3629, 3637, 3641) have decorative features in the form of mouldings or grooves.

Bow form varies only slightly. Only one key (3623) has a bow which is completely dissimilar to the rest, being a small loop projecting from the head of the stem. Three keys have decoration on surfaces of their bows.

If all morphological details are taken into account, three keys (3613, 3641, 3653) stand out from the rest in several respects. All three are plated and in addition, 3641 and 3653 have grooves, or notches, cut into their bows and 3613 has grooves at the head of the stem. 3641 has a moulding at the head of the stem and 3613 has one at the tip. 3641 and 3653 also have the most elaborate ward-cut patterns in the collection.

Solid stem keys

There are two keys (3618, 3621) which have solid stems whose tips project beyond the end of the bit; otherwise they have very little in common.

3.64.2 Keys for locks with sliding bolts and springs ('slide keys') (Cat. Fig.35)

3654 has a rectangular bit with two short teeth projecting at 90 degrees from the base. It operated as shown in Fig. 3.22 (after Almgren 1955, figs. 86-7). When closed, the bolt would have engaged in a stapled hasp and been held in place by a leaf spring resting against a ridge on the bolt's upper surface. To release the bolt the key was inserted into the lock, the tip of the stem engaged in a hole at the back of the lock, the key was then twisted so that the teeth pushed through the holes in the bolt releasing the spring and drawing back the bolt.

There are six other slide keys which were probably used with the sliding bolts with springs as described in 3.63.2 (Fig. 3.17). Five of them (3655-9) are basically L-shaped and one (3660) is T-shaped.

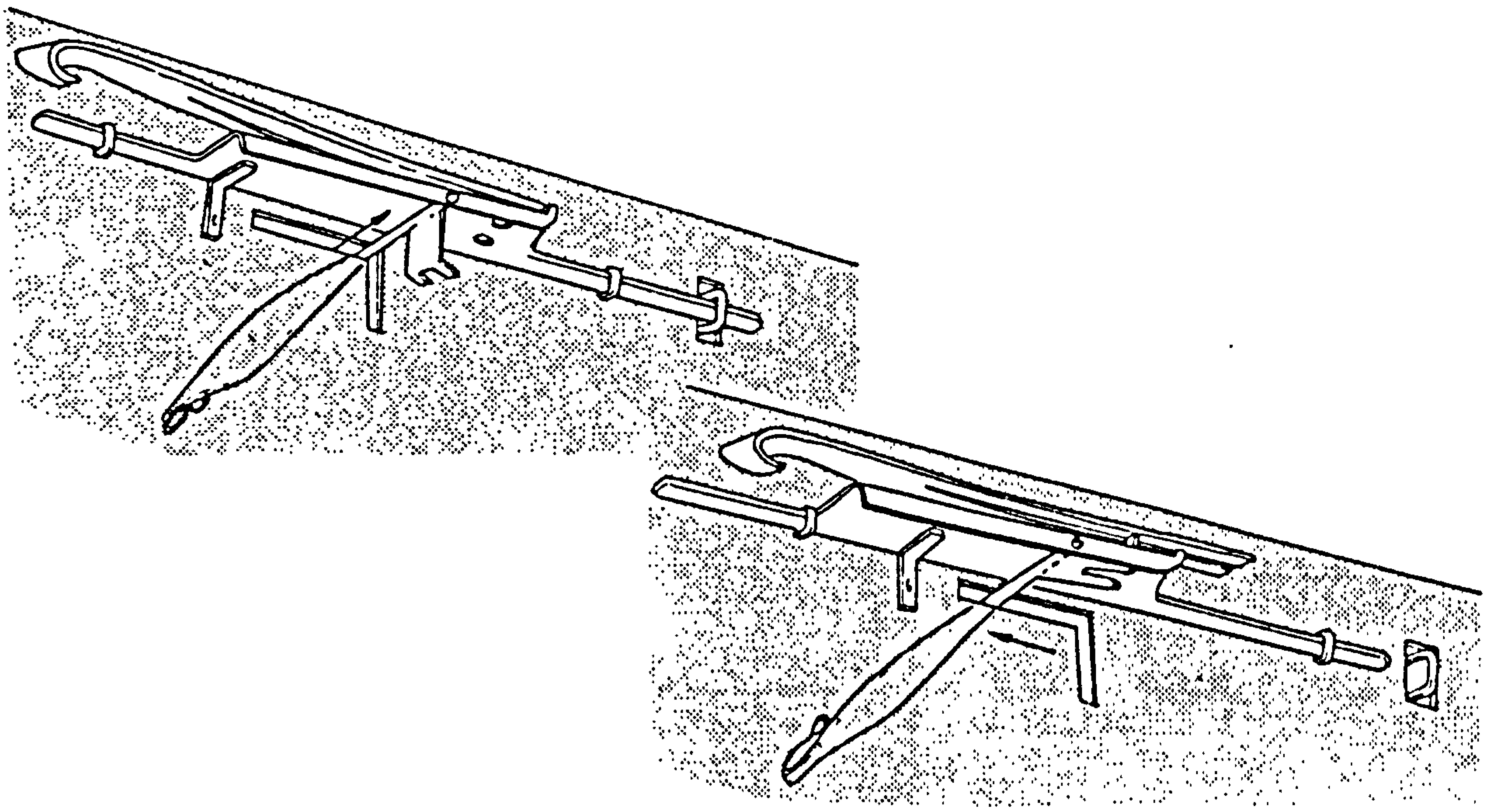


Fig.3.22 Operation of lock used with key 3654

3.64.3 Key for lock bolt with attached spring (Cat. Fig.35)

3661 has a crank-shaped stem and would have been used with a lock where the springs were attached to the bolt as shown in Fig.3.23 (based on Ypey 1964, Abbn.5-6).

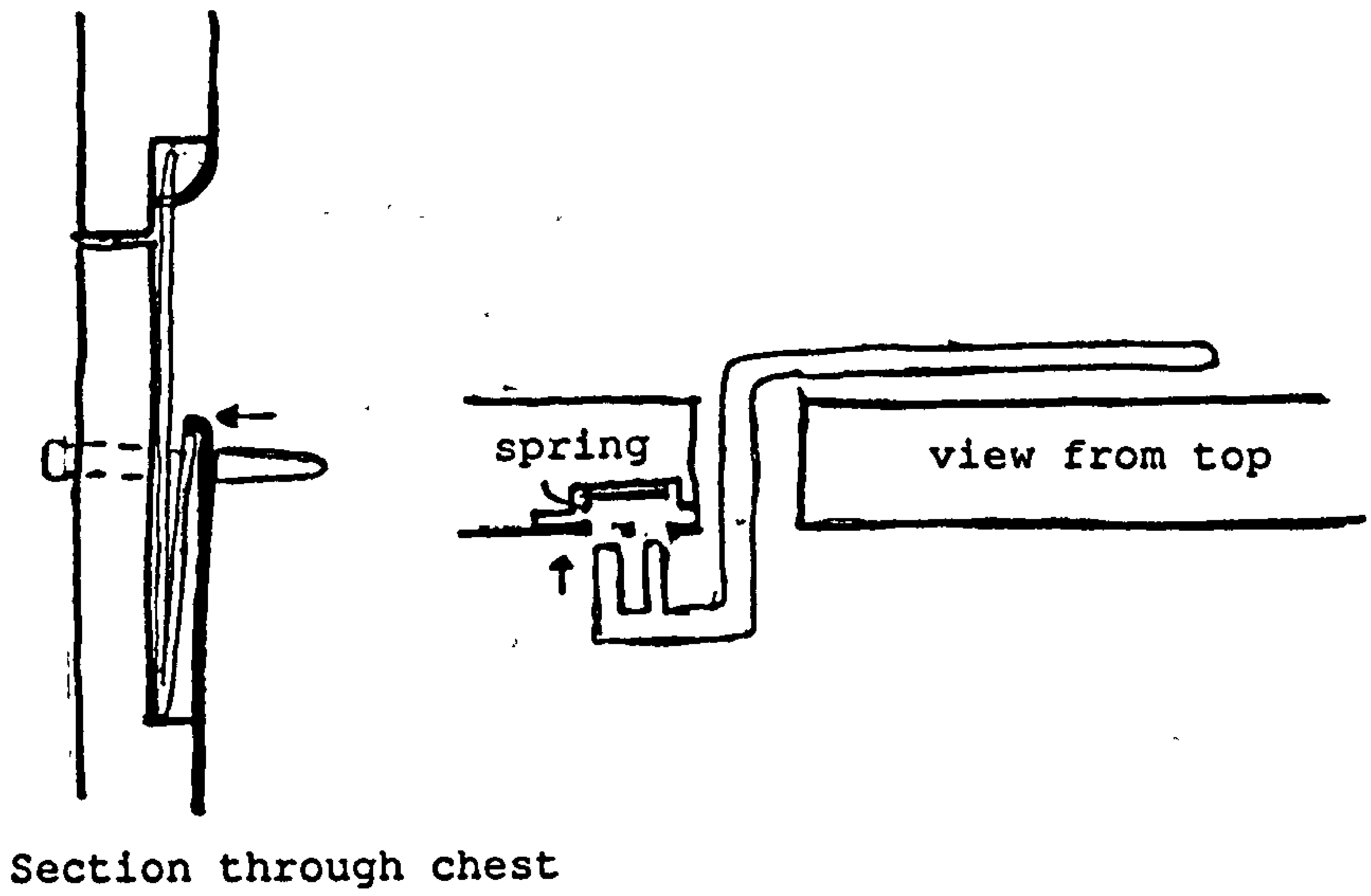


Fig. 3.23 Operation of lock with key 3661

3.64.4. Padlock Keys (Cat. Fig.35)

Barrel Padlock Keys

All the eight barrel padlock keys (3662-9), except one (3666) have or had bits set at an angle to the stem. They would have been used with padlocks which have a key

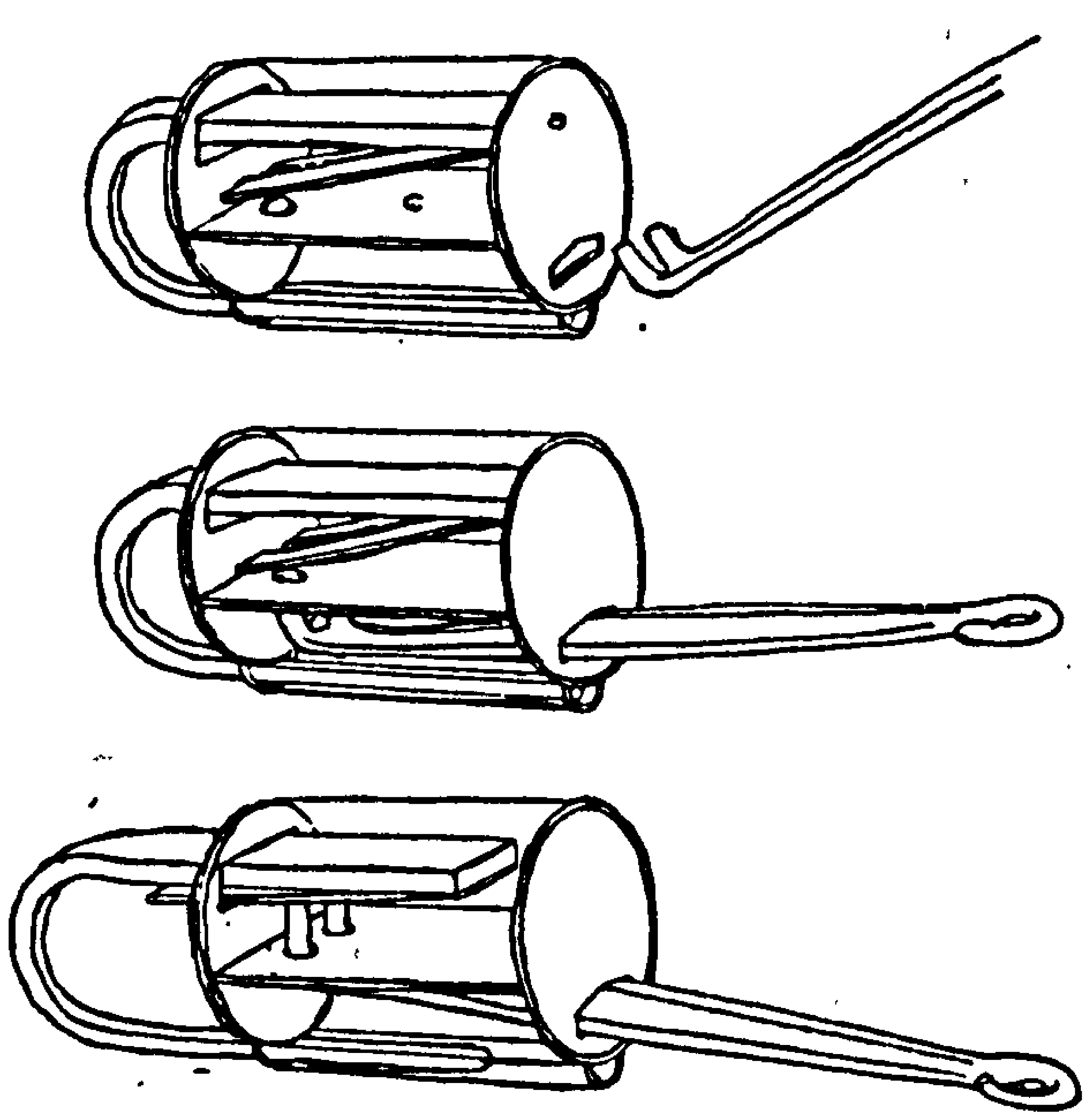


Fig.3.24 Operation of lock with key 3663 (after Andersen et al 1971, 186)

hole at one end of the case and a bolt hole at the other. Those with circular bits operated as shown in Fig. 3.20. 3663 is slightly different because it has two prongs projecting from the base of the stem which would have released the lock springs with a levering, rather than sliding, motion (Fig. 3.24).

3670 is probably a part-made key of the form which would have the bit at an angle to the stem.

3666 is the only example of a key from the Anglo-Scandinavian period at 16-22 Coppergate with its bit and stem in line. It would have been used with a padlock with a T-shaped slot in the side and it has a ward-cut flanked by two small holes, which presumably fitted over fine wires in the lock (Fig.3.21).

Box Padlock Keys

There are three box padlock keys (3671-3) which share the characteristic rectangular bit. Their form implies that the padlocks operated as shown in Fig.3.25.

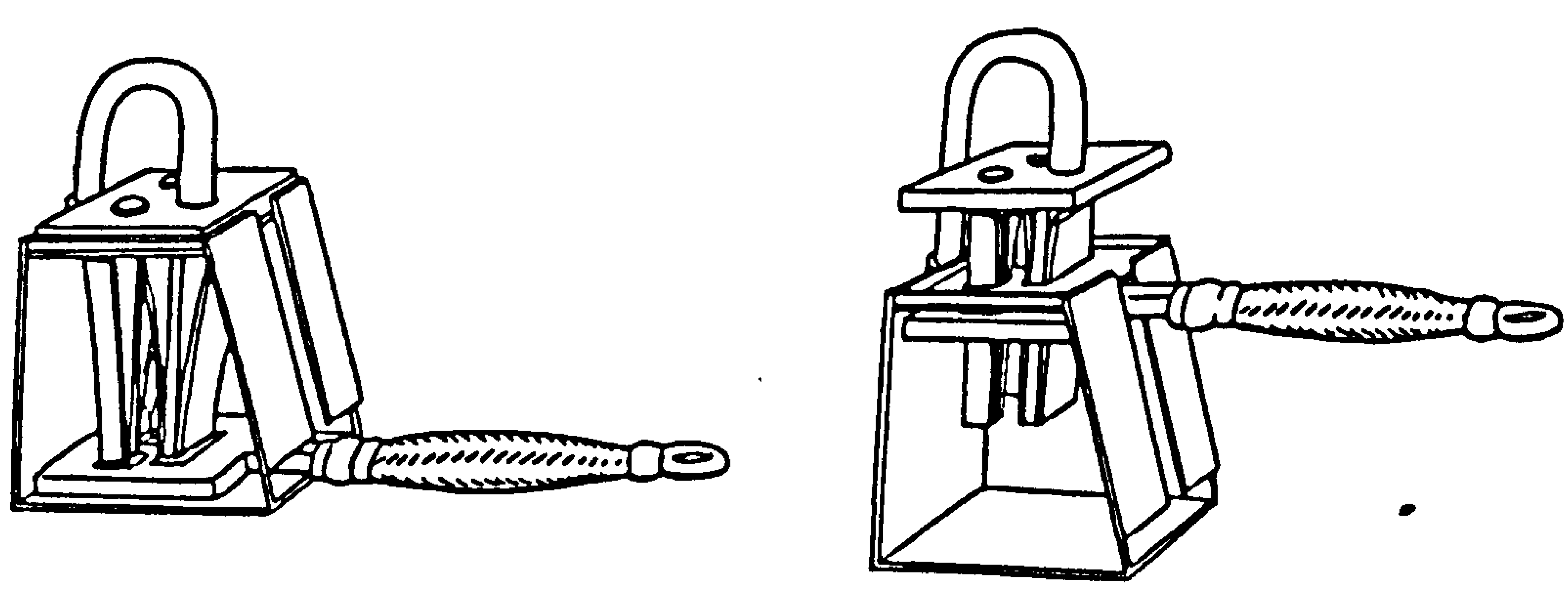


Fig.3.25 Operation of the box padlock

3.64.5 Metallography

Key 3634 was made from a single rod of iron; sections showed it had been carefully manufactured from phosphoric iron that contained few slag inclusions.

OBJECTS FOR HEATING AND LIGHTING

3.65 Candleholders (Cat. Fig.35)

There are four forms of iron candleholder from 16-22 Coppergate: the socketed (3675), one which consists of a bowl on the end of a shank (3676), the pricket (3677-8), and the quasi-pricket (3680)

The socketed candle holder (3675) has a stout L-shaped shank. 3676 consists of an elongated tang which is split at its thicker end and hammered out into a roughly-shaped bowl.

The prickets have a tapering shank which could be set into the ground or a suitable piece of wood. There is also a central spike on which the candle was impaled, hence the name pricket; additional arms helped keep the candle in place.

3680 is similar to a pricket, but has no sign of a central spike. The candle was presumably wedged between the arms.

3.66 Strike-a-lights (Cat. Fig.36)

There are four strike-a-lights. A sharp-edged flint would be struck on the metal surface and the spark caused the tinder to smoulder.

Two of the strike-a-lights (3681-2) are similar to those used until recent times. They have slightly tapering shanks and a C-shaped arm projecting at the wider end. The shank of 3681 is pierced, presumably to allow suspension, perhaps from a belt.

3683 is a small plate, pierced at one end, which is similar to two objects from Trelleborg identified as strike-a-lights on the basis, perhaps, of ethnographic parallels (Nørlund 1948, pl.29, 11, 13).

3684 consists of a plate which originally tapered at both ends into arms which curved back along one side.

DRESS FITTINGS and RIDING EQUIPMENT

3.67 Buckles (Cat. Fig.36)

There are 61 buckles, or parts of buckles.
The commonest form is the D-shape, of which there are 27 certain examples. Four frames also have a form quite similar to the D-shape, but both their longer sides appear straight and they are joined by two convex shorter sides. There are five oval buckle frames and five buckles which have rectangular frames with rounded corners.

3733 is a relatively large buckle whose frame is akin to a D-shape but is kinked on the curved side giving it a kidney-shaped appearance.

3738 is a five-sided buckle frame which has transverse grooves cut into it and was tinned.

3692 is a basically D-shaped frame but the straight side is held by two slightly widened terminals at each end of the curved part of the frame.

3741 is probably the rotating arm from a form of buckle used in horse harness.

3.67.1 Use of buckles

In the 9th-11th centuries buckles presumably functioned as dress fittings, but a particular context for iron buckles may have been as part of riding equipment. This is suggested by numerous discoveries in Scandinavian Viking Age graves including, for example, those at Süderbrarup (Aner 1952, 65, 70-1, Abbn. 3, 9-10) and Ladby (Thorvildsen 1957, 65-9, figs.56, 59.) where buckles formed part of bridles. The large buckle, c.93mm long, from the Balladoole burial in the Isle of Man is thought to have been a horse's girth buckle (Bersu and Wilson 1966, 35, fig.24).

Aside from riding equipment it is not usually possible to say where buckles were worn. A rare example of archaeological evidence, however, was the find of two gilt bronze buckles below the knees of a skeleton at

Lejre, Denmark (Graham-Campbell 1980a, pl.189) which may have been part of boot straps or garters.

3.68 Buckle-Plates (Cat. Figs.36-7)

There are 38 buckle-plates and three probable part-made buckle-plates.

The commonest form was made from a simple rectangular plate; there are probably 22 examples. There are also a few variants, however, such as 3690 which is triangular. 3826 and 3834 (both attached to spurs), and 3754 and 3762 have V-shaped notches cut into the ends which gripped the strap. 3762 and 3769 are similar but their sides have an elaborate scalloped form.

3774-6 are rectangular plates which have, or probably had, a central rectangular slot. They may therefore be unfolded part-made buckle-plates of the basic rectangular form which were discarded before the rivet holes had been punched.

Members of a second group of buckle-plates were made from elongated, folded plates. 3746 and 3759 are similar in form in narrowing inwards from the ends creating opposed triangular areas which are joined by short raised panels decorated with relief work. 3757 is one half of a somewhat similar buckle-plate which has slightly concave sides and is tinned. 3765 is probably the central raised panel from which triangular areas have broken off.

3.69 Strap-Guides (Cat Fig.37)

There are nine finished and three or four possible part-made strap-guides or belt-slides as they sometimes known. Strap-guides were usually set in a buckle-plate behind a buckle. When a strap had passed through the buckle it would then pass through the strap-guide which held it securely in place. It is clear from 3832 that strap-guides might form part of spur attachments (3.77), but it is possible that they were used on other straps and belts.

Three strap-guides (3778-80) are very similar in having flat diamond-shaped heads with a relief strip running across the upper surface. Three other objects (3785-7) appear to be part-made strap-guides of this form. Each has a diamond-shaped panel of similar size to the heads of the finished objects with a relief strip running across it, and two short projections from opposite sides of the panel which may be the remains of the unfinished clasp.

3777, 3781 and 3783 are, or were, very similar objects in having heads consisting of two lobes either side of a concave recess.

The strap-guide associated with spur and spur attachment, 3832, is domed and roughly oval with a relief saltire cross on the surface.

3784 also has a domed and roughly oval head but it has a pattern of V-shaped cuts into the sides.

3782 is probably a plain strap-guide with a narrow head of D-shaped cross-section rather than a staple, which it in some ways resembles.

3.70 Strap-ends (Cat. Fig.37)

There are five strap-ends (3789-93). Two of them (3789 and 3792) were made by folding a piece of iron in two; the half which faced outwards when in use is thicker than the other and has relief work and plating on it.

The other three strap-ends (3790-1, 3793) were made by welding two roughly triangular plates together at their narrower ends; the strap was gripped between the plates at the wider end. 3790-1 are similar in form, size and decoration, and may be intended to represent very simplified animal heads.

3.71 Riveted Dress Fittings (Cat. Fig.37)

There are two objects (3795-6) which are very similar in size and form to the two buckle-plates 3746 and 3759. They have not, however, been made to hold a buckle at one end and, unlike the buckle-plates, consist of two identical plates riveted together. The two plates narrow towards the centre creating a triangular area at each end. The bases of the triangles are joined by short raised areas with relief decoration on them.

Fitting 3794

3794 consists of two plates riveted together at one end and broken at the other. One plate has a row of small protrusions down the centre and is tinned.

3.72 Clip (Cat. Fig.37)

3797 consists of an oval panel which has a hooked terminal at each end of the longer axis. I suggest that it may originally have clipped onto a belt or strap.

3.73 Pins (Cat. Fig.37)

Four very similar pins (3798-3801) have slightly flattened spherical heads made of tin. There are also two other spherical pin heads from which the shank has broken off. 3816 is iron and 3815 is tin.

Two pins (3805, 3811) have polyhedral heads and immediately below the heads there is a small moulded expansion of the shank.

There is a complete, tinned iron ringed pin (3802); two shanks (3806, 3813) with looped heads may be incomplete specimens.

3803 and 3814 appear somewhat similar to each other. 3814 has a ball-shaped head with small pellets of pewter adhering to it, while 3803 has an octahedral head with small pellets of iron at each corner.

3808 has a flat, pierced head of roughly diamond shape. 3812 may have been a pin of similar form.

3807 and 3810 resemble each other in that they have somewhat similar mouldings towards their heads. 3810 also has criss-cross double grooves on the shank and is tin-plated.

Finally, there are two probable pins (3804, 3809) which have spirally-twisted shanks.

3.73.1 Use of pins

The majority of the objects discussed here are probably dress pins. Ringed pins and pins with pierced heads usually fixed cloaks or other outer garments and might be used in pairs with a chain between them. The pins with near spherical or polyhedral heads might have been more suitable as hair or hat pins (Owen-Crocker 1986, 144-5).

3.74 Armlets (Cat. Fig.37)

3817 has small ring-and-dot decoration punched into its outer surface and is tinned. It apparently had a clasp of some sort; the terminals are, however, incomplete.

3818 is a small piece of plaited, tinned strip which comes to an eye at one end which may have been part of an armlet clasp.

3819 is probably a fragment of a tinned bracelet with a D-shaped cross-section.

3.75 Dress Hooks (Cat. Fig.37)

There are three small triangular dress hooks (3820-2), 'lace tags' (Dickinson 1973) or 'hooked tags' (Graham-Campbell 1982). The context in which these objects, more usually known in non-ferrous metal, were worn is not entirely clear, although two silver examples from a grave in the Cathedral cemetery in Winchester were found near the knees of the skeleton suggesting they were garter hooks (Wilson 1965a, pl.79C).

3.76 Looped-Eye Dress Fittings (Cat. Fig.38)

There are three small objects (3823-5) which are made from a single strip of iron and consist primarily of a central loop or eye. I suggest that they were probably part of dress fastenings which worked on the hook-and-eye principle.

It should be noted, however, that similar to 3824 is a small copper alloy buckle from Whitby (Peers and Radford 1943, fig.12, 17), but its loop is rather larger than that of 3824 which does not appear capable of accommodating a strap.

3.77 Spurs (Cat. Fig.38)

There are six spurs (3826-7, 3832, 3834, 3836, 3838) and, in addition, another six spur terminals, and another neck and goad.

The spur arms are all straight when viewed from the side and their goads are in the same plane. The arms have a variety of cross-sections. On 3826 and 3836 they are triangular, on 3828, 3832 and 3834 they are D-shaped, and on 3827 octagonal.

The arms also exhibit a variety of incised and relief decoration. It usually occurs on only one side of the surface, presumably that which faced upwards when the spur was worn, and was thus more easily seen.

The arms of these spurs have terminals which, with the exception of 3836 and probably 3838 (which is largely missing), are basically of the same form. The six single terminals are also similar. They are basically rectangular, or as on 3832 more D-shaped, and pierced by a roughly rectangular or oval slot. This slot is not usually in the centre of the terminal, but is displaced towards the upper face of the spur. The tips of the terminals may also be curved outwards, as on 3834 for example.

The surviving terminal of 3836 is rather different from the others. It was formed by flattening the end of the arm and curving it outwards into an oval loop.

The goad of 3836 is relatively short, has a rounded cross-section and three grooves running around the base. The goad of 3838 is very similar, but without the grooves.

The rest of the necks and goads are more elongated and have simple three-dimensional mouldings.

3.77.1 How spurs were worn

The way in which the 16-22 Coppergate spurs were probably worn is shown in Fig. 3.26.

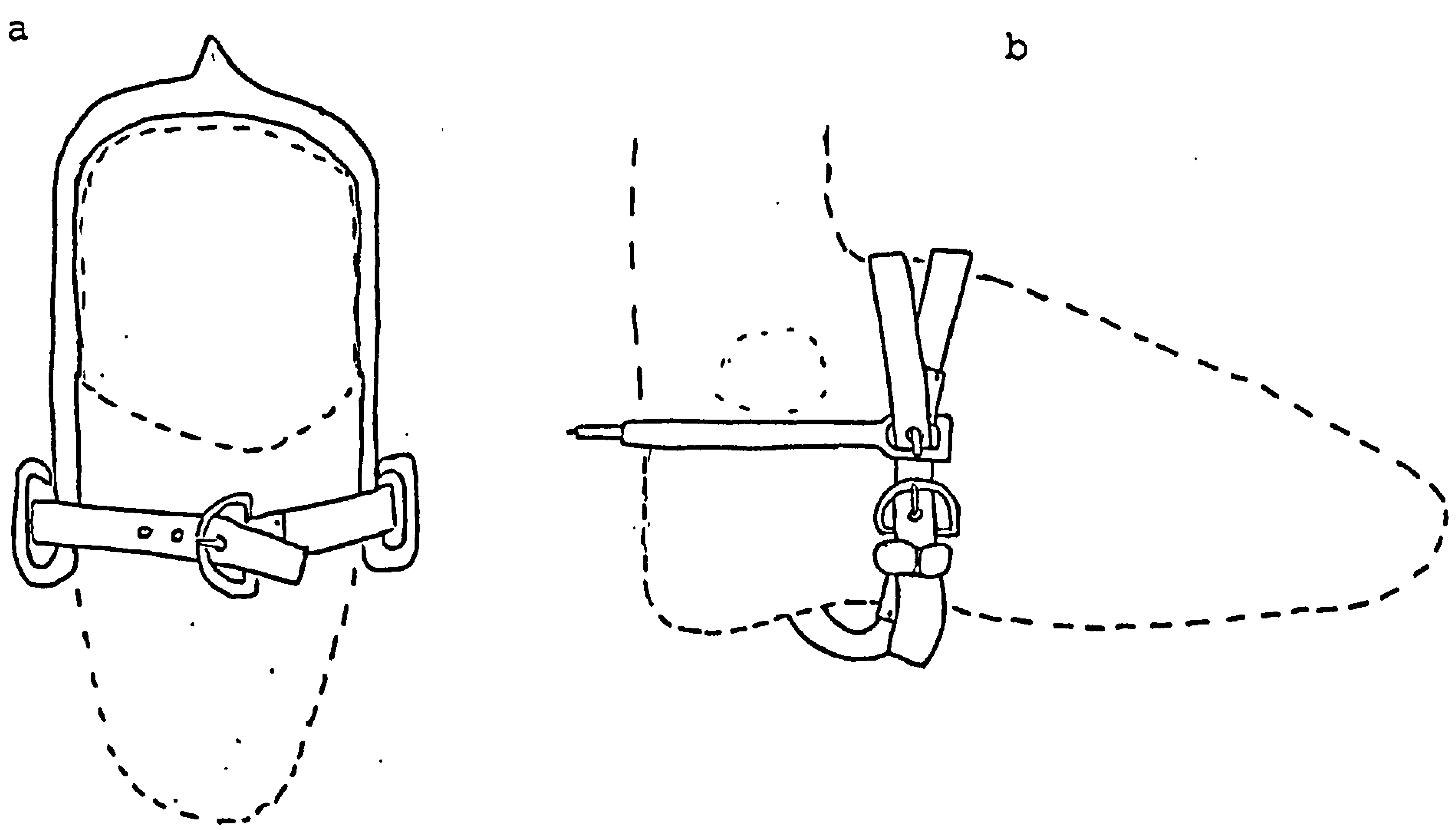


Fig.3.26 How spurs were worn (a: view from top of foot; b: view from side of foot)

The manner in which 3836 with looped terminals was fitted is shown in Fig. 3.26a (after Koch 1982, Abb.1). Fig. 3.26b shows how the other spurs may have fitted based on the evidence from a spur from York (Waterman 1959, fig. 25, 8). It has a tongue on the upper bar of each terminal showing that they functioned rather like buckles, and attached to each terminal is a buckle-plate, both of which are riveted to the remains of leather straps. The two straps were presumably crossed above the instep. On the right foot the strap coming from the right terminal would have been the longer and would have run through the left terminal and then under the foot to meet the shorter strap coming from the left terminal which would have passed over the foot and through the right terminal. One of the straps, probably the longer, would have had a buckle attached to it, on occasions with a buckle-plate bearing a strap-guide as with 3832. The two straps were then fastened on the outside of the foot so that any decorative treatment on the strap-guide was clearly displayed. On the left foot this arrangement was reversed.

HORSE EQUIPMENT

3.78 Bits (Cat. Figs.38-9)

There are twelve objects which are parts of snaffle bits; nine mouthpiece links (two incomplete), an incomplete eye, one cheek piece and one bridle attachment link. A snaffle bit was usually composed of two links of roughly equal size forming the mouthpiece which at each end was connected to a cheek piece which in turn was connected to the bridle, often by means of a looped-eye strap fitting (such as 3546; 3.56).

The most common form of mouthpiece link has a shank with a rounded or rounded rectangular cross-section, and a rounded eye at each end formed by flattening or tapering the shank and curving it over. 3840 is more elaborate; it has an S-shaped shank of which one half is flattened and widened before tapering to form an eye while the other tapers away from the centre before bifurcating. The surviving arm is curved over, but unfortunately the other is broken so that it is not clear exactly how a cheek piece could have been attached. The object has been identified as a bit link on the basis of its resemblance to a link in a complete bit from Norway which has two curved-over ends (Petersen 1951, fig.6).

Incomplete object 3945 may also be part of a snaffle link. In AY17/6 it is not identified as such hence its number, but it is possibly part of the eye of a snaffle link with a decorative projection as can be seen on a few Viking Age bits from Scandinavia, including a specimen from Kaupang (Blindheim et al. 1981, pl.35, 10a).

There is only one distinctive cheek piece (3848), although a number of the rings from the site may also have been cheek pieces (3.55). 3848 is a ring, now incomplete, which has a strip projecting from it that is flattened and widened towards its tip. Presumably there was, originally, a similar strip projecting from the other side.

3844 is a link from a form of bit also current in the 9th-10th centuries which had three components: snaffle links, cheek pieces, usually elongated bars, and bridle attachment links. At one end of 3844 is an eye made by tapering and curving it over and at the other end of the shank there is a small circular eye into which the cheek piece fitted, and beyond it a slightly larger eye, now incomplete, which would have engaged with the bridle attachment link.

3849 is a bridle attachment link from a tri-partite bit. The rounded eye joined with the snaffle link and the rectangular eye took the bridle strap. There is a domed protrusion between the eyes on one face.

3.79 Horseshoes (Cat. Fig.39)

There are six horseshoes (3851-6; for terminology see Fig.3.27 after Clark 1986). The only complete example is 3852. Its branches have largely smooth outer sides but widen very slightly by the nail holes. It has calkins formed by turning down the heels at right angles.

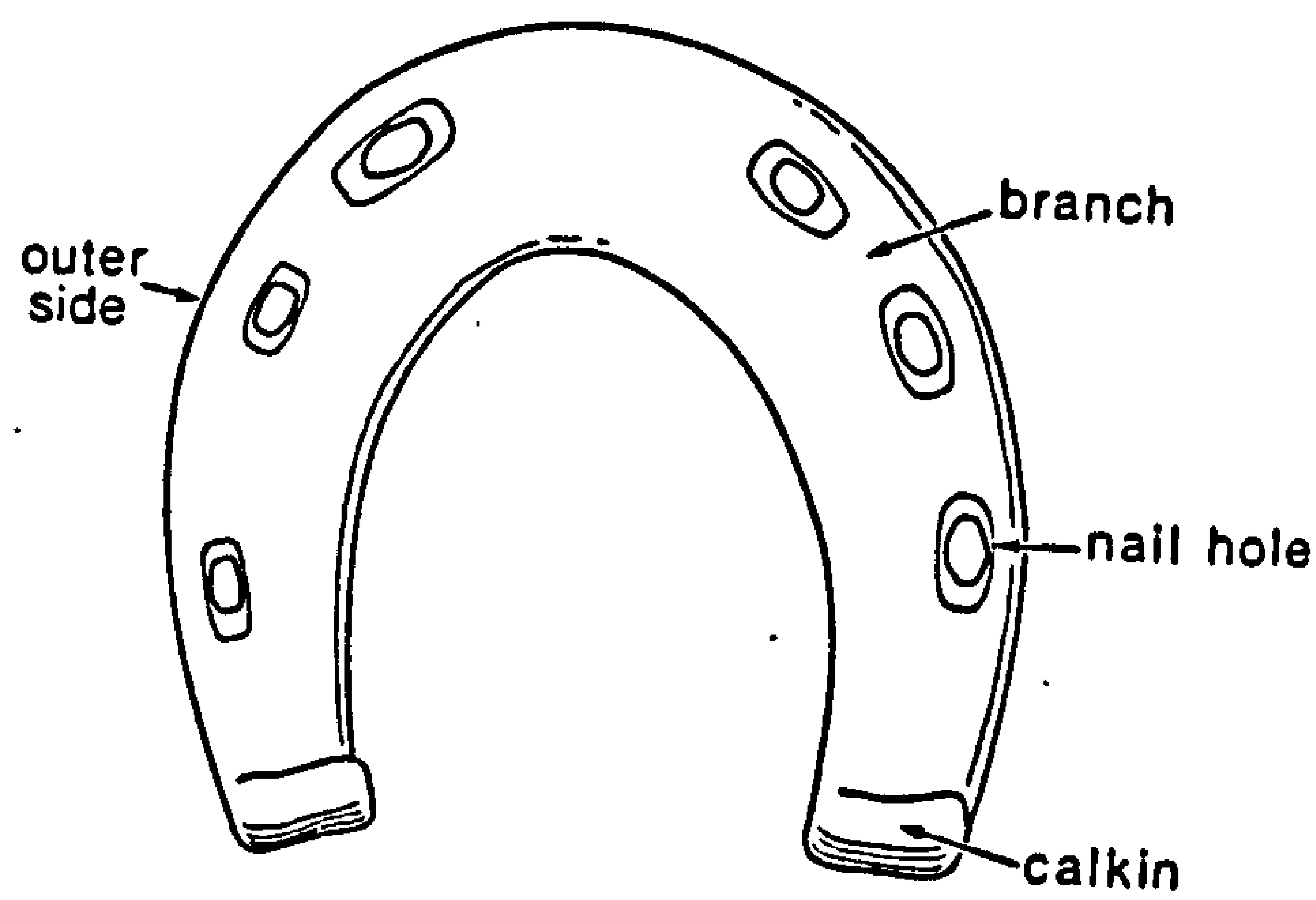


Fig.3.27 Horseshoe terminology

Branch fragments 3854 and 3856 also have smooth outer sides. 3855 is a branch fragment which has a slightly wavy outer side. Branch 3851 has a more markedly wavy outer side. 3853 is the branch fragment of a shoe whose form cannot now be determined.

All these horseshoes have countersunk holes so that in use the base of the nail heads lay partly below the surface of the shoe leaving only the tops projecting.

In addition to the horseshoes there are 56 horseshoe nails (including those in 3852 and 3855), although their identification in some cases is not entirely certain. The most common head form is a D-shape, but others have thin flat or slightly triangular heads which probably result from the wearing down of the D-shape.

WEAPONS

3.80 Arrowheads (Cat. Fig.40)

There are twenty-six arrowheads of various forms (3905-30), the leaf shape predominating.

Leaf-shaped arrowheads

Leaf-shaped, or lentoid, blades (twelve certain and two probable, but incomplete, examples) are usually elongated with convex sides and at their widest at around the mid-point.

It is characteristic of the leaf-shaped arrowheads to thicken at the base before either tapering or stepping in to a tang. Only one example (3924) is socketed.

The blade cross-sections are usually a flat diamond, or lozenge, shape. On 3906 and 3915 each facet is slightly concave. The blades of 3912 and 3925 differ from the rest in that the central ridge divides a little below the tip to form ridges which run to the sides of the blade and then converge again to meet at the base. 3922 is unusual in that on each face it has four pairs of ridges sloping down to the sides from the central ridge.

These leaf-shaped arrowheads are all of fairly similar length. The longest is 3922 (155mm) and the shortest is 3923 (102mm). 3922 also has the longest blade (132mm). The form and dimensions of these arrowheads may be related to their function. Wegraeus (1972; 1986, 23) comments that hunting requires a relatively wide blade which can create a wide, though not necessarily deep, wound, to cause maximum blood loss in the animal in order that it will die quickly and not run away. In war, however, an arrowhead does not need to make such a wide cut, but must be able to pierce deeply through armour or protective clothing. This requires an arrowhead with a slim but robust blade. On the basis of Wegraeus' classification, all the leaf-shaped arrowheads from Coppergate were probably used for hunting, although Wegraeus also suggests that this form may have been, to some extent, general purpose before the introduction of more specialised forms. There is, unfortunately, very little evidence from the bones found at 16-22 Coppergate for the hunting of large animals (O'Connor 1989) and these arrowheads would be much too large for hunting small game birds.

Arrowheads with other blade forms

In addition to the leaf-shaped arrowheads there are a few of related, but rather different forms.

The blade of arrowhead 3916 is akin to the leaf-shaped blades, but is unusually slim; it has the diamond-shaped cross-section but expands upwards and is at its thickest a little below the tip.

3909 and 3917 are both relatively short and their blades run directly into the tang without any thickening. 3909 has the diamond-shaped cross-section, but 3917 has a flat blade with bevelled edges.

3927 is also small, has a flat blade and is socketed.

3910 is unlike the other arrowheads in that the blade has two short concave shoulders before narrowing to the tip; the central ridge is on one face only and it has a spirally-twisted tang.

3918 is socketed and its simple tapering blade has a rectangular cross-section.

3926 is also socketed and it has a relatively thick and powerful blade which has a flat lentoid panel on each face and its cross-section in the centre is hexagonal. 3926 is also similar in proportion to 3918. Both of them may, perhaps, be seen as heavy, armour-piercing arrowheads for warfare.

Finally, there are two small arrowheads (3919 and

3921) which are socketed and have slim tapering blades of rectangular cross-section; they are in a sense smaller versions of 3918 and might perhaps have been suitable for hunting small game.

3911 and 3920 are heavily corroded and their form cannot be determined.

3.80.1 Metallography

Two sections were cut from 3915, one at the tip and the other at the base of the blade. The arrowhead had been well made using steel (max. hardness 350 HV) sandwiched between two ferritic sheaths. It had, however, been heavily cold-worked in an attempt to sharpen it, but this had been clumsily done so that the steel core no longer formed the cutting edge.

3.81 Spearheads (Cat. Fig.41)

3931 has a leaf-shaped blade very similar to that of many arrowheads, but an elongated socket which indicates that it is probably a small spearhead. There are also two blade fragments (3932-3) whose robust nature suggests they are from spearheads.

3.81.1 Metallography

3932 was sectioned transversely and longitudinally and was shown to have been competently manufactured from piled low carbon steel that contained bands of phosphoric iron.

3.82 Swords (Cat. Fig.41)

There are nine pieces of sword. 3937 and 3943 are knops from a composite pommel and 3937 has a staple in its base which would have fitted it to the pommel guard (Wilson 1965a, fig. 15). 3937 is shaped somewhat like a brazil nut; 3943 is of a tri-lobate form with a central lobe which fitted over the hilt and two side lobes formed into what may be very simplified animal heads. 3938 is a pommel guard from a composite pommel. 3940 is a non-composite pommel also of a brazil nut form which was tinned and had a band of relief lozenges running along the base of the faces.

3934 and 3941 are guards; the surfaces of 3941 have vertical grooves cut into them and it was silver plated.

3936, 3939 and 3942 are blade fragments which appear to have been cleanly cut with a chisel.

3.82.1 Metallography

Two sections were removed from blade 3936 and they showed that the sword was manufactured from high phosphorous iron but, surprisingly, there was no evidence for a steeled cutting edge.

3.83 Caltrop (Cat. Fig.41)

3944 consists of four short radiating prongs. It is probably a caltrop, an object used to deter cavalry.

CHAPTER 4

CLASSIFICATION BY FORM AND COMPOSITION

4.1 Introduction

Throughout the description of the iron objects in Chapter 3 I have referred to their formal attributes and, where possible, to their metallographic composition, with a view to showing how form related to practical function. In this chapter I intend to focus on the formal and, to a lesser extent, compositional attributes themselves and to classify them independently of the object classes. The first objective of classification on these bases is to illustrate how the that body of knowledge and processes I have termed the smiths' practice related to the practical constraints imposed by the properties of iron the metal. The second objective is to supplement the functional connexions established between objects in Chapter 3 with the identification of connexions between objects in different functional classes which may suggest areas of specialisation in the smiths' practice.

4.2 Method

In order to analyse the variability in formal features I have considered the artefacts primarily in terms of their main components, a component being defined as a part which is functionally distinct and appears to have a formal unity probably deriving from manufacture in a single, discrete operation. A few artefacts, such as the wool comb teeth (3.17), consist of a single component (although one of several in a complete wool comb), more commonly they consist of two or three components: a knife, for example consists of a blade and tang, and an auger of a blade, shank and tang.

The form of each object or object component may be divided into two parts. The first part is the form of the object in its two greatest dimensions (length and width) which I will call 'plan form', and the second part is the form in the smallest dimension (thickness) or what is usually called cross-section. Since objects were, presumably, largely conceived and executed in three dimensions this division is obviously artificial, but it provides a clear basis for analysis. Strictly, perhaps, form should have been considered in three parts corresponding to the three dimensions, but this proved impractical.

The second artificial division imposed on the artefacts for the purposes of discussion was on the basis established for describing the bar iron and blanks in 3.1. which, depending on the ratio of the length of the cross-section sides, were referred to as 'strips', if this was less than c.4:1, and 'plates' if it was greater. Because I am now discussing finished objects I have, for the purposes of discussion in this chapter, adopted the terms 'strip-shaped' or 'plate-shaped'. The division is useful as it allows the picking out of the slightly different techniques of working bar iron and flat plate

Although it was possible to describe the formal variability of the objects by employing the procedure I have just outlined, it should be stressed that the manufacture of an iron object by even the most skilled smith is always likely to yield formal irregularities; sides are not always straight, cross-section form may vary slightly over the length of a component, and some formal features assume states which can only be defined as idiosyncratic. Irregularities in form will also occur due to the use of the object or to corrosion after burial, although the good preservation of the ironwork at 16-22 Coppergate renders this factor less serious than on many sites.

As I noted in 2.5 I have not adopted the procedure of coding every object according to its formal attributes and quantifying the occurrence and co-occurrence of each. The relative frequency of different formal features and combinations of features have not, therefore, been accurately calculated. I suggest, however, that absolute numbers in this context do not have great significance since the occurrence of artefacts in the ground at 16-22 Coppergate is subject to a number of factors which cannot themselves be quantified accurately (see 5.2 - 5.3). What follows, therefore, is a rapid survey of the Coppergate ironwork with a view to identifying the principal aspects of formal patterning.

4.3 The formal attributes

For an understanding of this section I think it is helpful to begin by stating that one of my principal conclusions from the study of the formal variability of the Coppergate ironwork is that the smith's practice was largely based on a series of simple processes with only an occasional resort to anything unusually practically or technically demanding. In a formal sense these processes meant, for the most part, the manipulation of simple geometrical forms, principally the rectangle or circle, or their three dimensional counterparts. More elaborate forms are rare. Since the vast majority of the smiths' products probably began life as elongated bars or strips comparable to numerous examples found on the site (3.1.1), the vast majority of finished artefacts were probably produced with relative economy of effort.

In Fig.4.1 the principal plan forms (A1-21) of strip- or plate-shaped objects are shown diagrammatically. There are numerous strip-shaped objects or object components with straight parallel sides (A1). They range from the relatively thick auger shanks (3.14) to the slender stems of shears (3.20), shanks of fish hooks (3.37) and bodies of small fittings (3.47). The most common developments of this form involve a constriction in one or two dimensions, i.e. a narrowing (A2) or tapering (A3) which would have been achieved by a simple hammering or drawing-out process. The purpose of this would, on occasions, have been merely to lengthen a piece of iron and narrowing or tapering for no apparent practical reason is visible on some objects, but, on the whole, there was a specific end in view. The narrowing or tapering strip form is embodied in a large number of objects, principally tools, or components of tools, as it clearly related to three of the main properties of an iron object: the ability to pierce, make impressions on, or be inserted into softer materials. A simple narrowing towards the blade edge is visible on chisel 2245, but tapering is more common, for example on punches (3.4), nail shanks (3.44) and tangs for a variety of tools. Some objects, including awls (3.22; 3.24), combine two distinct tapering components with, on occasions, a panel between them. Other objects have components which are tapered towards each end (A4) and pin shanks have this feature to secure them in garments (3.73). In other cases, as on the spoon stems (3.38) or small pierced fittings, such as 3322-3, the feature is less obviously practical.

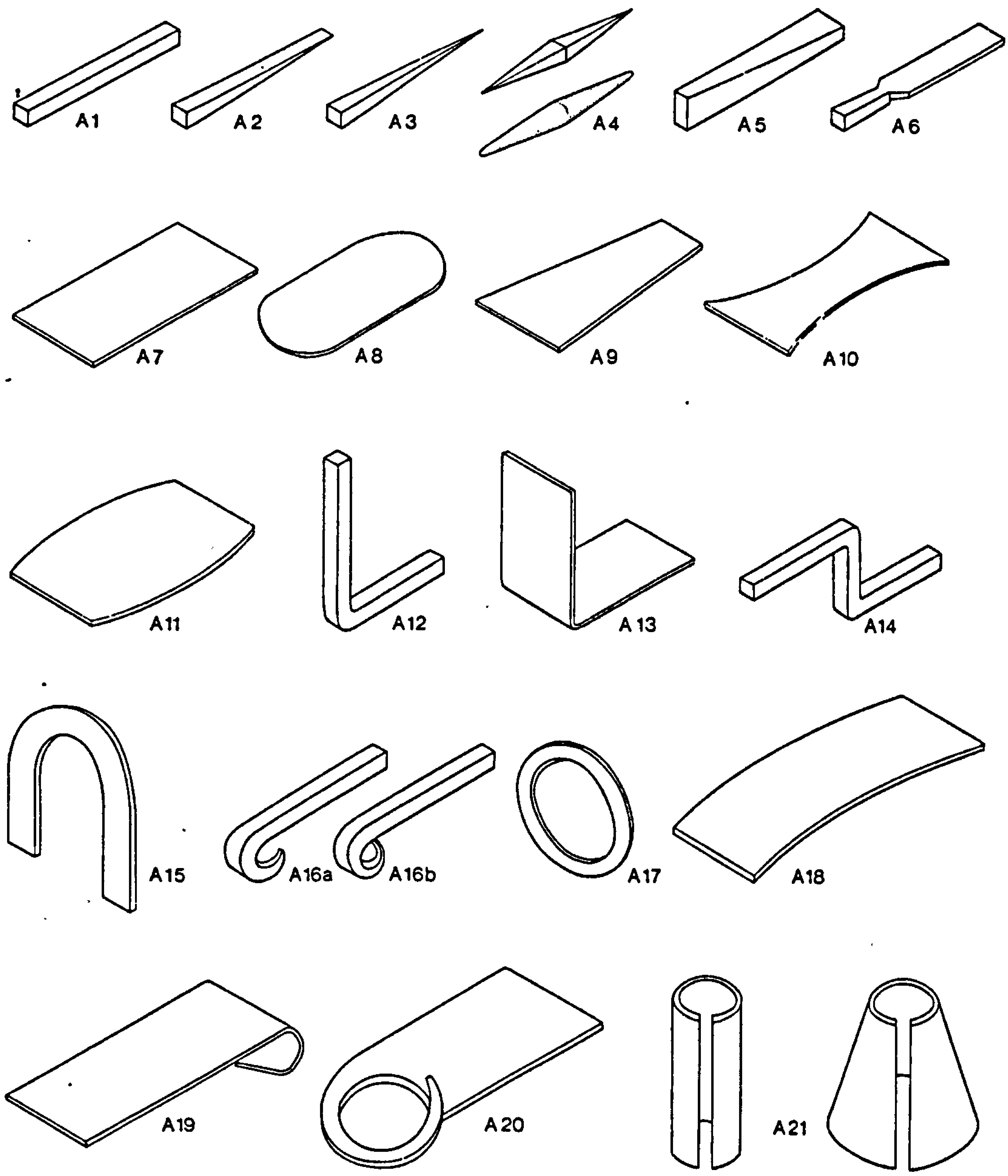


Fig.4.1 Principal plan forms of strip- or plate-shaped objects

Finally, an unusual variant of the constricting forms can be seen on the arms of clippers 2249 (3.7) which over most of their length narrow and thicken towards each end but in opposite planes (A5).

Rather than narrowing or tapering gradually towards one end strip-shaped components may be flattened and widened with varying degrees of abruptness at some point along their length (A6), often, apparently, with the intention of making the object easy to grip. This can be seen, for example, on the shank of pot hook 3565 and key 3654. Flattening at one end is also used as a device on strip- and plate-shaped objects to create rounded terminals suitable for piercing.

There are numerous plate-shaped objects and object components which have parallel sides and flat surfaces, and they may either have straight or rounded ends (A7, A8). The regularity of the sides may vary somewhat, but it is noticeable that the relatively small objects such as the small fittings (3.47) or hinges (3.50.3 - 3.50.5) are usually more regularly formed than the larger. This is presumably because the context of use required high standards of finish (see 7.8 for some further discussion of this point). The narrowing or tapering of plate-shaped components (A9, A10) is again common: for example on fittings such as 3342 (3.47), hinge strap 3345 (3.50.1), and hasp 3497 (3.52). Some objects narrow from both ends creating a waisted form

(A11) as in the case of hinge strap 3307 (3.50.1).

In addition to being suitable for narrowing, tapering and flattening, iron is a ductile metal which also lends itself to being bent or curved. Strip-shaped objects which were formed by bending a bar at a 90 degree angle (A12) include the hinge pivots (3.50.2) and wall hooks (3.58.1). Rectangular staples were formed from strips, tapered at each end, bent twice at 90 degrees. Plate-shaped objects made from iron bent at 90 degrees (A13) include the corner brackets (3.51). Examples of the unusual crank-shaped strip form (A14) are the tang for small gouge 2269 (3.15) and stem of slide key 3661 (3.64.3).

A simple U-shaped strip (A15) is employed to make the U-shaped staples (3.46) and is also the basis for the arms of the spurs (3.77). Strips were also commonly curved to make a variety of simple loops, either open-ended or closed (A16a-b), which usually had the function of a link to another object. Examples include the bows of fixed lock keys (3.64.1), the terminals at the head of barrel padlock keys (3.64.4) and the eyes at the end of snaffle bit links (3.78). There are also frequent examples of strips formed into simple rings (A17), either circular or oval, and the same process was used to create buckle frames (3.67) but often with localised widening or thickening to suit their specific function.

Plate-shaped objects and components may also be curved (A18). Hasps 3490 and 3496 (3.52) were curved to accommodate convex box lids and 3496 also shows that plates could be curved over into loops (A19) in this case for an attachment device at one end. A plate could also be drawn out, curved around and welded back onto the strap to form a closed loop (A20). This can be seen on five of the hinge straps from Coppergate (3.50.1). Finally, plate was folded lengthwise, as well as widthwise, to form with parallel-sided tubes (A21a) for key stems or tapering tubes (A21b) for the socketed components of objects such as the socketed chisel (3.12) and some of the arrowheads (3.80).

In addition to the common forms of strip- and plate-shaped objects or object components which have wide application, there are a few which are more unusual and were developed for more specific functions. Examples include the needle eye and key bit. Many unusual forms are also associated with metallographic complexity. Knives (3.30), for example, employ a combination of a very simple formal component, the tapering strip tang, with a blade, a component subject to a number of formal variations peculiar to it and requiring unusual metallographic composition, including the use of steel, to perform its functions. The only object where the knife blade forms may also be seen are shears (3.19) which are related in function. Arrowhead blades (3.80) also require steeled metallographic structures and they have a series of double-edged blade forms especially developed to suit their function. Other components with specific functions and a steeled element include the blades of the file (3.6) and auger (3.14). Unusual forms were also often associated with relief work and non-ferrous plating.

Amongst cross-section forms there is also a contrast between the extensive use of simple forms, in this case two, and the occasional use of a number of others. The principal forms are shown in Fig. 4.2 (B1-10). The rectangular cross-section (B1) which can range from square to more elongated forms on plate-shaped objects is, by far, the commonest. There is a component with a rectangular cross-section on objects in the vast majority of classes ranging from the anvil (2200; 3.1) to wool comb teeth (3.17), nails (3.44), hinge straps (3.50.1) and hinge pivots (3.50.2). This again indicates that relatively little work was required on the bars and strips, the vast majority of which also have rectangular cross-sections, to produce many of the iron objects from 16-22 Coppergate. A rectangular cross-section also, however, had, up to a point, a practical function in the sense that it would have been better than a rounded for, for example, shanks or tangs to be set in wood as the surface area and so friction needed for gripping would be greater. Strip-shaped objects with rounded cross-sections (B2) are also common and were made in the majority of cases, perhaps, by the modification of an iron strip or bar of rectangular cross-section and there are examples of strips from the site possibly discarded in the process. The rounded cross-section usually has a practical function. Needle shanks (3.19), for example,

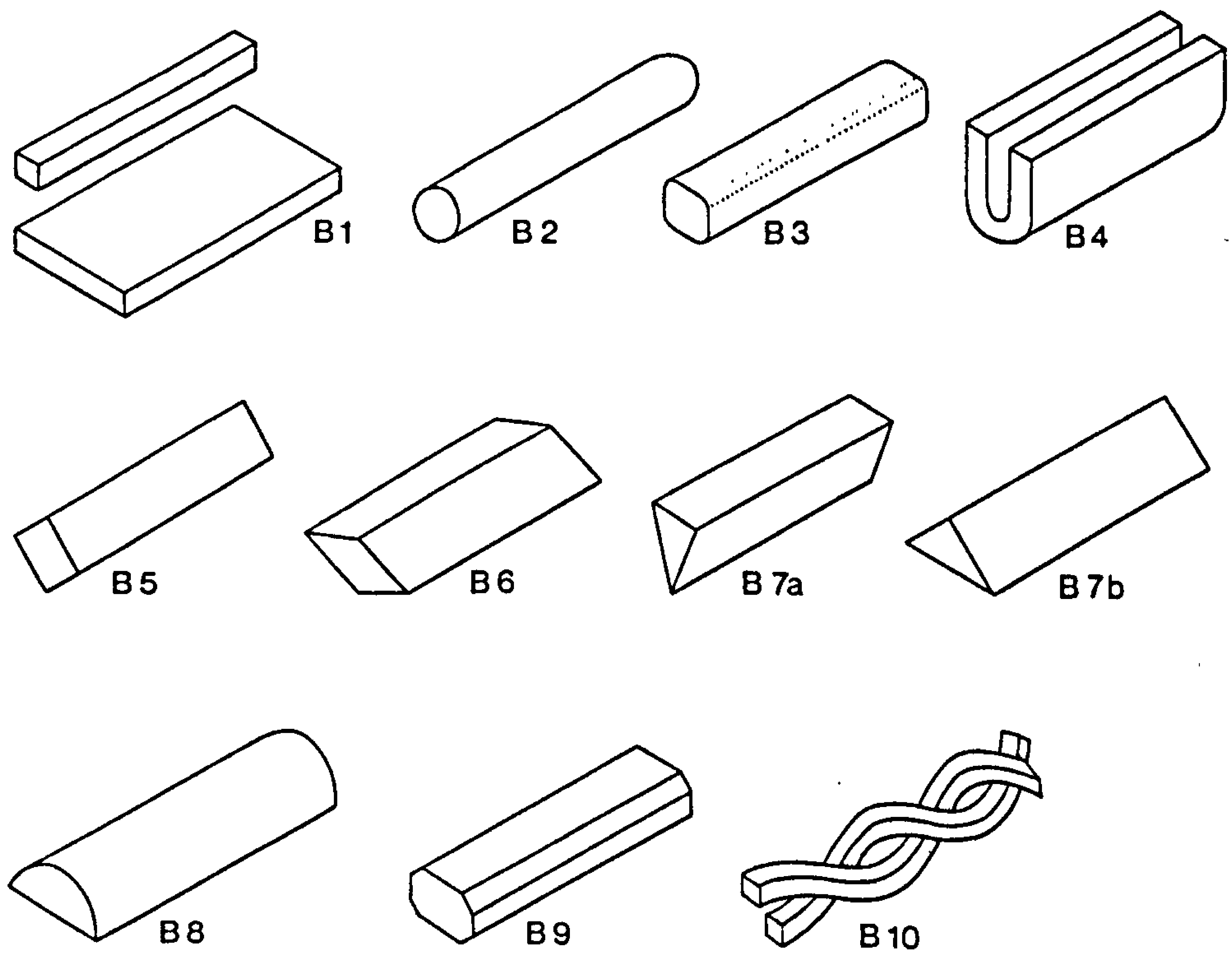


Fig.4.2 Principal cross-section forms

adopted a rounded cross-section to prevent cloth fibres being torn, the guide arm of hinge pivots (3.50.2) needed the form rounded to allow free rotation of the hinge strap, and bit snaffle links needed it to prevent cutting of the horse's mouth. On occasions the rounding of the cross-section was not done completely and only the corners were rounded giving a rounded rectangular cross-section (B3). This can be seen on most of the auger shanks (3.14) and some of the wool comb teeth (3.17).

Other less common cross-section forms were clearly adapted to specific purposes. A U-shaped cross-section (B4) be found on a few pierced fittings, including 3375 (3.47), which would have been used as edge-bindings, and on the auger blades (3.14) and small gouge blades (3.15). The diamond-shaped cross-section (B5) of the leatherworkers awl was used to aid cutting but to avoid tearing the leather (3.22). Related to this diamond-shaped form is a flattened version which may be described as the lozenge (B6) and also served a similar specialist cutting function on arrowhead blades. The elongated triangular cross-section (B7a) of knife blades is integral to the function of the object but both knives and arrowheads exhibit variant cross-section forms which introduce formal elements less closely related to practical function (3.30.5; 3.80). The slight triangular shape (B7b) which, for example, appears on fitting 3339 is otherwise rare at Coppergate, although it is common on structural fittings from other sites.

A few strip-shaped objects have a D-shaped cross-section (B8), including small pierced fittings (3323, 3367; 3.47), small U-eyed hinges such as 3475 (3.50.3), and the arms of some of the spurs (3.77). This appears to have no practical function but is often associated with objects also exhibiting surface treatment and may be seen as particularly appropriate to them as it enlarges the surface area available for display (see 4.4 and 4.5 below). The rarest of the cross-section forms is the octagon (B9) to be found on spur arm 3827 (3.77).

Another strip form which has not yet been referred to is the spiral which was created by twisting two strips of rectangular cross-section together (B10), as can be seen on handle 3502 (3.49) where they are parting. The spiral is found on a number of object components at 16-22 Coppergate including hasps 3489 and 3493 (3.52), the shanks of S-hook 3561 (3.58.2), hook 3562 (3.58.3) and the applied strips on barrel padlock 3610 (3.63.4). In the Roman period the spiral was often associated with hearth-related objects and may have been adaptive in the sense of preventing the warping of iron exposed to heat. A spirally-twisted shank has a greater surface area than one of simple rectangular cross-section and can absorb a change in temperature more quickly. In the Coppergate material, however, of objects on which the spiral appears, only the hooks were probably hearth-related.

In addition to the working of bars or strips of rectangular cross-section, the working of thin plate or sheet iron was also a feature of the smiths' craft, although it was not apparently used for the elaborate three-dimensional modelling known in the Roman period on objects like the parade helmet from Newstead (Curle 1911, pls.27-8). The use of sheet was principally confined to vessels, ranging from the large pan (3004; 3.39) to the domed heads of some nails (3.44), and to cylinders such as that composing case of padlock 3610 (3.63.4). Thin plate was also used for the sheathing of wooden objects such as wool combs (3.16) and spade blades (3.26). Some small rectangular objects such as clench bolt roves (3.45) were probably cut cold from iron sheet with clippers rather than forged hot from a bar.

Important formal variability is also manifested in more localised features of objects, as well as in plans and cross-sections. The remainder of this section will look at piercings and then at various forms of what may be termed finish.

Iron objects were usually pierced by the simple punching of a round hole from one side, although needle heads were punched from both sides to ensure the eye had smooth edges (3.18). It is apparent that piercing was skilfully related to practical function both where it was required for functional efficiency, as in the case of needle eyes (3.19) or sliding bolts from locks with springs (3.63.2), and where it was required for attachment to another object, especially those made of wood. Where there are multiple piercings their arrangement is very predictable; the holes are set axially along the main body of the object and, on occasions, into a specially formed rounded terminal. Examples of holes set transversely are very rare as they create a weak point in the object. This is shown by the hinge strap 3345 (3.50.1) which has broken across two transversely set holes. The attachment plates of small handle hinge fitting 3485 (3.50.6) are only able to bear transverse holes because they are very thin. Holes are usually rounded as this creates less potential for stress than a rectangular form. The size of hole appears to relate to the stress expected and the properties of the material to which the object was to be attached so that, for example, objects pierced for attachment to leather, such as buckle-plates (3.68) and riveted dress fittings (3.71), have fine holes for small rivets which, being thin, are often arranged transversely. A specialist form of piercing is that found in horseshoes where the holes are countersunk so that the nail heads project to prevent wear of the shoe itself (3.79).

By the term finish I refer initially to aspects of the treatment of the limits of formal components. Sides, ends and edges are usually neatly finished, but in some cases particular trouble was taken. Examples can be found where mechanical efficiency was at stake, as on key bits (3.64), or where some aesthetically pleasing effect was apparently required, as in the case of the unusually neat rounding of the plated nail heads (3.44.5). A desire to emphasise the appearance of the object probably also lay behind the occasional careful chamfering or rounding over of edges, presumably by filing. No excess effort was put into finish, however, and this is shown by the stepped or bearded end commonly found at the thicker end of wool comb teeth which derives from the way the object was severed from the blank (3.17). Were this end to have been exposed the roughness would have been filed smooth, but since the teeth were to be hidden in the comb it was not thought worth while.

As far as strip-shaped components are concerned, a principal focus of variability is the tips of those which are narrowed or tapered and this is usually related to functional adaptation. A wedge shape, either straight or slightly convex across the end, is usually favoured for objects to be driven into wood, such as nails (3.44), staples (3.46) and the tangs of numerous tools. A wedge-shaped end is also found on the chisel (3.5) and some punches (3.4), and is obviously related to their cutting function. A pointed end is found on needles (3.19) and awls (3.22; 3.24) and was presumably intended to minimise damage on the items pierced. Other strip-shaped components were finished by curving over, perhaps to prevent injury caused by a sharp end, as with the arms of prickets 3677-8 (3.65), or to make them easier to grip, as in the case of stapled hasp 3495 (3.52) and the slide keys (3655-9; 3.64.2).

Another, and related, aspect of formal variability in finish resides in the way in which formal components are joined together. In many cases there is nothing remarkable in the way this occurs and one will flow directly into the other. The junction may, however, be marked by some formal device. This is often apparent when a plate-shaped component gives way to a strip-shaped component or a wider component to a narrower. Here there is need for shoulders and they may take several forms. Usually the two components will have the same thickness at the join and so the shoulders will be two dimensional. They may either be double as on knives, where the shoulders also function to hold the handle in place, or single as on shears. Forms include a simple right angle, as on many knives (3.30) and a slope as at the junction of auger shanks and tangs (3.14). On structural fittings, such as hinge straps (3.50.1) and U-eyed hinges (3.50.3), shoulders may be right-angled, sloping or convex. Shears have shoulders at the junction of blade and stem and there are forms peculiar to them (3.19). Arrowheads also have a small group of devices, by which the blade is joined to the tang (3.80) whose primary function is to prevent the blade slipping into the tang; they include a right-angled step and a slight expansion at the base of the blade before it tapers into the tang.

Another aspect of finishing is the weld. The technology of welding is discussed in 1.8, but the occurrence of quality welds was, I suggest, principally related to the stress the object was likely to endure in use; economy of effort again appears to have been a guiding principle. Specialist tools were usually welded to a high standard and the welds cannot be detected except by metallographic analysis whereas poorer welds were used on numerous classes of other objects and are frequently visible on X-ray or to the naked eye, especially where they have parted. Simple scarf-welds created by overlapping two pieces of iron and hammering them together are common. They were employed, for example, in the formation of the eye on hinge straps such as 3333 (3.50.1) and in making chain links (3.54), rings (3.55) and buckle frames (3.67). More unusual is the parted scarf-weld on the tang of knife 2804. The failure of this weld may have been the reason for the discard of the knife, whose blade appears little worn. Simple butt-welds can also be seen on a few objects, such as hinge strap 3307 (3.50.1), where it was intended to close the end-loop and has since parted, and a few of the buckle frames (3.67).

A less common method of joining pieces of iron was by riveting. The pan 3004 (3.39) has two handle terminals riveted, or nailed, on to it and has been repaired both by the use of small rectangular-headed rivets with split shanks or by the riveting on of metal sheets. The iron sheet around the head of the wool comb 2273 was also riveted together and onto the wooden base (3.16).

4.4 Surface treatment: relief work

The formal features under discussion here primarily manifest themselves as relief work on the surface of an object, although they can on occasions involve the three-dimensional shaping of an object or object component. The occurrence of relief work on iron in the 9th-11th centuries, along with the appearance of non-ferrous plating (4.5), appears to be connected with the increased manufacture in iron of objects formerly made exclusively in non-ferrous metal, notably dress fittings, but the nature of iron and constraints of working a metal while solid, as opposed to being able to mould it, preclude any great complexity of treatment. There is a relatively restricted range of basic formal units of relief treatment and they are usually based on work with a punch or file to create either impressed grooves and notches or raised panels. Fine lines imply the use of a very fine chisel or graving tool. In addition a relief effect was occasionally created by applied strips as on padlock 3610 (3.63.4).

The basic formal units might be used singly, but were usually grouped together or built up with other units into motifs; these are again relatively simple in form and organisation when compared with what could be achieved in other media and appear to be based on various simple geometric shapes, notably the rectangle or square, the triangle and circle, with occasional use of such forms as the ring-and-dot (e.g. 3817) and C-shape (3408; 3.48). Symmetry in the organisation of the motifs and in the relationship between them on an object is also a dominant principle.

The occurrence of relief work on a class by class basis has already been described in the relevant sections of Chapter 3 and details will also be found in Appendix 5. The data may be summarised by noting that surface treatment occurs in a relatively restricted range of object classes including fittings, especially the smaller examples, (3.47), keys (3.64.1), dress fittings and riding equipment (3.67 - 3.77) and weapons (3.80; 3.82). Knives (3.30.6) also have relief work, but awl 2739 (3.24) is the only other object to have it. The significance of this distribution will be discussed more fully in 7.6 - 7.8, but at this point it need only be noted that the majority, of objects with relief surface treatment were probably used in contexts in which they were widely visible in the community.

The location of the motifs on the objects appears to confirm the point about a relationship between their occurrence and visibility in the sense that surface treatment appears primarily on what may be presumed to be the exterior surfaces of, for example, buckle-plates (3.68) or strap-ends (3.70). On spurs it is focussed on the face which would have faced upwards (3.77). The principle of economy of effort, found in other aspects of form described above, can again be seen to guide the production of iron objects.

The occurrence of relief surface treatment in most object classes appears to correlate strongly with that of unusual plan or cross-section forms. Examples of the former include the buckle-plates (3.68) and riveted dress fittings (3.71) with opposed triangular fields. Examples of the latter include fittings, such as 3322-3 and 3367 with the D-shape (3.47). This form, along with the triangular is, as I have already noted in 4.3, ideal for surface treatment as they give a larger area than a flat surface and by projecting outwards serve to call attention to the relief motifs.

A complex moulded treatment may, on occasions, dominate two or three dimensions of an object or object component, as is the case with sword pommel 3943, probably the most elaborate example, and, at a simpler level, the bi-lobate strap-guide heads (3777, 3781, 3783; 3.69) or some of the spur goads (3.77). It is more usual, however, for surface treatment to appear as an addition to a completed formal component. The motifs operate principally, I suggest, to divide up a surface and/or to mark its limits which often correspond to the limits of the object or component itself. The result is to draw attention to particular parts or dimensions of the object and consequently away from others. While details of the location and organisation of surface treatment is given in Appendix 5, some examples may usefully be discussed here to illustrate this point about organisation. 3303 is a small pierced fitting which between pierced terminals is divided into three fields with D-shaped cross-sections by groups of transverse relief strips and grooves. The eye is as a result distracted from the length dimension and the grooves and strips also emphasise the junction of the body with the terminals. In contrast to 3303, attention is drawn to the linearity of the spoon stems (3.38) with the fine engraved lines which run parallel to and just inside their edges. On bit link 3844 the saltire crosses created by double grooves are arranged so as to emphasise both the linearity of the object and its triangular cross-section. The idea of emphasising component limits is well-developed on key 3641 where the surfaces of the bow have on their outer edges a pattern composed of triangular and rectangular notches and the junction of bow and stem is marked by relief strips around the stem.

The distinctive variability in the surface treatment of arrowhead blades (3.80) essentially involves the simple juxtaposition of panels and facets, but of particular interest, perhaps, are the raised spines on the blade of 3922. They have the effect of dividing up the surface of the object and emphasise its length dimension but also appear, by metaphoric associations with a feather, to suggest function i.e. flight, in a way otherwise rare on iron objects. Another example of this phenomenon, however, is probably the simplified animal heads which appear on small box fittings (3322-3; 3.47), U-eyed hinges (3475-8; 3.50.3), and a stapled hasp (3496; 3.52) which recall the iconic connections between beasts and guardians of treasure in the Anglo-Saxon period (Speake 1980, 90; Chapter 7.8.1).

The presence of comparable relief motifs on objects in a number of classes of iron object is good evidence for an area of specialisation within the Anglo-Scandinavian smith's practice not specifically related to production for practical purposes. Within this practice, moreover, I suggest that the use of a number of very distinctive motifs may indicate a single craftsman or workshop operating in York. A number of examples may be cited.

A connexion between buckle-plates 3746, 3759 (3.68) and riveted dress fittings 3795-6 (3.71) is immediately suggested by their unusual plan form, but the form of the relief work on the central panels is especially similar on 3759 and 3796 with their transverse grooves and rectangular punched impressions; the latter are also very similar to the impressions in the panel on 3746. It is possible that the same punch was employed on all these objects.

Strap-ends 3790-1 (3.70) not only have a very similar triangular form, but the upper surface is divided up in a similar way by relief strips. There are triangular notches along their wider ends and they both have three rows of impressed dots in the wide rear field. Strap-end 3790 is also remarkable because one of the raised transverse strips has two oblique punched impressions in it identical to those in the raised strip running across the head of strap-guide 3780 (3.69). Some of the strap-guides (3.69) are remarkably similar to one another. The only difference between 3778 and 3780 is that the former has impressed dots on the raised strip across its head. The strap-guides with lobed heads (3777, 3781 and 3783) are almost identical and are also very similar to strap-end 3789.

Another striking motif is the simplified animal head found on small fittings 3322-3 (3.47), and small U-eyed hinges 3475 and 3478 (3.50.3), which are virtually identical in every particular. There is also the distinctive saltire cross motif formed of double grooves which occurs on key stem 3629 (3.64.1), the shank of pin 3810 (3.73), spur terminal 3828 (3.77), snaffle bit link 3844. Finally, the pattern of triangular notches cut into the ends of buckle-plate 3753 (3.68) also occurs on strap-ends 3790-1 (3.70) and riveted dress fitting 3795 (3.71).

4.5 Surface treatment: non-ferrous plating

The final aspect of classification by form does not directly involve the working of the iron but the application of non-ferrous metal to the surface of otherwise finished objects (1.10). 171 objects are plated with non-ferrous metal (for details see Appendix 6) usually tin or tin-lead alloy (150 examples), although there are also examples of copper alloy plating often known as brazing.

The function of non-ferrous plating was, as already noted in 1.10, probably primarily decorative and may have been intended to make iron objects appear as if silver or gold. Plating would, however, have served to prevent corrosion and brazing was used to join the components of objects such as bells 2752-3 (3.29), tubular object 3592 (3.62) and the barrel padlock 3610 (3.63.4),

The pattern of occurrence of plating on iron objects is closely comparable to that of surface treatment, except that it does not occur on any tools, one obvious reason being that it would soon wear off, but plating is found on keys (3.64), although presumably not those which were heavily used (see 7.8.3 for a further reference to this point). Plating is especially common on small pierced fittings (3.47), dress fittings and riding equipment (3.67 - 3.77). Within the classes where plating occurs it can be found on objects which are otherwise formally unexceptional, but its occurrence correlates strongly with the presence of relief work. There are, however, objects which have relief work but are not plated, although closely comparable objects are so treated. This is so unusual that I suggest that these unplated objects may have been discarded during the manufacturing process after forging but before plating.

Close examination of the very well preserved buckle-plate 3759 may confirm the point; it not only appears unworn with the relief work very crisp, but there are no marks or distortions around the piercings to suggest there had ever been rivets in these holes. Other examples of objects possibly discarded before plating include strap-guides 3778-80 (the clasp of 3778 is probably incomplete) and clip 3797 (3.72).

In conclusion, the two aspects of surface treatment relief work and plating were clearly intimately related and this implies that there was a specialist branch of the smiths' practice defined by the production of a range of objects with these features.

4.6 Metallographic Structure

The iron objects from 16-22 Coppergate examined metallographically are listed in Appendix 2 and in the appropriate sections of Chapter 3 I have summarised the results of the work on a class by class basis, but in this section I will summarise the data and show how they relate to some of the themes which have emerged in previous sections. Although only a small sample of the objects have been examined, certain patterns clearly emerge.

The iron micro-structures from Coppergate can, as noted in 3.1.4, be divided into four: ferritic and phosphoric iron, piled structures and steel. This division can be correlated closely with the object classification. It should be noted, first of all, however, that although the majority of the bar iron examined was ferritic or phosphoric, some steel structures were found (3.1.4). These results support the proposition that the majority of the Coppergate iron objects could have been made from strips and bars comparable to those found on the site. The results from examination of objects other than bladed tools, suggests that the majority of objects of the 9th-11th centuries were made from relatively soft and heterogeneous ferritic or phosphoric iron which was not specially treated to harden it, although it was functionally adequate. These objects are also those which are relatively simple in form, embodying, in general, the common plan and cross-section forms. In metallographic terms the bladed and edged tools, however, were also well adapted to their role of cutting, slicing and punching etc., with a variety of metallographic structures giving hard and durable cutting edges or tips. These specialised developments were, moreover, accompanied in many cases by specialised plan and cross-section forms. Techniques of steeling and heat treatment required considerable skill and expenditure of time to implement and their restricted use implies both a specialised branch of the smiths' practice, but again illustrates the principle of economy in the use of energy and materials.

4.6 Conclusion

In this chapter I set out to describe the characteristic and distinctive features of the smiths' practice in Anglo-Scandinavian York which underlie the adaptation to specific practical functions described in Chapter 3. The analysis has shown that while the relationship between, on the one hand, the processes of manufacture and, on the other, the formal features and metallographic structures indicates a high degree of sensitivity to the requirements of practical function, there is also evidence for the employment of a principle of economy in use of energy and materials. The majority of objects were manufactured by a range of relatively simple processes resulting in simple forms and a technologically unsophisticated composition. In terms of both form and composition, however, some specialised features were also apparent, embodied especially in objects for cutting or penetrating iron or other materials. Among these objects the rarer plan and cross-section forms and sophisticated metallographic structures appear to be strongly correlated.

Appearing to run counter to the adaptively efficient character of the smiths' practice, however, there is formal variability which may be described as redundant to considerations of practical function. This is particularly, but not exclusively, evident in those objects which have some combination of unusual plan and cross-section forms, and relief work and non-ferrous plating. This redundancy serves to emphasise that a variety of constraints of a non-practical nature must be taken into account in the interpretation of ironwork classification. In 7.5 - 7.8 I discuss some of the contexts in which these constraints operated, and how they may be understood, but to look ahead, one of the conclusions of that discussion is that the principle of economy can again be seen to operate in the pursuit of non-practical functions (7.6).

The value of the approaches to classification in this chapter is both to indicate areas of specialisation in ironworking and to show that they should not be seen as entirely separate crafts since they were subject to similar constraints exerted by the material, the capacities of the tools and conceptual horizons of the smiths. These classifications may also be used to indicate areas where cognitive connexions exist between the smiths' experience as members of a distinct social group and the social context in which they operated. In Chapter 7 I will examine these connexions in more detail with a view to understanding the role of ironwork in contemporary social strategies. Before this topic can be tackled, however, it is necessary to relate the Coppergate iron objects in more detail to their archaeological context on the site itself and beyond.

CHAPTER 5

CONTEXT and THE INTERPRETATION OF CLASSIFICATION

5.1 Artefact assemblages and human activity

In Chapter 1.2 there is a general description of the archaeological context in which the iron objects from 16-22 Coppergate were found which refers to the location of the site in relation to the topography of Anglo-Scandinavian York and summarises the principal chronological periods identified by the excavators. In Appendix 1 there is a detailed table showing the objects' provenances by period; this is summarised in Table 5.1. largely using the broad divisions of the material employed in Chapter 3. Since they are only tool components, however, wool comb teeth have been counted separately as have knives since they are sufficiently numerous to form a significant part of the assemblage.

Although these data are of some interest as they stand, full interpretation of them requires a more detailed investigation both of the contexts which made up the period groups and of the mechanisms by which the objects were buried in them. This investigation will allow discussion of the significance of the objects for the 16-22 Coppergate site (5.6) in particular and aspects of the economy and society of the 9th - 11th century in York and elsewhere (Chapter 7).

Table 5.1a Summary of the occurrence and chronological distribution of iron objects from 16-22 Coppergate

Abbreviations:
- Bar = Bar iron, blanks
- Tls = Tools of trades and crafts and other implements
- WCT = Wool comb teeth
- Knvs = Knives
- Struc = Structural ironwork and fittings including objects for heating and lighting
- Df = Dress fittings and riding equipment
- Hrse = Horse equipment
- Weap = Weapons

Period	Bar	Tls	WCT	Knvs	Struc	Nls	Df	Hrse	Weap	Total*
3	139	44	21	47	112	965	25	6	8	1367
4A	36	27	7	7	23	52	12	2	3	169
4B	228	163	40	74	190	477	71	11	12	1266
5A	73	39	16	14	57	98	20	0	1	318
5B	131	85	75	67	188	365	24	17	12	964
4-5	8	3	2	4	11	56	5	1	1	91
5CF	4	1	3	2	6	6	0	0	0	22
5CR	46	27	21	8	36	154	6	29	0	327
US	2	6	0	9	5	5	3	0	3	33
Total	667	395	185	232	628	2178	166	66	40	4557

(* In addition there are 59 fragments which are included in totals given in the other tables in this chapter)

Table 5.1b Summary of the occurrence and chronological distribution of iron objects expressed as percentages of Period assemblages. (Over 10 objects required to qualify for entry, otherwise : na)

Period	Bar	Tls	WCT	Knvs	Struc	Nls	Df	Hrse	Weap
3	10	3.5	1.5	3.5	8	70.5	2	na	na
4A	21.5	16	na	na	13.5	31	7	na	na
4B	18	13	3	6	15	37.5	5.5	1	1
5A	23	12.5	5	4.5	18	31	6	na	na
5B	13.5	9	7.5	7	19.5	38	2.5	2	1
4-5	na	na	na	na	12	61.5	na	na	na
5CF	na	na	na	na	na	na	na	na	na
5CR	14	8.5	6.5	na	11	47	na	9	na
All	14.5	8.5	4	5	14	48	3.5	1.5	1

There has been little theoretical work on the meaning of archaeological artefact assemblages in relation to the nature of their context. In most site reports non-structural artefactual material is primarily analysed with a view to dating occupation phases, buildings, roads or other structures. Synthetic analyses of artefactual material which might lead to greater understanding of how the archaeological contexts on the site were created and what they mean in terms of past activities on the site, other than the construction or destruction of structures, are usually absent.

Artefacts other than pottery are, of course, frequently sparse and archaeologists are understandably reluctant to base interpretative constructions upon them. The very lack of finds may be significant for understanding the past as Barker suggests in his comparison of the lack of material culture with documentary evidence for an aristocratic residence at Hen Domen (1986, 148-9). By contrast, 16-22 Coppergate is clearly an example, albeit unusual perhaps, where material culture items were recovered in such large quantities as to immediately prompt inferences about many aspects of life in the past.

There are circumstances where meaning can be ascribed to artefacts in a fairly direct way with an assumption that they relate directly to activities performed on the site itself. On sites occupied for short periods of time with little post-depositional disturbance this may have some validity. On American colonial sites, for example, South (1977, 50) proposes, that "...variability in artefact frequencies in various parts of a historic ruin will reflect behavioural activity." South's basis for determining the nature of past activities on a site is quantification of the finds which involves simple statistical exercises using the total numbers and relative proportions of different classes of artefacts (ibid., 83). He has used his statistics both for intra-site analysis, to establish the functions of different buildings, and for inter-site comparisons to assess differences in the social status and nature of economic activity between sites. On deeply stratified sites with continual redeposition this approach must clearly be treated with caution.

In this chapter I begin by discussing some of the factors which determine the content of archaeological artefact assemblages and must be taken into account in any interpretation of them. I will then review methods for the analysis of the meaning of archaeological deposits with particular reference to 16-22 Coppergate (5.5).

The problem of interpreting artefacts in relation to past behaviour has recently been tackled by a number of ethnoarchaeological investigations which show how difficult it can be to reconstruct the activities of living people even on recently vacated sites (Hodder 1982b, 56). In his well known study of Millie's Camp, Bonnichsen (1972), for example, attempted to identify the function of activity areas and the social composition and organisation of the residents from their material remains. The results of his work are summarised thus (ibid., 286): "1) items were misidentified and assigned to the wrong functional categories; 2) false associations were made between items; 3) activity areas were interpreted incorrectly; 4) the relationships between activity areas were misinterpreted."

It should be added, however, that the remains on Millie's Camp and other sites occupied by nomadic communities are not directly comparable to British urban stratified sites. Nomadic sites are only briefly occupied and their material culture is relatively poor so that the remains at occupation sites are sparse. Since material is usually deposited on the surface rather than in pits or on building floors, post-depositional factors of weather and other environmental forces are often able to intervene to cause considerable disturbance. Nevertheless, I support the conclusion which Bonnichsen (1972, 287) reached that "...the intuitive analytic approach commonly used for the interpretation of prehistoric remains should be critically examined."

As I noted in 2.3 the systems theorists search for patterning in material remains which have cross-cultural predictive value has led to detailed analysis of site formation processes. A pioneer in the study of how archaeological sites are formed and what they imply about behaviour in the past is Michael Schiffer (1972, 1976, 1987). He rejects a simple equation of artefacts and behaviour (1976, 11): "Archaeological remains are not a fossilised cultural system. From the time artefacts were manufactured and used in the past and the time they are excavated they are subjected to a series of cultural and non-cultural processes which have transformed them spatially, quantitatively, formally and relationally." He proposes the concept of the cultural or "C-transform" as a basis for understanding the archaeological record (ibid., 12) by which he means the pattern of physical remains the archaeologist encounters in excavation. Schiffer believes that cultural formation processes can be accounted for by laws of cultural formation which allow the archaeologist to specify ways in which a cultural system generates material which may be recorded in the ground. His conclusion is, in other words, that there are predictable generalised relationships between the patterning of discarded artefacts and systemic or cultural variables which will emerge if the cultural and natural transformation processes can be evaluated.

There is no room in Schiffer's approach, however, for the influence of non-adaptive ideological factors on the patterning of material remains and for the active use of discard processes in social strategies. This point is also made by Gould (1980), another systems theory archaeologist, who opts for a functionalist interpretation of remains. From his study of native Australians he proposes that knowledge of the total cultural system in its adaptive context will allow a full interpretation of past behaviour without the need to resort to a consideration of ideological factors. The occurrence of, for example, non-local, yet inferior, lithic material in Aboriginal assemblages may be understood solely as a means of staying in contact with other tribes with whom relations may be needed in times of drought rather than as indicating any abstract symbolic system surrounding the use of stone. He concludes that (ibid., 159): "...by looking first at the utilitarian relationships of material residues in their final resting place, we can avoid the pitfalls of prematurely imputing high level symbolic or ideational explanations, thereby making it possible to infer accurately when and under what conditions these ideational variables were operating to account for the totality of the material residues."

The work of Schiffer and Gould provides a starting point for the interpretation of archaeological deposits and artefact patterns but, as I have suggested in my critique of the systems theory approach to archaeology (2.3), if artefacts have an 'active' role in social strategies then the problem of how deposits are formed and how artefacts arrive in them becomes more complex and purely adaptive considerations may not be the sole basis for understanding deposition and discard patterns. Schiffer (1987, 73) attempts to criticise Hodder's (1982b) assumption that ideology influences discard behaviour by claiming that patterns of discard have failed to show that artefacts have active ideological roles. Schiffer appears to miss the point, however, that structuralist based analyses draw on the evidence of the use of artefacts in living societies for its conclusions on discard. From this evidence it follows that abstract ideological, as opposed to purely adaptive factors must motivate discard just as they influenced use, although determining how these processes operated in ancient societies is not easy.

The problems of the motivation of discard behaviour may be considered further within the framework of a discussion of how artefacts came to leave their use context and enter the archaeological context.

5.2 Discard and Curation Behaviour

A certain proportion of the objects which move from their use context to burial in the ground will do so as a result of accidental loss due to the operation of human motor skills rather than forces directly related to cultural factors (Hodder 1982b, 59). This is probably the main reason for the predominance of relatively small artefacts in most archaeological assemblages from occupation sites since they are easily dropped and not easily found. It may be supposed that retrieval was particularly difficult on the earth floors of the poorly lit buildings and on the muddy yard surfaces of Anglo-Scandinavian York.

Accidental loss apart, however, an artefact is usually discarded once it has ceased to perform its function (Schiffer 1987, 48-9) which, it should be stressed, need not be that for which it was originally manufactured. Objects may pass through a long cycle of use and re-use in both complete and broken form before being discarded. The rate of discard, which could be measured as the proportion of the total stock of an object in use which is discarded in a given time period or the average length of time between manufacture and discard of a particular class of object, may be subject to simple practical considerations of durability and the extent and intensity of use. Pottery vessels, for example, are usually relatively fragile and rarely re-used after breakage, but because pots were also amongst the more intensively and widely used artefacts on British urban sites, their fragments usually form a substantial proportion of artefact assemblages. Amongst iron objects nails are found in relatively large numbers because of both their wide use for a variety of functions (3.44.1) and the relatively poor quality of the metal which usually prevented re-use. Knives are also common finds because their extensive and intensive use and a life restricted by the durability of the steel cutting edge (3.30.3).

The relationship between, on the one hand, discard patterns and, on the other, the physical properties and use patterns of artefacts will not always be a simple one, however, and artefacts may be deliberately curated. Although the principal determinant of curation behaviour may be the value of an artefact to its owner, this can be defined in a number of different ways. It may be defined in purely economic terms, reflecting the relative cost of repairing, if feasible, or replacing the object. Changes in these relative costs, which may be a product of many economic and technological circumstances, will obviously affect curation behaviour. Technological change may even render a new improved product sufficiently more attractive in economic terms than the old to warrant the latter's disposal even before it is worn out. The extent to which an object is curated will also be affected by the economic circumstances of its owner. This has been demonstrated in the modern world by the American 'garbage projects' (Schiffer et al. 1981) which show, for example, that as individuals or households enter new income groups they will acquire new material items and discard or dispose of others. In simple nomadic societies this may not be a major factor influencing discard, but as societies become more hierarchical with a greater spread of income differences it will become more important.

An artefact's value may also derive from its symbolic role in social strategies rather than its practical function and this will again affect curation behaviour. The way artefacts may fulfill an active role in social strategies has been discussed in 2.4, but one example of a 9th-11th century iron object whose pattern of discard clearly reflects such a role is the sword. In a society where warfare based on personal combat was endemic, good weapons were clearly vital and would be curated for this reason, but literary sources suggest that swords might become mystically associated with their owner's identity. The right to own a sword may have been reserved to members of certain social groups (Loyn 1984, 31) and so a sword would also have expressed a collective social identity. On both practical and symbolic grounds, therefore, a sword would have been curated by heirs or comrades and discarded only in very particular circumstances. As a result complete swords are rarely found in archaeological contexts other than burials or presumed ritual contexts such as river and stream beds. Other weapons and objects of iron were probably curated for non-practical reasons in 9th-11th century England, but they are not easy to identify in the virtual absence of literary sources and furnished burials. Scandinavian graves of the period suggest, however, that in addition to weapons, certain other classes of iron object, such as cauldrons or horse trappings, may have been curated as symbols of social status (for further reference to the socio-economic context of such objects see 7.3 and 7.5 - 7.8).

Just as values measured in strictly economic terms are rarely stable for long, so more abstract social values also change, and inasmuch as an artefact has a role in their reinforcement or mediation this will affect the manner in which it is curated. One important factor affecting an object's value is its role in strategies of emulation which usually involve the acquisition of artefacts associated with an elite group by those aspiring to their status (Miller 1985, 185). Once the aspirants achieve their aim, however, new symbols of status may be sought by the elite so reducing the value, and extent of curation, of the original artefact. The length of time status symbols are curated will, therefore, be affected by the degree of social mobility; as it increases artefacts will tend to be curated for their status value for shorter periods (Schiffer 1987, 38). Possible examples of the emulation process in the 9th-11th centuries are discussed as part of an analysis of formal variability in dress fittings and knives in 7.6 and 7.7.

Since certain classes of object probably played a more active symbolic role in respect of social values than others, the extent of their curation and patterns of discard will be particularly sensitive to the pace and mode of social change. Dress fittings are a good example of objects which not only exhibit considerable formal variability but also rapid formal change (for further discussion of the context in which this took place see 7.6). Curious though it may seem, at first sight, changing social values could account for the disposal of the lavishly decorated and apparently still serviceable 8th century helmet in an Anglo-Scandinavian pit at 16-22 Coppergate (Addyman et al. 1982). Similarly, it might be suggested that the sword fragments (3.82) found on the site reflect new attitudes to the disposal of weapons, with recycling as scrap rather than ritual burial being considered more acceptable by the mid 10th century. Had the character of urban society changed such that it no longer valued the warrior so much as the craftsman who would 'beat swords into ploughshares'?

Even if an object is deemed valueless, however, this does not mean it will be discarded since the material from which it was made may itself be of value and curated as a scarce resource. Ethnographic evidence suggests that scavenging or gleaning of materials for re-use is taken very seriously by simple or poor societies today (Schiffer 1987, 106-7) and this was probably true of most ancient societies. Rigorous recycling of scrap iron must have had an important effect on the components of the Coppergate ironwork assemblage. In spite of the evidence for intensive occupation at 16-22 Coppergate throughout the 200 or so years of the Anglo-Scandinavian era, on average only about ten iron artefacts per annum (excluding nails) found their way into the ground of which between three and four were probably waste from the smithing process. The remainder were, on the whole, relatively small and many of them had probably been accidentally lost rather than deliberately thrown away. There is no evidence, therefore, for profligacy in the use of iron; on the contrary it is likely that the metal was very carefully curated. When an artefact became unusable or obsolete it would have been recycled as scrap especially if it had a steel component and it is especially notable that apart from knives, many of which appear heavily sharpened thus removing most or all of the steel, very few bladed tools were found. I suggest, moreover, that the evidence of chisel cuts and deliberate breakage makes it possible to identify a number of artefacts which were probably discarded, accidentally or otherwise, in the process of recycling (Table 5.2).

Non-ferrous metal was probably even more assiduously curated by the inhabitants of Anglo-Scandinavian York. Although evidence for working was found in the form of crucibles, moulds, ingots and part-made artefacts (Hall 1984, 58-60) there were, compared to the number of iron objects, very few (under 300) made of non-ferrous metal. This indicates no doubt the higher value of copper, lead and precious metals but also, perhaps, the greater ease of recycling by melting down.

Table 5.2 Iron objects probably discarded during recycling

No.	Description	Period
2250	Mould (3.8)	3
sf13993	Coin Die (3.9)	4B
2254	Axe (3.10)	4B
2255	Axe "	5A
2256	Axe "	5B
2261	Auger (3.14)	4B
2263	Auger "	4B
2265	Auger "	4B
2749	Sickle (3.27)	5B
2750	Pitchfork (3.28)	4A
2986	Knife (3.35)	3
2987	Knife "	3
2988	Knife "	4B
3342	Pierced strip (3.47)	4B
3932	Spearhead (3.81)	5B
3933	Spearhead "	U/S
3935	Sword (3.82)	4A
3936	Sword "	4A
3939	Sword "	4B
3938	Sword "	4B

5.3 Location of Discard

Determining the practical and ideological constraints on curation behaviour and discard in an ancient society may be difficult, but archaeology is well placed to study how this behaviour is expressed spatially. Much of the patterning in material remains that archaeologists uncover is principally related to refuse disposal practices rather than the activities which generated them in the first place.

Practical considerations of convenience and health may play the primary role in what Schiffer (1987, 65) refers to as the "maintenance processes" which are related to the mode and location of discard. Artefacts discarded at their location of use, "primary refuse" in Schiffer's terms, may be sparse on archaeological sites, especially within and around buildings, for the simple reason that performance of the buildings' functions demanded regular removal of any obstructions. Only small objects left, for example, in floor cracks or unswept corners may therefore survive to be excavated in their original discard locations. The nature of the floor or ground surface will, moreover, have some influence on the survival of artefacts in buildings (Schiffer 1987, 126). Relatively soft surfaces, such as those in the 16-22 Coppergate buildings, for example, into which material could be trampled, will usually incorporate more artefacts than those made of harder material. (An inventory of artefacts in 'floor' layers from the Period 4B buildings at Coppergate appears in Appendix 7).

The relationship of a community to the area in which it lived can also be shown to influence the way in which it disposed of its refuse. Ethnographic evidence, for example, suggests that there is an important distinction between migratory and sedentary societies. In her analysis of 79 cultural groups Murray (1980) found that the former were much more likely to deposit refuse in and around living and working locations than the latter who had distinct disposal areas. Nomadic societies are, presumably, less inconvenienced by refuse as they can always move away. Within sedentary communities the extent of pressure on space may also determine patterns of refuse disposal. In settlements such as towns where there is a great deal of pressure and property is divided into small units, refuse may be disposed of very close to dwellings and pits may be required, but if there is less pressure refuse may be spread over a large area and pits are less frequent. If a settlement has good relations with, or is under the same jurisdiction as, the surrounding area, then refuse may be taken out of the settlement for disposal but if, conversely, there are legal or social distinctions between them refuse will be deposited within the settlement.

The evidence from Anglo-Scandinavian York, and 16-22 Coppergate in particular, suggests that the occupants lived in a settlement where there was considerable pressure on space. Pit digging was frequent and midden material accumulated at a rapid rate, although it was not possible to say how much, if any, of the refuse generated in the Coppergate properties was discarded elsewhere. If aspects of the discard behaviour in the Anglo-Scandinavian town indicates a sedentary community, it is nevertheless possible that elements in it, such as certain craftsmen, were nomadic and may, like tinkers today, have employed different discard behaviour from the rest of the community. Murray found that at the level of individual activities there were again distinctions in discard practices which could manifest themselves in archaeological contexts. There was, for example, an important distinction between activities centred on a fixed location and those which were peripatetic. In the former case refuse was usually concentrated in a limited number of locations whereas in the latter it was thinly distributed over the area in which the activity was practiced. As Hodder (1982b, 59) has pointed out, moreover, peripatetic activities may be characterised by residues with working debris but without tools, which were carried about, whereas sedentary activities create residues which do include tools. In the 9th-11th centuries many activities, including blacksmithing, may have had both sedentary and peripatetic practitioners, but it may be difficult to distinguish between them in an urban archaeological context on the basis of patterning in the material remains (for a further reference to the problem of sedentary or peripatetic smiths see 7.4).

In the case of sedentary activities the nature of the activity may also influence the location of discard in the sense of the distance to which it is removed. Some activities, such as iron working, produce bulky waste products which are awkward to transport great distances and will therefore usually be discarded as near to the point of generation as possible. This is one reason for proposing that the occurrence of large quantities of slag at 16-22 Coppergate indicates iron working in the immediate area. There may, however, be circumstances in which even the bulkiest of waste products are re-used which can lead to their being transported considerable distances. Slag, for example, can be used as shipping ballast. Other activities produce waste which by its nature may be a given a form of re-use in specific locations, including, for example, organic waste used for manuring fields.

Up to this point in the discussion I have assumed that convenience and health as factors determining refuse disposal patterns are defined in much the same way in all societies, but ethnographic studies suggest that there are great differences between societies in what is considered convenient and healthy (Douglas 1966, 2-3; Hodder 1982b, 194). In such considerations ideological factors may be of great importance or, as Hodder has written, (ibid.) : "Attitudes to refuse will play an important part in conceptual schemes governing social behaviour." Such attitudes, often based on oppositional concepts of what is pure and what is polluted, have an important influence on refuse disposal practices. Many of them may appear most unsavoury to the modern western observer, but they may form an important and active part in social strategies. Hodder (1982b, 190), for example, describes how some tribes of the Nuba people of east Africa "..can live in the filth (i.e. filth as defined by western man) because they go to great lengths symbolically to protect their food and their bodies. The dirt acts in various ways; in reaction to the sense of cleanliness of the Arabs, so that the Mesakin themselves can cope with their hated minority position, and as an integral part of the tensions between men and women."

The significance of ideology as a determinant of refuse disposal behaviour in an archaeological context is shown by Deetz's survey of American colonial archaeology in In Small Things Forgotten (1977, 125-6). He has identified a change in c. 1750 from the practice of spreading domestic refuse in "sheets" around the outside of dwellings to one of depositing it in specially dug pits. He proposes that this change was not entirely due to adaptive constraints such as increasing population and pressure on space, but was also due to a new world view which involved a "compulsion to order" in a wide range of cultural phenomena.

The evidence from 16-22 Coppergate appears, at first sight, to indicate a community with scant regard for convenience or health in its refuse disposal patterns. Kenward et al. (1978, 67), for example, summed up the biological evidence as follows: "This picture of a town composed of rotting wooden buildings with earth floors covered by decaying vegetation, surrounded by streets and yards filled by pits and middens of even fouler organic waste, is probably not too far from the truth..." In addition to the organic material there appear to have been large quantities of debris from domestic and craft activities strewn around. It should not be assumed, however, that the inhabitants of Anglo-Scandinavian York did not have strong views on the proper form of the disposal of refuse whether from iron working, bodily functions or any other activity. In contemporary terms the excavated pattern of remains probably represented a highly ordered response to the problems of refuse disposal.

Understanding patterns of discard at 16-22 Coppergate requires careful analysis of the locations in which material remains were found. For the purposes of a study of iron objects and ironworking residues I have classified discard locations into four:

1) Layers which built up on exterior surfaces (referred to as 'layers' below).

2) Pit fill layers (referred to as 'pits' below). Pits may be defined as deliberately cut features over c. 50cms. in depth. Under this heading I have included as a sub-class layers backfilling the semi-basements of the

Period 5B sunken buildings which served as a form of ready-made pits.

3) Fills of shallow features under c. 50cms in depth (referred to as 'cuts' below) including gullies, trenches and post-holes.

4) Layers found inside the Period 4B and 5B buildings which I refer to as floors. Many of these may have been deliberately laid earth floors but it was apparently difficult to distinguish them from deposits which may have been more in the nature of refuse dumps. Many 'floors' contain very few finds but others contain a surprisingly large number of artefacts. Two contexts (22670 and 25350) from Period 4B building in Tenement C, for example, contained sixteen and thirteen iron objects. Most of the objects from floors are small, but again there are exceptions and axe 2253 was found in a floor in Tenement C. It is not clear, however, if numbers and class of object are criteria for distinguishing between a laid floor and a dump (see Appendix 7 for a summary of iron objects from floor levels).

The site may also be divided into four areas, numbered from 1 at the west to 4 at the east (Fig. 5.1). These areas are based on divisions of the site during excavation and they are not equal in size. In approximate terms I calculate that Area 1 is 125 square metres, Area 2 172 sq.m, Area 3 312 sq.m,and Area 4 245

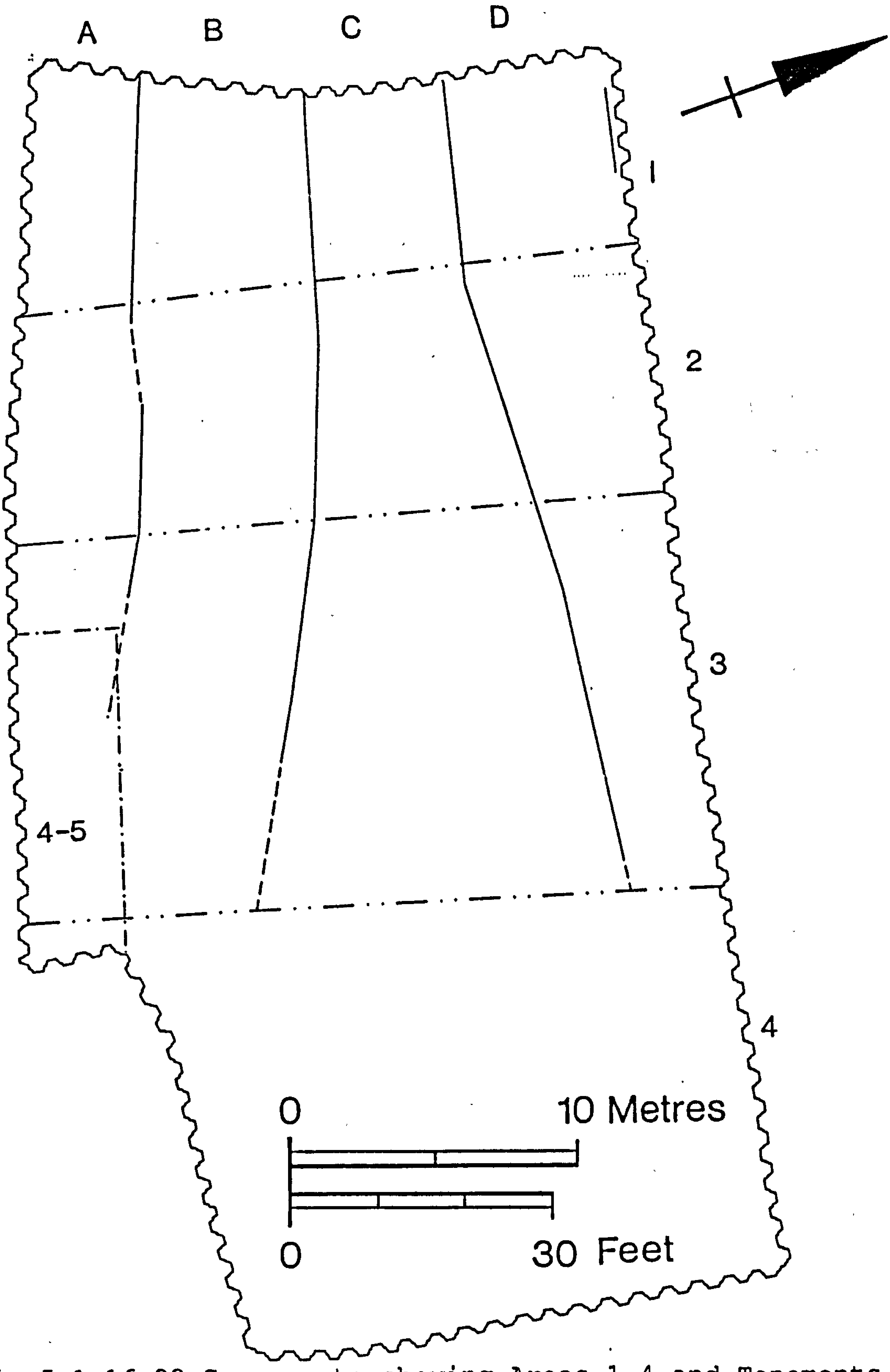


Fig.5.1 16-22 Coppergate showing Areas 1-4 and Tenements A-D (boundaries extrapolated to the junction of Areas 3 and 4) 4-5 = area where deposits could only be assigned to either Period 4A/4B or 5A/5B

sq.m. (Note that the site was not excavated in its entirety over its whole area in each period, see 1.2. In Period 4B only 160 sq.m was excavated in Area 3 and Period 5A contexts were only identifed in 125 sq.m of Area 2). From Period 4B onwards the site could also be divided into 4 Tenements (A-D; 1.2; Fig. 5.1) except in Area 4 where no tenement boundaries were identified.

In Tables 5.3 - 5.11 the numbers of objects and quantities of smithing slag and smelting slag are shown for each context class by period and for Periods 4B, 5A and 5B by Area and Tenement. Any discrepancy between Tables 5.3 - 5.5 and all subsequent tables in total numbers or quantities are due to the exclusion of material from a few unlocatable contexts in the later tables.

Table 5.3a Numbers of iron objects by Period and context class

Period	Total	Layers	Pits	Cuts	Floors
3	1391	773	458	160	na
4A	171	133	26	12	na
4B	1296	843	112	93	248
5A	327	280	20	27	na
5B	993	667	187	109	30
4-5	91	63	8	20	na
5CF	22	16	0	6	na
5CR	325	255	66	4	na
Total	4616	3030	877	431	278

Table 5.3b Numbers of iron objects as percentage of Period assemblages by context class

Period	Layers	Pits	Cuts	Floors
3	56	33	11	
4A	78	15	7	
4B	65	9	7	19
5A	86	8	6	
5B	67	19	11	3
4-5	69	9	22	
5CF	72.5	0	27.5	
5CR	78	20	2	
Total	65.5	19	9.5	6

Table 5.4a Quantity of smithing slag (in grammes) by Period and context class

Period	Total	Layers	Pits	Cuts	Floors
3	36961	23011	10195	3755	na
4A	17135	13635	665	2835	na
4B	53788	32301	3615	2840	15032
5A	25045	19115	3690	2240	na
5B	38945	27695	6305	4660	285
4-5	745	595	125	25	na
5CF	670	650	0	20	na
5CR	5820	4900	790	130	na
Total	179109	121902	25385	16505	15317

Table 5.4b Quantity of smithing slag as a percentage of Period assemblages by context class

Period	Layers	Pits	Cuts	Floors
3	62	28	10	
4A	80	4	16	
4B	60	7	5	28
5A	76	15	11	
5B	71	16	12	1
4-5	80	17	3	
5CF	97	0	3	
5CR	84	14	2	
Total	68	14	9	8

Table 5.5a Quantity of smelting slag (in grammes) by Period and context class

Period	Total	Layers	Pits	Cuts	Floors
3	421	240	131	50	
4A	600	560	0	40	
4B	10560	6760	745	190	2865
5A	5780	3895	1885	0	
5B	3431	2771	280	370	10
4-5	30	25	5	0	
5CF	75	75	0	0	
5CR	849	774	35	40	
Total	21746	15100	3081	690	2875

Table 5.5b Quantity of smelting slag as a percentage of Period assemblages by context class

Period	Layers	Pits	Cuts	Floors
3	57	31	12	
4A	93.5	0	6.5	
4B	64	7	2	27
5A	67.5	32.5	0	
5B	81	8	11	
4-5	83	17	0	
5CF	100	0	0	
5CR	91	4	5	
Total	69.5	14	3	13.5

Table 5.6a Numbers of iron objects by Area in Periods 4B, 5A and 5B

		Area			
Period	Total	1	2	3	4
4B	1295	497	158	375	265
5A	319	248	71	na	na
5B	992	220	254	272	246

Table 5.6b Percentage of iron objects by Area in the assemblages of Periods 4B, 5A and 5B

	Area			
	1	2	3	4
Period				
4B	38.5	12	29	20.5
5A	78	22		
5B	22	25.5	27.5	25

Table 5.7a Quantity of smithing slag (in grammes) by Area in Periods 4B, 5A and 5B

		Area			
	Total	1	2	3	4
Period					
4B	53788	23507	10201	11250	8830
5A	25070	21350	3720	na	na
5B	38945	14060	9365	8660	6860

Table 5.7b Percentage of smithing slag by Area in the assemblages of Periods 4B, 5A and 5B

	Area			
	1	2	3	4
Period				
4B	43.5	19	21	16.5
5A	85	15		
5B	36	24	22.5	17.5

Table 5.8a Quantity of smelting slag (in grammes) by Area in Periods 4B, 5A and 5B

		Area			
	Total	1	2	3	4
Period					
4B	10560	9585	155	650	170
5A	5780	5610	170	na	na
5B	3431	1920	235	691	585

Table 5.8b Percentage of smelting slag by Area in the assemblages of Periods 4, 5A and 5B

	Area			
	1	2	3	4
Period				
4B	91	1.5	6	1.5
5A	97	3		
5B	56	7	20	17

Table 5.9a Numbers of iron objects by Period and Tenement

		Tenements				
	Total	A	B	C	D	Area 4
Period						
4B	1290	62	437	383	143	265
5A	325	30	124	107	64	na
5B	978	69	105	356	202	246

Table 5.9b Number of iron objects by Tenement as percentage of Period assemblages

	Tenements				
	A	B	C	D	Area 4
Period					
4B	5	34	30	11	20
5A	9	38	33	20	na
5B	7	11	36.5	20.5	25

Table 5.10a Quantity of smithing slag (in grammes) by Period and Tenement

		Tenement				
	Total	A	B	C	D	Area 4
Period						
4B	52673	3940	29807	8600	1496	8830
5A	24985	535	15590	4035	4825	na
5B	38385	4015	2010	19630	5870	6860

Table 5.10b Quantity of smithing slag by Tenement as a percentage of Period assemblages

	Tenement				
	A	B	C	D	Area 4
Period					
4B	7.5	56.5	16	3	17
5A	2	62.5	16	19	
5B	10.5	5	51	15.5	18

Table 5.11a Quantity of smelting slag (in grammes) by Period and Tenement

		Tenement				
	Total	A	B	C	D	Area 4
Period						
4B	10525	610	4340	5245	160	170
5A	5770	0	675	770	4325	na
5B	3431	1370	256	1180	40	585

Table 5.11b Quantity of smelting slag by Tenement as a percentage of Period assemblages

	A	B	C	D	Area 4
Period					
4B	6	41	50	1.5	1.5
5A	0	11.5	13.5	75	
5B	40	7.5	34.5	1	18

It is clear that a number of spatial and chronological patterns appear in these data, but before they can be fully interpreted the excavated contexts must be examined in more detail in terms of the processes by which they were formed.

5.4 Context and the Interpretation of Classification

Archaeological contexts may be divided into two classes according to whether they represent removal of material from the ground, by the cutting of pits, ditches and the like, (negative contexts), or the introduction of material by dumping, gradual accumulation and other similar processes (positive contexts). Positive contexts may also be divided into structures and deposits. Structures, including walls, roads etc., are by definition deliberately created and the processes involved are relatively well understood; the processes involved in the creation or accumulation of deposits are, however, much more problematic. Since the ironwork from Coppergate derives almost entirely from deposits I will be largely concerned with their meaning in the following discussion.

The nature, components and interrelationships of an archaeological deposit are usually described in detail during excavation. It is not always easy, however, to use this information to determine either the manner in which a deposit was created or what may be termed its 'status'. I suggest that 'status' may be defined as the extent to which constituents retain the spatial pattern and interrelationship they had at the time of initial discard. In some cases, such as, perhaps, the infilling of a burial these constituents may be completely undisturbed, but in others they may derive from discard episodes of many different time periods and locations. While there is a mineralogical and biological aspect to the determination both of the manner of creation and status, the problem of status is primarily archaeological in that it relates largely to the significance of cultural material.

In the United States the context status problem has been discussed by systems theory archaeologists who are interested in making generalised predictions of past activity and behaviour from the patterning of material remains (2.3; 5.1). The sites used for generating their theories were, however, usually occupied for relatively short periods and had little depth of stratigraphy. The archaeologists' focus of attention has, therefore, been on deposition and redeposition within a single time period. Schiffer (1972, 161; 1987, 17, 59) and South (1977, 296-7), for example, distinguish between primary and secondary 'refuse'. Primary refuse is, first of all, material discarded at the place of use; secondly, it may be material discarded at activity locations which are not strictly locations of use (Schiffer 1987, 59). Worn-out tools, for example, may be discarded at refurbishing rather than use locations. Similarly, rejects and waste products have no use but can be discarded at their locations of manufacture. Thirdly, primary refuse can include material which has reached the ground without the performance of discard activities through loss or abandonment. Secondary refuse is defined as material discarded at a place which is not the same location as that of use or any related activity. Creation of secondary refuse may result either from primary redeposition as a result of deliberate refuse disposal practices, or secondary redeposition as a result of such post-depositional forces as weather, running water or animal behaviour.

Although these concepts are useful there is little attempt in the work of either Schiffer or South to tackle the problem of deeply stratified sites where disturbance of earlier deposits is continual. Schiffer, for example, merely concludes that: "With increasing site population and increasing intensity of occupation there will be a decreasing correspondence between use and discard locations for all elements used in activities and discarded at a site" (1972, 161).

There has been little work on the subject of context status in British archaeology except by Carver (1979a, 67-8; 1979b, 8-9) who, confronting the problems of deep stratified sites, has attempted to set guidelines for the identification of material which is relevant for the "activities and culture" (1979b, 8) of a site's past inhabitants. Contexts of primary status, equivalent to Schiffer's primary refuse, fulfil this requirement whereas contexts of "secondary status", equivalent to Schiffer's secondary refuse, but also including residual material originally deposited in earlier periods, do not "...since they contain, technically, associations of artifacts and biological material which belong to other places and periods."

Context status will usually be determined on the basis of artefactual content, although, as suggested above, mineral and biological inclusions may have a contributory role especially if cultural material is sparse or undiagnostic of date. Using artefacts to identify primary contexts will always, however, be somewhat problematic in the absence of homogeneous assemblages of closely datable or intrinsically dated artefacts such as coins, for example. Such assemblages are unusual and on most urban sites pottery, because it is so plentiful, must be used as the principal indicator of status. A seriation method which relates site stratigraphy to the occurrence of pottery classes has been proposed by Carver (1979b, 4-8, fig.3) for identifying primary contexts. The condition of artefacts may also be used to assess status, especially if some measure of the extent of breakage or deterioration can be created. Schiffer (1987, 282-5) proposes methods which are suitable for pottery based on size and weight of fragments and relation of fragments to complete objects. It is difficult, however, to envisage a method of assessing degrees of fragmentation of metal objects, in other than an impressionistic manner, since the weights of similar objects will vary due to corrosion and, if broken, their complete form is not always known. State of corrosion may be a better indicator of residual objects if soil regimes in different periods on a site preserve metals in different ways.

Another means of identifying the survival of a context or groups of contexts of primary status which may have some value is patterning in the spatial distribution of artefact find spots. This is always likely to be problematic, however, because of the intervention of cultural factors in the mode and location of discard, and on most stratified urban sites there will be the added factor of the continual redeposition of material by the digging of pits, ditches and other features. Cluster analysis techniques may, I suggest, only be used with any confidence to interpret the spatial patterning of remains and assess the extent of disturbance of an original pattern of discard if: 1) a relatively large area can be examined; 2) the artefacts were discarded wholly or mainly in one type of context (layer, pit, grave etc.); 3) deposition took place within a relatively brief period of time; 4) if there are no or few major voids caused by later disturbance. The further from these ideal conditions an actual site departs, the less likely it is that satisfactory conclusions can be arrived at.

Quantification of spatial patterning, whether based on quadrats (grid squares of standard size) or distance between neighbouring find spots, relies on a comparison of an observed pattern with a theoretical random distribution (Hodder and Orton 1976, 30-52). In inter-site analysis clustering is used to identify artefact production or distribution centres and at the intra-site level the location of activity areas. In the latter case, however, it must be assumed that the original discard pattern survives and this may only be the case on sites where the ideal conditions outlined above prevail. On sites occupied for any length of time there are numerous factors, besides the location of activity areas, which may give rise to non-random patterning, and clustering may indicate either the location of secondary refuse dumps or areas of upward displacement or some mixture of the two. Other cultural factors may also intervene to affect the distribution patterns in an unquantifiable manner.

If, however, an activity area, such as a kiln or workshop, can be identified on independent grounds, for example, by the presence of characteristic structures, analysis of spatial patterning may at least have some contributory role in indicating the extent of disturbance of the original discard pattern and status of related contexts. The degree of find spot clustering in these circumstances does not involve comparison of the observed pattern with a theoretical random pattern, but with some form of regular regression relationship between numbers of objects and distance away from the source. The extent of divergence from the predicted pattern may then be quantified and, depending on the nature of site, be accounted for by redeposition, upward displacement, preferences for particular discard locations or other factors.

In conclusion it must be admitted that few deposit contexts on deeply stratified sites occupied intensively over a long period are likely to be primary; the vast majority will contain residual or redeposited material. In my view, however, it is an overly pessimistic approach to the interpretation of urban sites which would ignore all the constituents of secondary contexts. I suggest that, with careful analysis, it can on occasions be shown that within secondary contexts some components are at, or close to, their original place of discard, or at least more likely to be so than others. This is especially so if it is possible to identify the original location of deposition of residual material as may be the case with many of the iron objects from Period 5A from 16-22 Coppergate (1.2). In such a case, although the original pattern has been destroyed, the objects themselves retain some meaning in relation to the site. I also suggest that secondary contexts may be of value for understanding refuse disposal practices which have as much cultural significance as the activities which generated the refuse. I am therefore cautiously optimistic that most urban archaeological contexts and their components may play some part in the interpretation of a site and the culture of its inhabitants.

5.5 The status of contexts at 16-22 Coppergate

There were c.20,000 contexts ascribed to the Anglo-Scandinavian period the vast majority of which were deposits. To analyse the status of all these contexts in detail lies beyond my terms of reference but I have examined the contexts from which the iron objects and ferrous working residues derive, some 2000 in all, which may be taken to representative sample of total.

In Appendix 7 the numbers of contexts of each of the four classes which contain objects, smithing slag and smelting slag are shown. It may be noted, however, that 1587 contexts contained iron objects, 748 contained smithing slag and 244 contained smelting slag. The majority of these contexts were layers (62.5%, 63.5% and 69.5% respectively) and this pattern was repeated in the major periods except that percentage from pits was rather higher for objects and smithing slag (31% and 33%

respectively) in Period 3 than in the others.

The first step towards interpretation of the information in Tables 5.3 - 5.11 is to consider the problem of residuality. The 16-22 Coppergate Anglo-Scandinavian contexts have produced over 57,000 sherds (Mainman forthcoming) providing a good data base for throwing some light on the problems of deposit origins, although the material has not been subject to detailed analysis for this purpose. The following discussion of residuality is therefore based on sherd numbers rather than weight or any measure of disaggregation.

The pottery most easily recognisable as residual in Anglo-Scandinavian contexts is Roman and at 16-22 Coppergate it occurs in large quantities in the deposits of all site periods (Table 5.12). The Roman material probably derives substantially from the disturbance of Roman deposits on the site itself since there is no evidence for major landfill on the site during the Anglo-Scandinavian era, until perhaps Period 5CR, which could have brought in large quantities of residual material from elsewhere. Continual secondary disturbance of earlier deposits in successive Anglo-Scandinavian periods has probably meant that the vast majority of Roman sherds have been redeposited on many occasions before reaching the spot at which they were excavated.

Table 5.12 Occurrence of Roman Pottery in Roman, Anglian and Anglo-Scandinavian contexts at 16-22 Coppergate (Periods 1-5C)

(Source: Mainman forthcoming)

Period	Nos. of sherds	% of period pot assemblage	% of total Roman
1 (Roman)	5934	100	21
2 (Anglian)	1747	100	6.5
3	9024	87.5	32.5
4A	731	35.5	2.5
4B	4532	31.5	16
5A	1389	23	5
5B	3420	20	12.5
4-5	336	81	1
5CF/R	799	15	3
Total	27912		

Of particular interest in these data is the very high proportion of Roman pottery in the earliest Anglo-Scandinavian period (Period 3) which is followed by a marked drop in Period 4A; thereafter there is steady decline in the major period assemblages. The substantial quantity of Roman pot in Period 3 can probably be explained as the result of redeposition following the digging of a large number of pits (c.80) in all parts of the site, most of which penetrated Roman deposits. Thereafter secondary disturbance may have become the principal source because ground level rose steadily during and after Period 3 and pits ceased to penetrate the Roman layers to such a great extent.

At first sight the residual component in 16-22

Coppergate contexts based on the occurrence of Roman pottery appears disturbingly high, but within each period the amount varies considerably from area to area and from context class to context class. This is particularly striking among the Period 4B contexts. Some 60% of all contexts contained Roman pottery but its occurrence on a sherd count basis was as shown in Table 5.13.

Table 5.13 Percentage of Roman pottery in Period 4B contexts by Area and Tenement
(Source Mainman forthcoming)

	Tenement A	B	C	D
Area 1	28	19	21	16
Area 2	37	17	14	24
Area 3	42	50	48	8.5*

Area 4: 74
(* based on less than 100 sherds)

Analysis of the pottery in the contexts containing iron objects and slag shows a similar picture (Table 5.14).

These data show that residuality is highest in pit fill layers, perhaps because pits penetrated Roman layers to some extent but principally because they penetrated Period 3 deposits which themselves contained large quantities of Roman pot. Conversely, residuality was relatively low in floor levels and cuts, and in the western half of the site (Areas 1 and 2).

Table 5.14 Percentage of Roman pottery in Period 4B contexts which contain iron objects and slag by context class, Tenement and Area.

Total	33.5						
Layers	36	Tenement	A	31	Area	1	21
Pits	52	"	B	33	"	2	18
Cuts	23	"	C	27	"	3	48
Floors	23	"	D	15	"	4	70

From Period 4A onwards it is likely that Anglo-Scandinavian pottery begins to form a residual component in many contexts, especially, of course, in Period 5A which is defined as consisting substantially of redeposited material (1.2). In the present state of knowledge, however, this is difficult to quantify. Virtually all the principal pottery classes occur in each period, albeit in varying proportions.

There are few other categories of material from the site which can be sufficiently well dated to allow their use for the determination of residuality and none of them occurs in any numbers. It may be noted, however, that of 31 9th-11th coins found on the site (Pirie 1986), thirteen were residual in their contexts. There is as yet no information on other non-ferrous objects.

As far as the iron objects themselves are concerned, only two items, both keys, in Anglo-Scandinavian contexts (one from Period 3 and the other from Period 4-5) can be identified as Roman on formal grounds. A large number of objects can, by contrast, be positively identified as Anglo-Scandinavian by analogy with well provenanced comparanda from other sites (6.3), but it is difficult to give them date ranges within the period. Many other objects, however, especially tools and structural fittings, have forms which are not diagnostic on formal grounds. In summary, although there will be residual Anglo-Scandinavian ironwork in Anglo-Scandinavian contexts from Period 4A onwards, especially in 5A contexts, it is, in the present state of knowledge, virtually impossible to identify them.

The extent of fragmentation may theoretically be a guide to residuality but it is, as noted above, difficult to measure for iron objects. As an example, however, a count of the proportion of knives with incomplete blades and tangs in the major periods was made; the result was inconclusive as in each of them c.40% of knives fell into this category. At a general level the nature of the corrosion products may also be a useful indicator of residuality at 16-22 Coppergate as the burial regime in the Anglo-Scandinavian contexts was quite distinct from that in the Roman. The former were characterised by anoxic organic material very favourable to the preservation of iron as well as textile and other artefacts (Hall 1989, 294). O'Connor (1989, 146) has suggested that it is possible to identify as residual a proportion of the animal bone on the basis of its condition which suggests burial in the relatively oxygenated conditions of the Roman layers. In cases of doubt, therefore, a contributory indicator of residuality from the Roman period may be the nature of the iron corrosion products. The variable condition of both the iron and other objects, however, suggest that micro-environments causing both unusually good and bad preservation existed throughout the Anglo-Scandinavian deposits making any quantification of preservation as a systematic basis for suggesting residuality very unreliable.

Although the pottery indicates that considerable redeposition through time has taken place, if variably so in terms of parts of the site and classes of context, it need not necessarily be the case that all components of secondary deposits are residual to the same degree. A higher proportion of pottery may be residual because its durable nature ensures that it survives the process of redeposition rather better than most other categories of material. Measurement by sherd count alone may, moreover, distort the picture. Redeposition presumably causes fragmentation of the material allowing a given volume of Roman pottery to create an impression of greater residuality in an assemblage of Anglo-Scandinavian origin, where pottery of the latter date may be less fragmented because it has been less disturbed since discard. This was apparently confirmed in Period 3 contexts at Coppergate by observations of the excavators (Hall 1984, 47).

It is also possible that the proportion of different categories of material which is residual in a context may vary according to the components of the deposits from which residual material derives. A comparison of the pottery, iron and slag from Anglo-Scandinavian contexts at Coppergate indicates that they may be differentially residual as there were different quantities of each category of material in Roman contexts. Table 5.15 shows that the relative quantities of iron and pottery in Roman contexts as a proportion of all in Periods 1-5C (i.e. Roman, Anglian and Anglo-Scandinavian), based on a simple numerical count, was much the same. The Roman ironwork, however, consisted largely of nails and tacks and whereas 10% of ironwork from Periods 1-5C comes from Roman contexts this is under half the percentage of nails and tacks. Less than 2% of objects other than nails and tacks come from Roman contexts. On this basis it can be suggested that although there may be a substantial amount of residual Roman ironwork in Anglo-Scandinavian contexts, it will be principally represented by nails and tacks. This appears to be borne out by the fact that, just as Roman pottery forms a very high proportion of pottery in Period 3, nails and tacks form a very high proportion

(70.5%) of the Period 3 ironwork assemblage compared to c.37% in 4B and 38% in 5B (Table 5.1b). Moreover, 33% of Period 3 nails come from pit fill deposits, which are probably more likely to contain residual material, as compared to 11% of other classes of object.

Some smithing slag, especially in Period 3 contexts, where a rather higher proportion came from pit fills than in other periods (Table 5.4b), may have been displaced from Roman contexts, although they contained only 1035g, a very small proportion of the total from the site (1.9). The vast majority of smithing slag, therefore, was probably generated by smithing during the Anglo-Scandinavian era. There is, moreover, no smelting slag at all in Roman deposits and so much, if not all, of this material from the site is probably Anglo-Scandinavian.

Table 5.15 Percentage of different categories of material in Roman contexts as percentage of the total in Roman, Anglian and Anglo-Scandinavian (Period 1-5C) contexts.

Category of material	Percentage
All Pottery	10.5
All Iron objects	10
Iron nails and tacks	21
Iron objects other than nails and tacks	<2
Smithing slag	<1
Smelting slag	0

In 5.4 above I discussed the theoretical and practical problems of using the analysis of find spot distribution to measure the extent of disturbance of an original discard pattern and concluded that, unless a particular set of circumstances prevailed, any clustering observed will be difficult to interpret. At 16-22 Coppergate circumstances were far from ideal since there were several classes of context, stratification was deep, redeposition continual, few contemporary surfaces could be traced over large areas and large voids caused by later pits appear in the strata of all periods. There are, however, patterns in the spatial distribution of the finds spots of iron objects and residues which may have interpretative as opposed to merely descriptive value in respect of the survival of the original discard pattern on the site and the activities that took place there.

In 5.4 I suggested that it was desirable to approach intra-site spatial analysis by identifying, on independent grounds, a source for the material whose patterning was to be investigated. At 16-22 Coppergate the most obvious source was the buildings in Periods 4B and 5B. On purely practical grounds the nature of the climate in Anglo-Scandinavian York probably demanded that human activity on the site was centred on the buildings for much of the year. That the buildings were the principal sources of artefactual and other categories of material on the site appears to be confirmed, in general terms, by the greater volume of deposits which accumulated towards the street frontage in the Anglo-Scandinavian era with an overall depth in Area 1 of about twice that in Area 4. This 2:1 relationship appears to prevail in both Periods 4B and 5B, although exact figures are impossible to calculate and, as Figures 5.2 - 5.19 show, the pits, which may be seen as localised areas of deeper stratigraphy, are most frequent in Area 3.

Tables 5.6 - 5.8 show that in Period 4B the numbers of iron objects and quantity of slag was greater at the west end of the site (Area 1) than at at the east. (See Fig.5.1 for plan of Areas 1-4) In Period 5B the numbers of objects from each area was much the same.

Because of the problems of establishing the relative volume of deposits in the different areas, it is difficult to assess whether these figures indicate an unusual concentration of finds towards the west of the site in excess of what would be expected given the greater volume of deposits. I calculate, however, that in approximate terms the numbers of objects and slag found per square metre in the four areas is as in Tables 5.16 - 5.18 (The calculations take into account the reduction of Area 3 excavated in Period 4B and the reduced extent of Area 2 identified for Period 5A, see Fig.1.2.)

Table 5.16 Estimated number of iron objects per square metre by Area for Periods 4B, 5A and 5B

	Area 1	2	3	4
Period				
4B	4.00	.90	2.35	1.10
5A	1.98	.57	na	na
5B	1.65	1.50	1.60	1.00

Table 5.17 Estimated quantity of smithing slag (grammes) per square metre by Area for Periods 4B, 5A and 5B

	Area 1	2	3	4
Period				
4B	188.06	59.31	70.31	36.04
5A	170.08	29.76	na	na
5B	112.48	54.45	27.76	28.00

Table 5.18 Estimated quantity of smelting slag (grammes) per square metre by Area for Periods 4B, 5A and 5B

	Area 1	2	3	4
Period				
4B	76.68	0.90	4.06	0.69
5A	44.89	1.36	na	na
5B	15.36	1.37	2.21	2.39

When the relative depths of Areas 1 and 4 are taken into account I suggest that in Period 4B there is still evidence for a comparative concentration of object and slag find spots in Area 1. The apparently low figures given in Tables 5.6 - 5.8 and 5.16 - 5.18 for Area 2, in spite of its position towards the west of the site, is probably due to the (unquantifiable) reduction in volume by major intrusion of the Period 5B sunken buildings rather than any sudden discontinuity in the original distribution. If the objects and slag from Period 5A contexts, largely found in Area 1, which are thought to derive largely from Period 4B, are taken into account, the original concentration in Area 1 of Period 4B was even greater. In Period 5B the concentration of slag is still greater at the west of the site, but the occurrence of objects appears to be roughly the same in each of the Areas which, in view of the volume differential, argues for a reversal of the pattern of concentration in Period 4B or, at least, a more even distribution. Before any conclusions can be drawn from these data, however, the problem of distortion by preferential use of certain types of location for discard must be tackled. In Tables 5.19 - 5.21 the average number of objects and quantity of slag from the four context classes (which contain objects or the form of slag in question, see Appendix 7) is shown.

In interpreting these data I have had to assume that, on average, all deposits have much the same volume. It remains possible, if indeterminable however, that differences in the figures are, at least to some extent, the result of differences in average volumes according to class and/or period. I suspect, for

Table 5.19 Average number of iron objects per context by context class

	All contexts	Layers	Pits	Cuts	Floors
Period					
3	3.66	3.84	3.85	2.67	na
4A	2.63	2.71	3.25	1.50	na
4B	2.59	2.74	2.15	2.16	2.56
5A	2.42	2.55	1.43	2.45	na
5B*	2.42	2.48	2.79	1.85	2.00
4-5	4.14	4.85	1.60	5.00	na
5CF	1.69	1.60	0.00	2.00	na
5CR	5.33	8.23	2.44	1.25	na
All periods	2.91	3.05	3.00	2.26	2.46

*= the figure for the dumps in the sunken buildings (three contexts) is 8.10.

Table 5.20 Average quantity of smithing slag (grammes) per context by context class

	All contexts	Layers	Pits	Cuts	Floors
Period					
3	249.74	287.63	208.06	197.63	na
4A	349.69	368.51	110.83	472.50	na
4B	200.70	196.95	190.26	157.78	221.06
5A	284.60	289.62	307.50	224.00	na
5B*	241.89	266.30	225.18	186.40	71.25
4-5	149.00	198.33	125.00	25.00	na
5CF	167.50	216.67	000.00	20.00	na
5CR	232.80	245.00	197.50	130.00	na
All periods	240.51	260.96	200.50	203.77	212.74

* the figure for dumps in the sunken buildings (3 contexts) = 568.30

Table 5.21 Average quantity of smelting slag (grammes) per context class. No figure given if there are less than five contexts in the period with slag (na*)

Period	All contexts	Layers	Pits	Cuts	Floors
3	28.00	26.70	na*	na*	na
4A	60.00	70.00	na*	na*	na
4B	129.24	150.22	na*	27.14	95.50
5A	140.98	114.53	269.28	na*	na
5B	49.01	50.38	56.00	41.00	na*
5CR	47.00	55.29	na*	na*	na*
All periods	89.12	89.35	133.96	32.86	92.74

example, that floors were on average of lower volume than the other two types of deposit. I also suspect that excavation technique may have distorted the figures. Because of the need to establish complex structural sequences, floors were probably removed with more care compared to exterior layers and pit fills and so artefact recovery may have been greater. It is striking, however, that the averages in Tables 5.19 - 5.20 show, on the whole, little variation, at least in the major periods, between the different location types. The slightly higher than average number of objects in Period 3 pit layers may can be accounted for by the presence of large numbers of residual Roman nails and tacks. It is not so easy to account for the high average in Period 3 layers although the stratigraphy was apparently characterised by more large volume spreads of deposit than in subsequent periods. The high average number of objects in Period 5CR layers is due to the presence of a number of high volume layers which contained large numbers of objects. I suggest, in conclusion, that there is no strong evidence that estimates of an unusual concentration of artefact and smithing slag find spots in Area 1 of the site in Period 4B and a more even distribution in Period 5B have been affected by differential preferences in the location of discard. In the case of smelting slag, Table 5.21 is probably based on too little data for useful conclusions, but it does, at least, suggest that deposition was more markedly more intense in Period 4B contexts than in earlier or later periods except for Period 5A which reflects the 4B pattern. The high figure for 5A pits again must indicate redeposition from Period 4B as is suggested by Table 5.5b.

Equally important in assessing the patterning of find spots is to look at how distribution varied across the site on the north to south axis. In Periods 3 and 4A this was difficult to determine because of the restricted nature of the areas excavated (Fig. 1.2). I have concentrated again therefore on Periods 4B, 5A and 5B using the tenement boundaries (projected to the boundary of Areas 3 and 4; Fig. 5.1) as the basis for analysis. Since they could not be traced in Area 4 there was no way of evaluating this part of the site. I have also ignored the eastern part of Tenement A where the stratigraphy could only be ascribed to either Period 4 or 5. Tables 5.9 - 5.11 above show the quantities of iron objects, and smithing and smelting slag found in each tenement.

If it is assumed that the distinctions in volume of material between the tenements correspond roughly to differences in their area, then I calculate that the relative concentration of objects and slag by tenement is as shown in Tables 5.22 - 5.24 where the figures are arrived at by dividing the number of objects or quantity of slag by the surface area of the tenement. The Period 4B Tenement A figures are unsatisfactory, however, because of the substantial (and unquantifiable) removal of material at its western end by the Period 5B sunken building.

Table 5.22 Relative concentrations of iron objects by tenement in Periods 4B, 5A and 5B

Period	A	B	C	D
4B	.79	2.56	2.25	1.30
5A	.60	1.24	1.53	1.78
5B	.88	.60	1.56	1.71

Table 5.23 Relative concentrations of smithing slag by tenement in Periods 4B, 5A and 5B

Period	A	B	C	D
4B	50.15	174.30	50.58	13.60
5A	10.70	155.90	57.64	134.02
5B	51.47	11.75	86.16	53.36

Table 5.24 Relative concentrations of smelting slag by tenement in Periods 4B, 5A and 5B

Period	A	B	C	D
4B	7.82	25.38	23.10	1.47
5A	0.00	6.75	11.00	134.03
5B	17.56	1.50	5.20	0.36

Important features of these data are the relatively high concentrations of objects in Tenements B and C in Period 4B, and in C and D in Period 5B, but the most striking, perhaps, is the high concentration of smithing slag in Tenement B in Periods 4B and 5A compared to the other Tenements and compared to Tenement B itself in Period 5B. With regard to smelting slag, Period 5A shows a high concentration in Tenement D (although it should be recalled that only Area 1 of Tenement D is involved here) which may reflect activity in Period 4B in which the bulk of the material was probably deposited. These features certainly suggest if not confirm, non-random spatial distributions which may reflect some survival of the original pattern of discard and indicate distinct activity areas. Although research is still in progress, it is encouraging to find similar discontinuities in distribution in other categories of material in Period 4B, including crucibles which are perhaps the best evidence for non-ferrous metalworking. Of c.1000 Anglo-Scandinavian crucible sherds, not only did 45% come from Period 4B, with another 16% from Period 5A, but c.80% came from Tenements C and D (Mainman forthcoming). Leadworking waste also came primarily from Tenements C and D (Bayley forthcoming). Amber waste is another category of material which was strongly concentrated in Tenements B and C, but virtually non-existent in A and D.

In order to look at the patterns outlined above in more detail the find spots of selected classes were mapped by period. Because they are particularly numerous and because the Period 4B buildings with their large hearths are a potential source, these classes included objects and slag associated with metalworking (Figs. 5.2 - 5.7). Also plotted were some of the other larger classes or groups of classes of object including needles (Figs. 5.8 - 5.10), knives (Figs. 5.11 - 5.13), dress fittings and riding equipment (Figs. 5.14 - 16) and plated objects (Figs. 5.17 - 5.19). Finds from Periods 3 and 4A have been excluded because insufficient of the site was excavated to allow distribution to be meaningful. Period 5A has been included because the majority of artefacts were probably redeposited after initial deposition in Period 4B (1.2) and their distribution may be used to enhance the 4B pattern.

The find spot of each artefact can be located with varying degrees of accuracy. The majority of them, other than those which appeared on site to be nails, were recorded as 'small finds' during excavation and their find spots were located three dimensionally on site plans. Nails and other artefacts taken to be nails were not made small finds, but were collected and recorded by context. Unfortunately many 'nail-like' objects such as wool comb teeth, needles, punches and strips were also collected in this way and only mass radiography revealed their actual identity. As a result the proportion of each class for which find spots can pinpointed exactly varies widely from c. 80% to under 30%. For analytical purposes the find spots of artefacts not three dimensionally recorded have been taken to be the centre of their context and this may mean an error of up to a metre in the case of artefacts from larger layers, but at the scale at which these maps are presented the distortion of original excavated pattern is negligible.

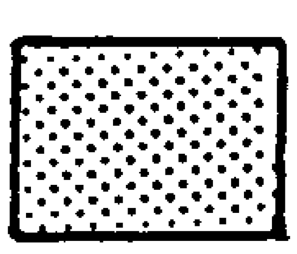
In general terms the maps confirm the patterns of distribution discussed above; find spot density in Period 4B is rather greater at the west end of the site than in the centre and east end. There is, however, no suggestion of a regular regression of numbers against distance away from the buildings. When viewed with the voids created by later intrusions, however, the Period 4B plots become more difficult to interpret. It is clear, for example, that the Period 5B sunken buildings have substantially removed parts of the distribution pattern in Tenements A and B which, had it survived, might have shown an even greater concentration of find spots towards the western end of the site in this tenement. The Period 5A plots confirm the concentration of discard which took place at the western end of the site in Period 4B. The Period 5B plots appear to show a more random, less clustered pattern.

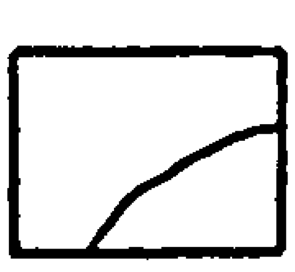
In addition to confirming the general pattern of find spot distribution, the principal value of these maps and others like them, is that they can potentially allow the location of discard sites for particular classes or groups of artefacts, although it is not necessarily possible to say whether those sites were composed of primary or secondary refuse. Examples of such sites at Coppergate would, perhaps, include the interiors of the Period 4B buildings, especially that in Tenement C, for needles (Fig.5.8), and an area in the centre of Tenement C on its northern limit for strips and plates (Fig.5.2) and, for no apparently related reason, wool textiles (Walton 1989, fig.121). In the final analysis, however, for the reasons I have already given, 16-22 Coppergate is far from being the ideal site for the study of spatial clustering since so few objects are likely to be in their original location of discard. The significance of plotting an object's exact location on this kind of site must, therefore, remain somewhat restricted as a means of determining the location of both primary contexts and activity areas.

Figs. 5.2 - 5.19

KEY

● = object find spots

 = major intrusions from later periods

 = pits

4-5 = area where deposits could only be assigned to either Period 4A/4B or 5A/5B

Scale

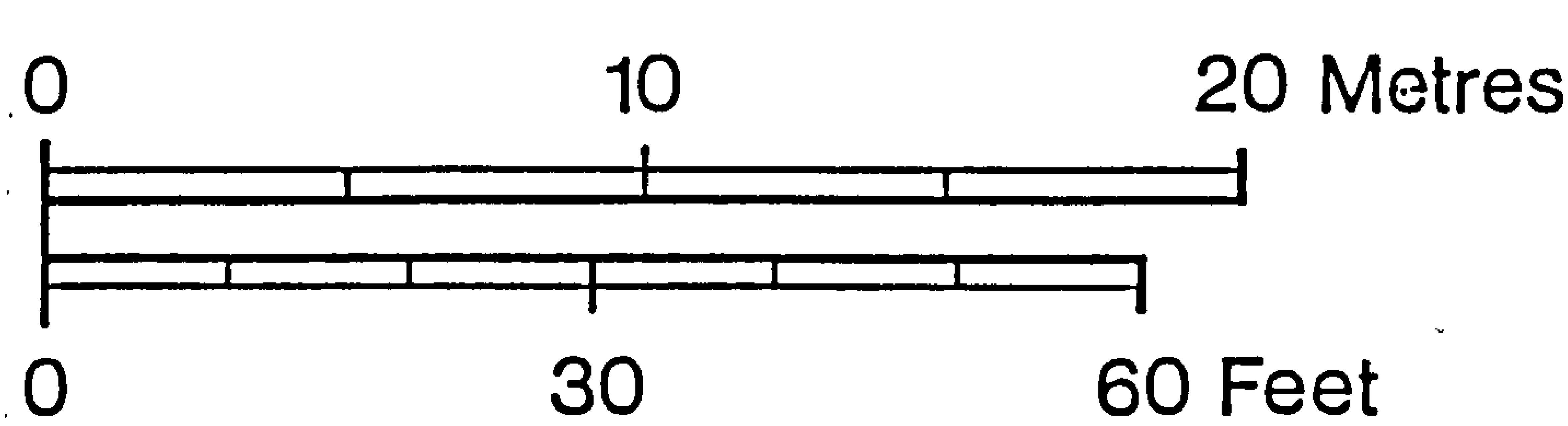


Fig.5.2 Distribution plan of bar iron, blanks and scrap, Period 4B

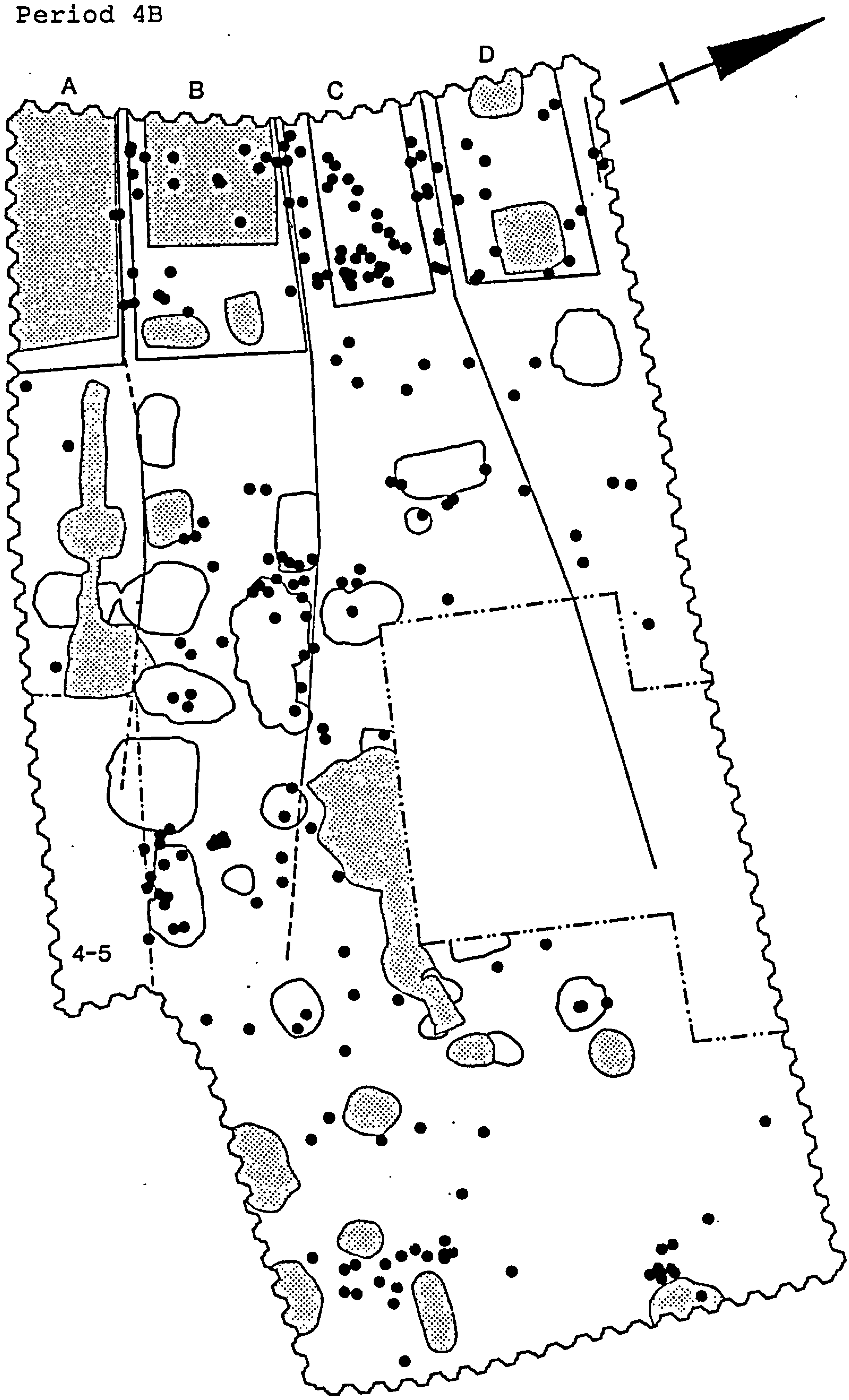


Fig.5.3 Distribution plan of bar iron, blanks and scrap, Period 5A

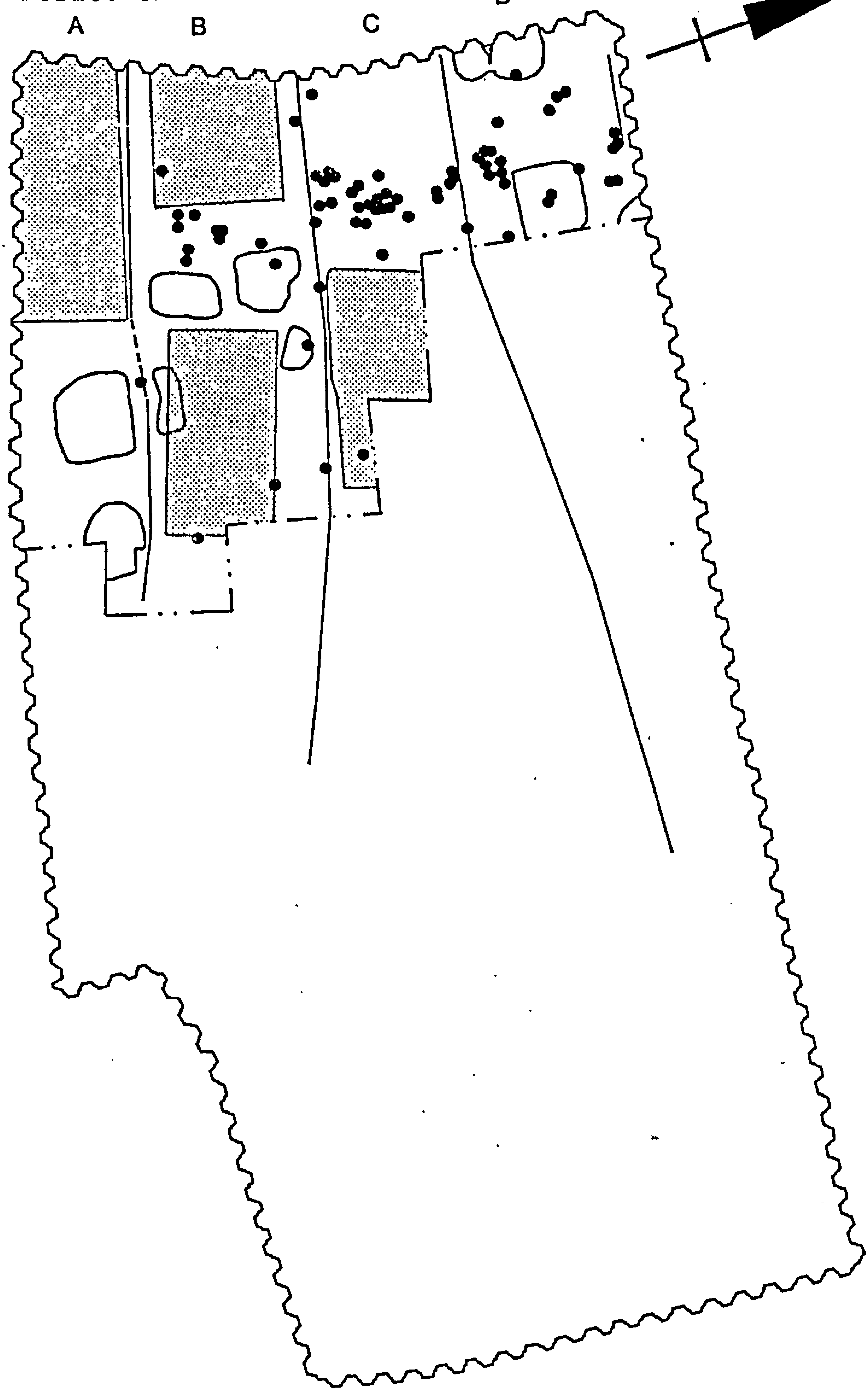


Fig.5.4 Distribution plan of bar iron, blanks and scrap, Period 5B

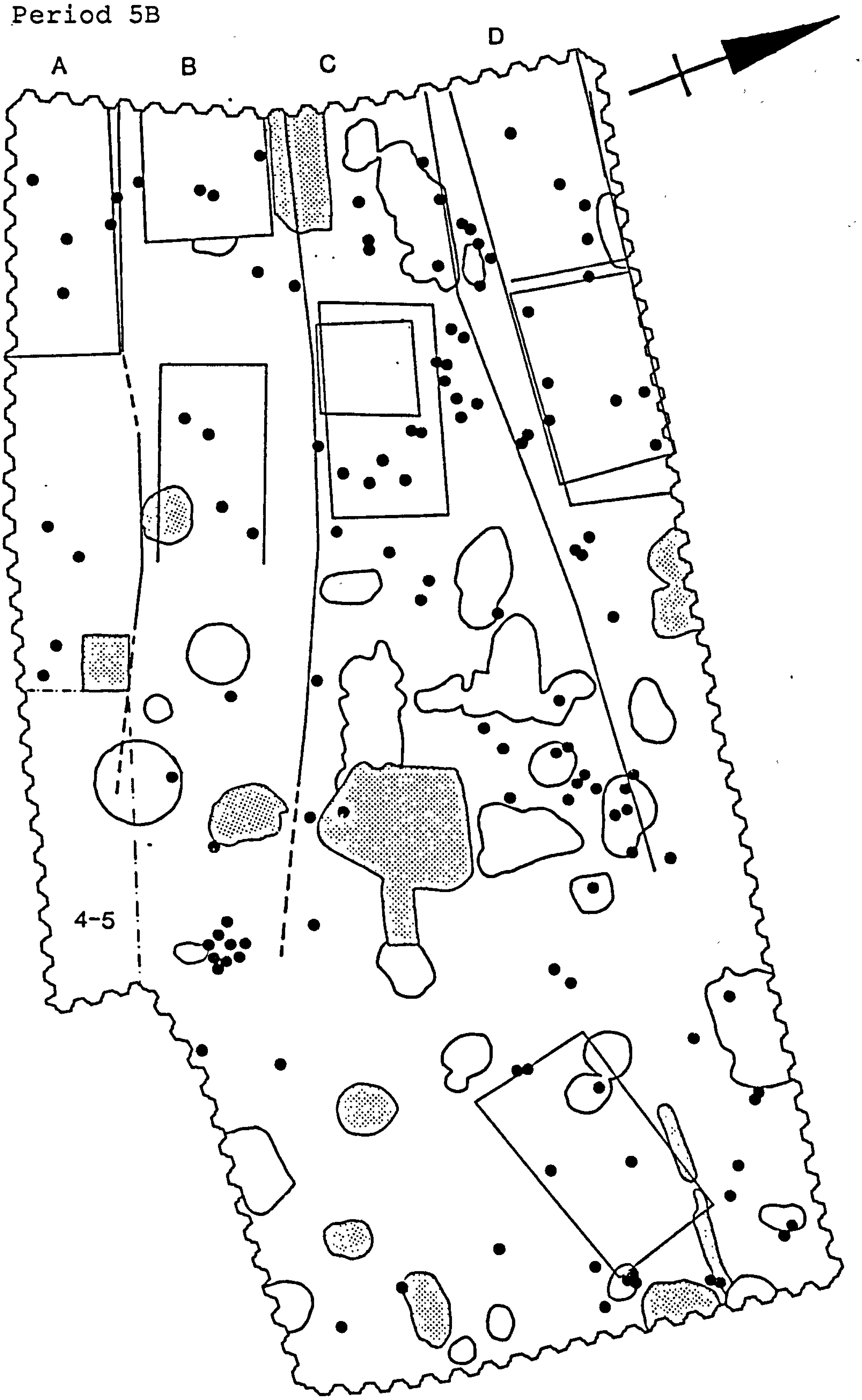


Fig.5.5 Distribution plan of metalworking tools, Period 4B

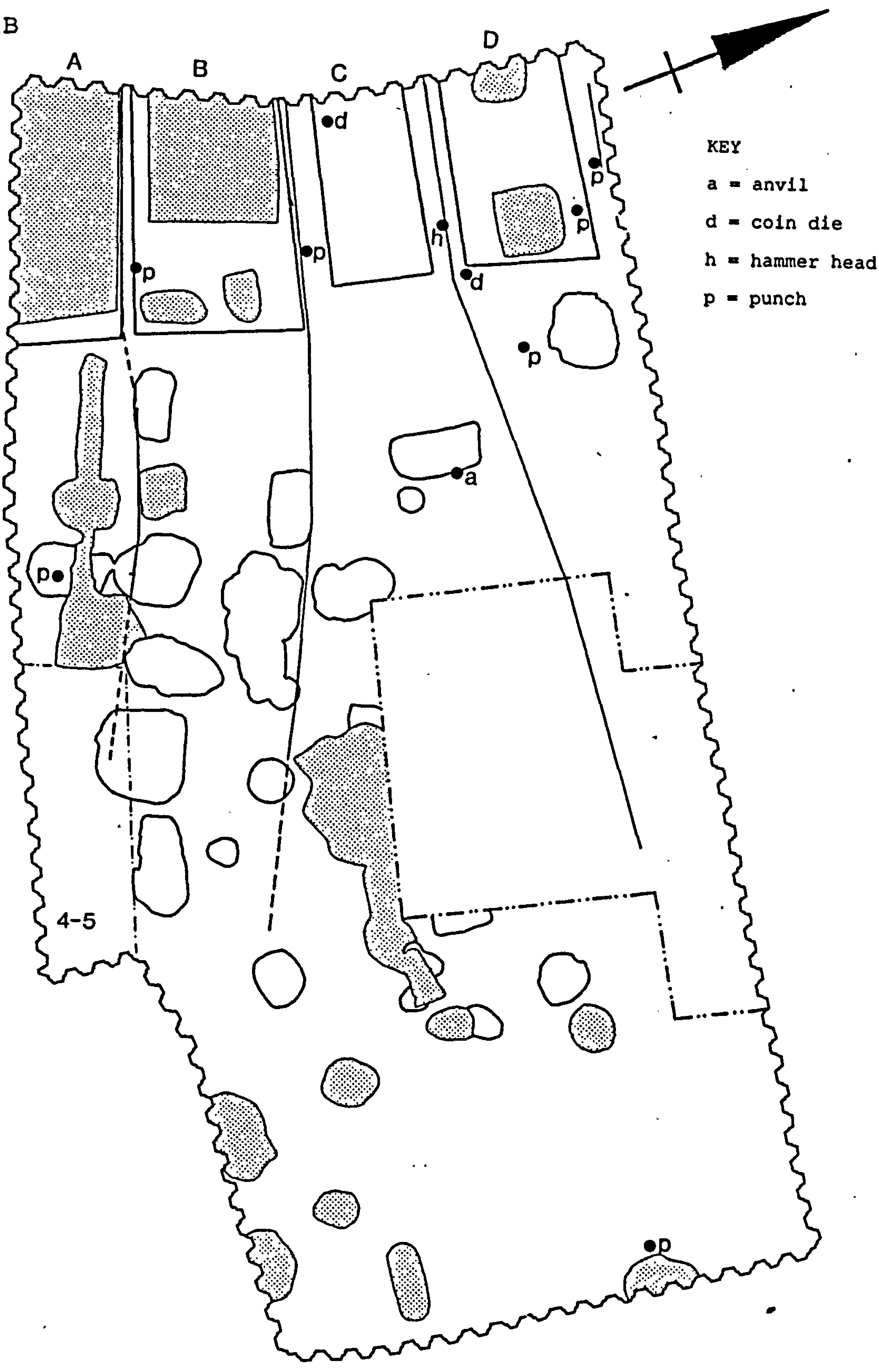


Fig.5.6 Distribution plan of metalworking tools, Period 5B

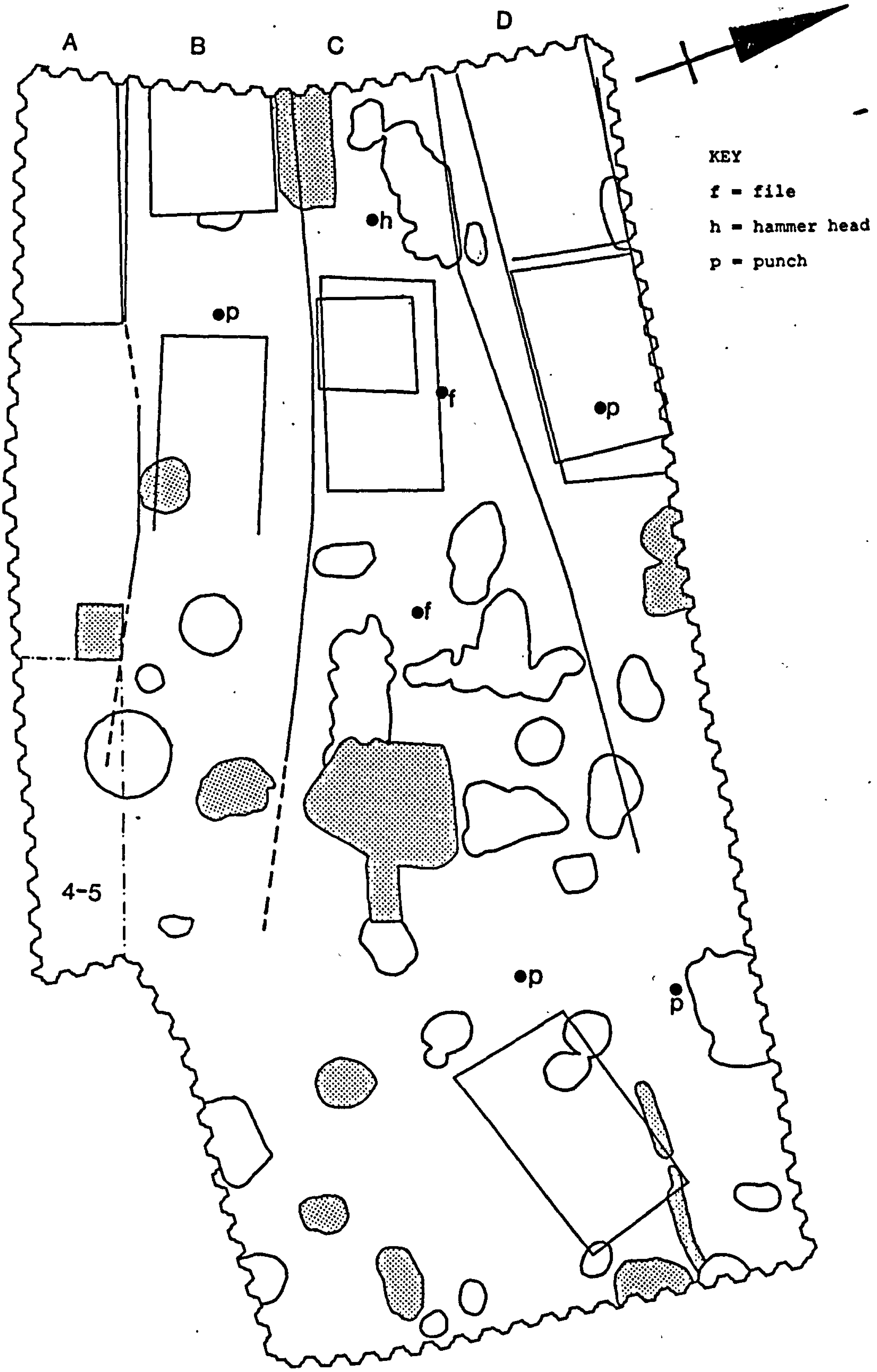


Fig.5.7 Distribution plan of smithing slag, Period 4B

Fig.5.8 Distribution plan of needles, Period 4B

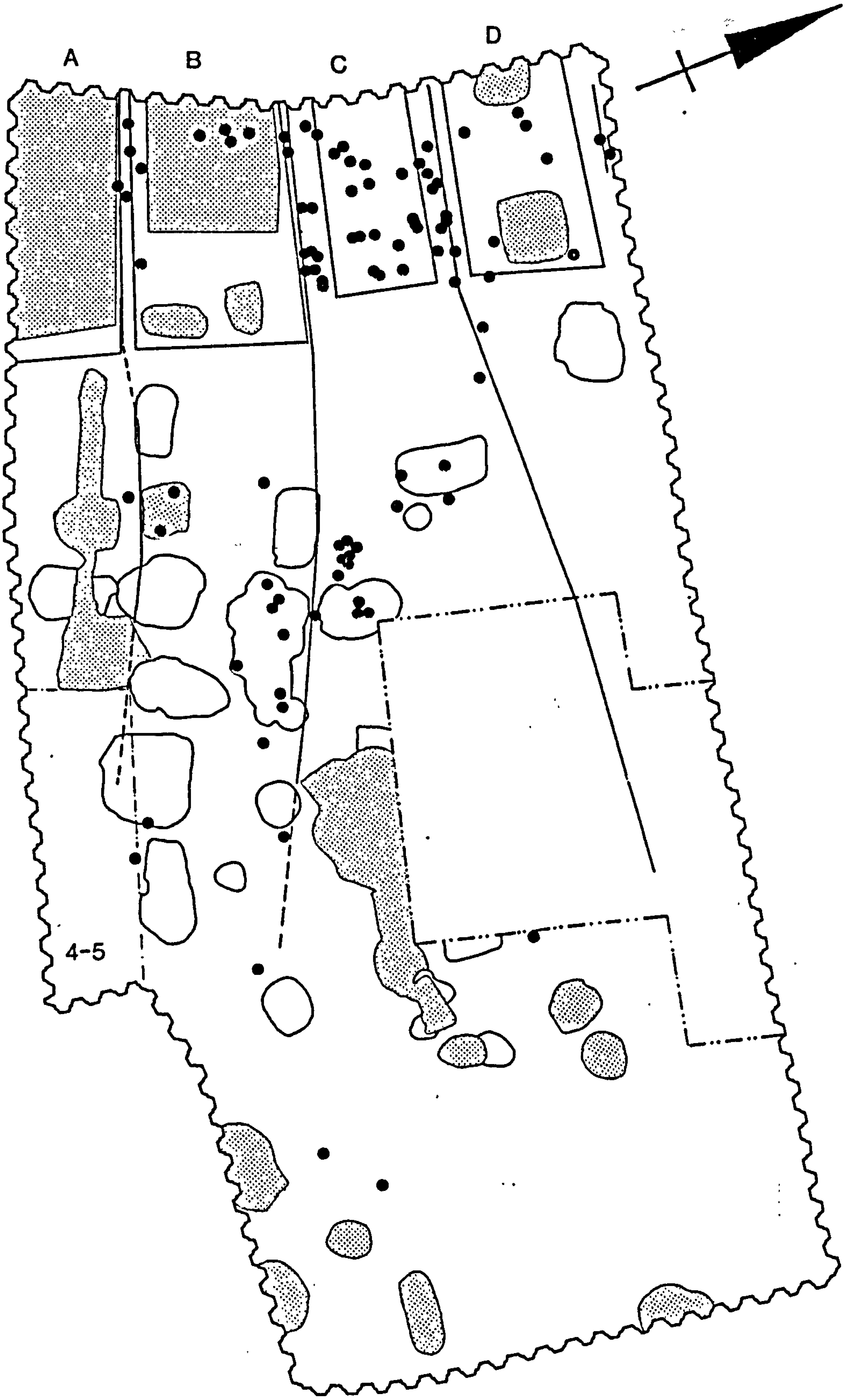


Fig.5.9 Distribution plan of needles, Period 5A.

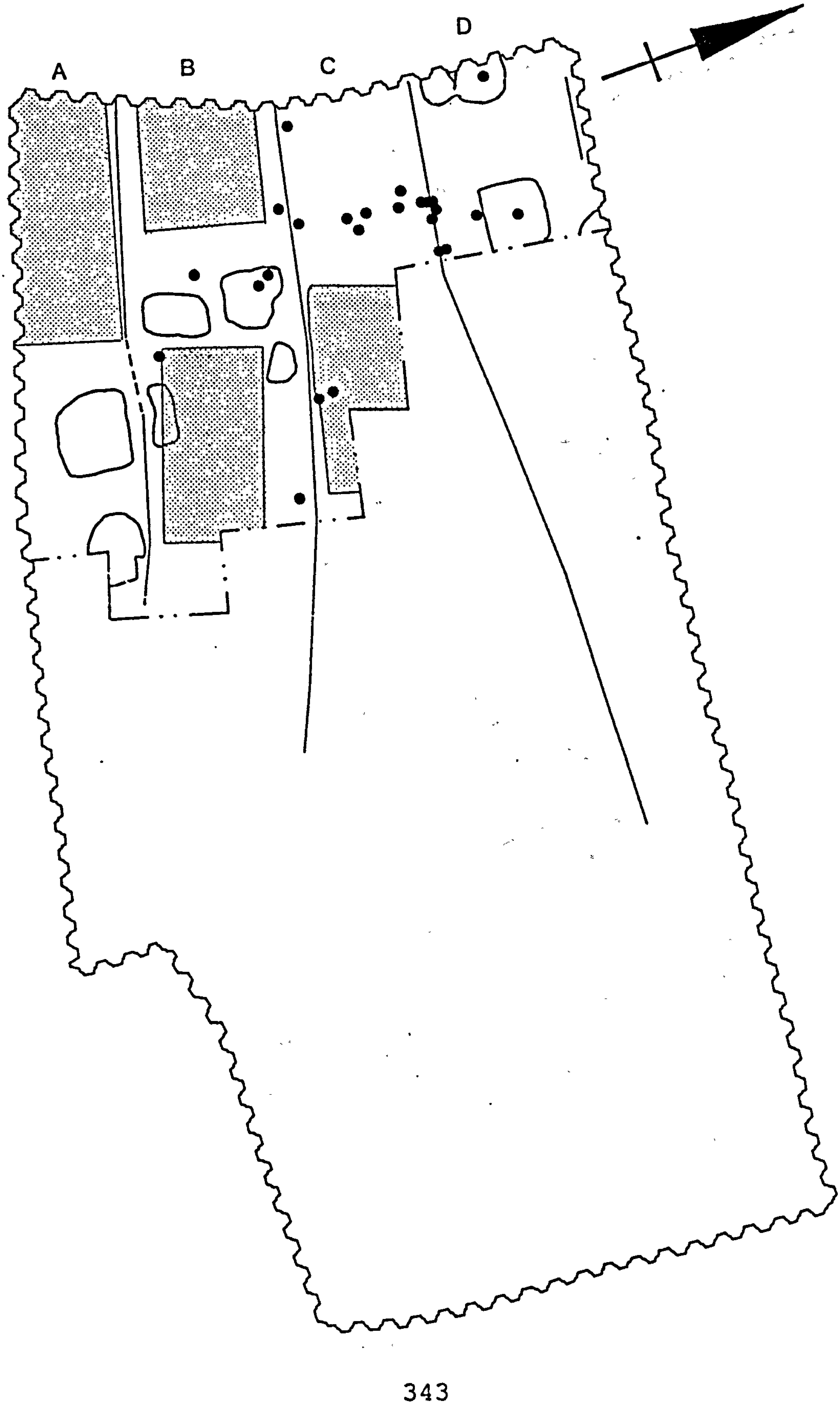


Fig.5.10 Distribution plan of needles, Period 5B

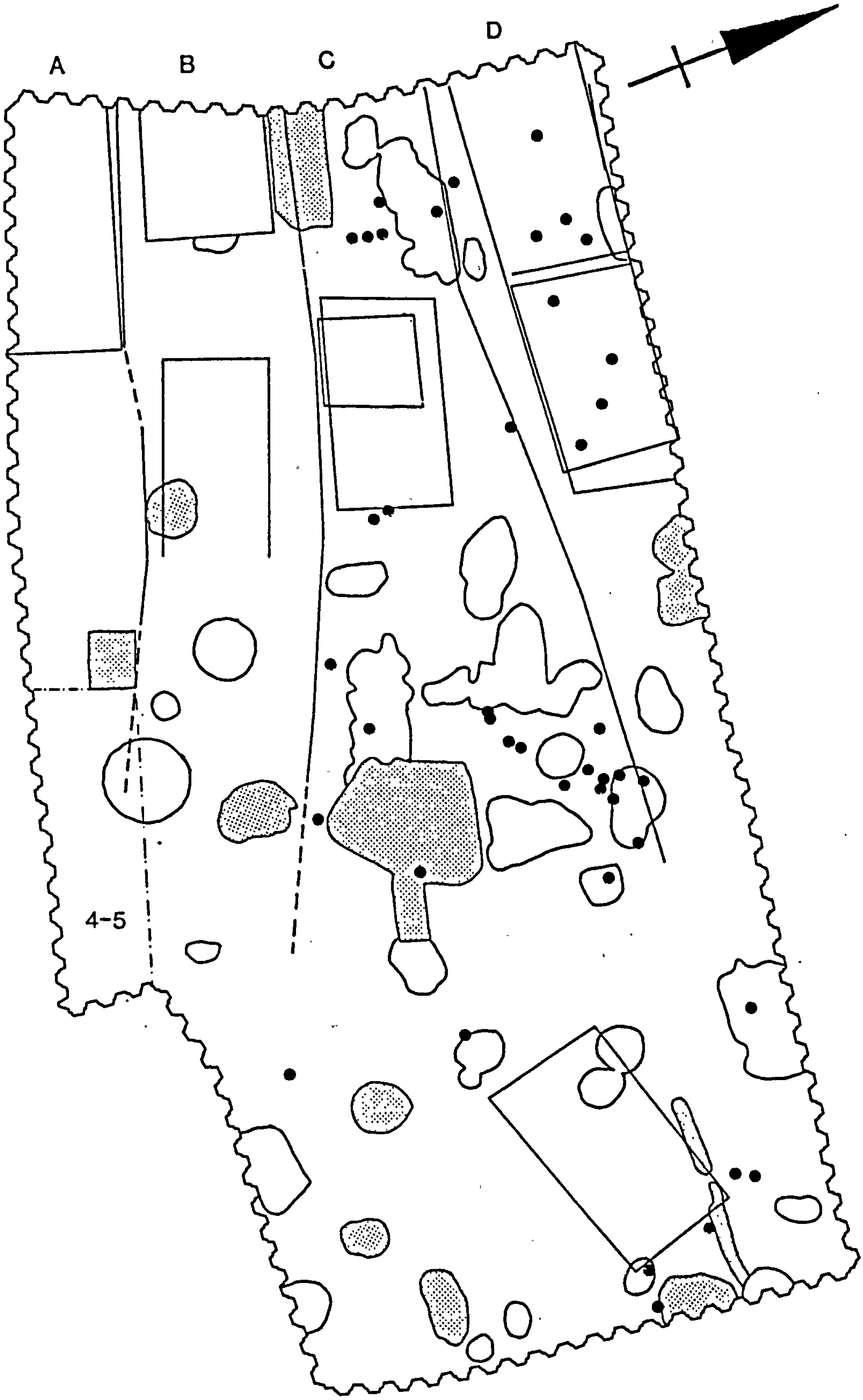


Fig.5.11 Distribution plan of knives, Period 4B

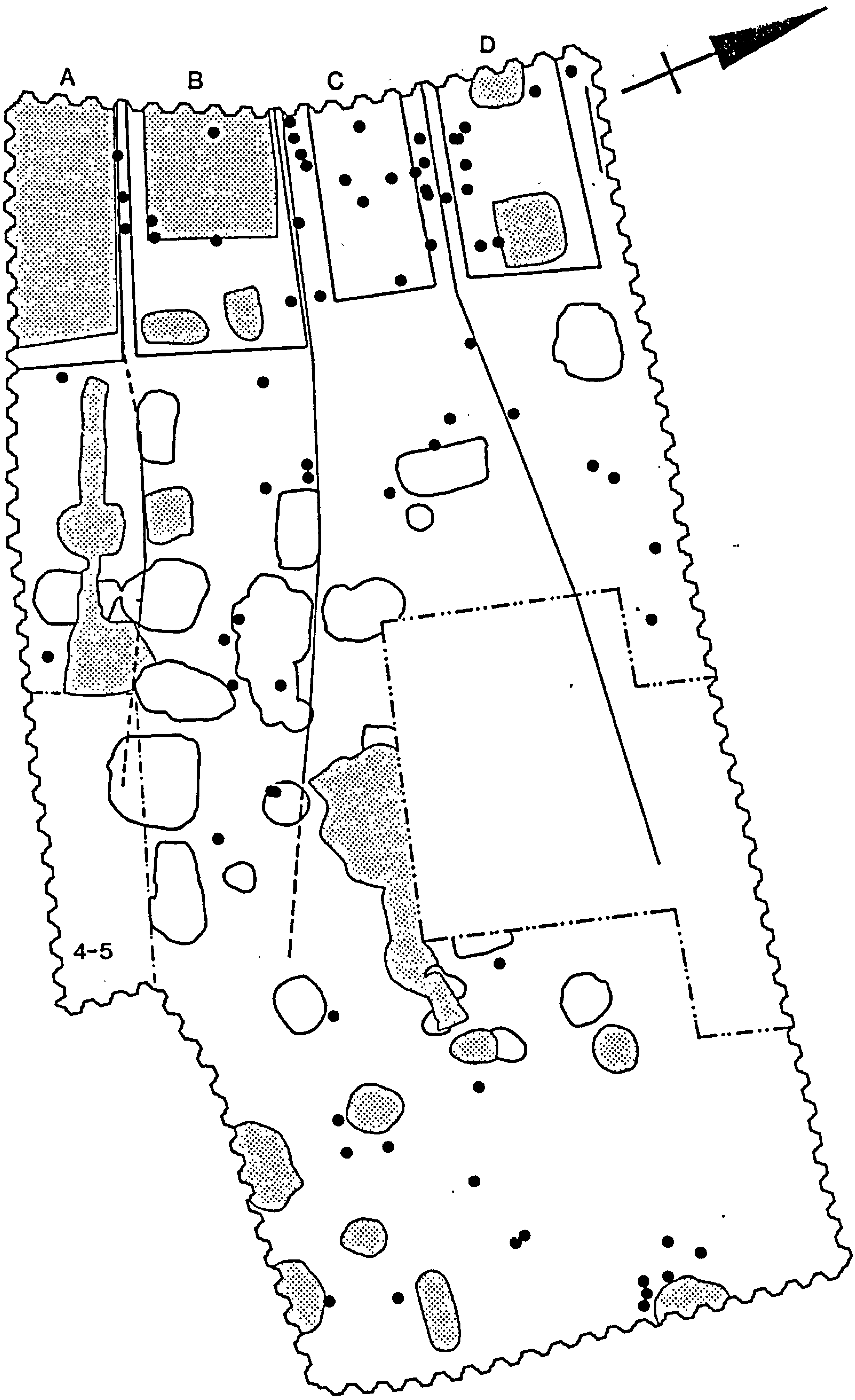


Fig.5.12 Distribution plan of knives, Period 5A

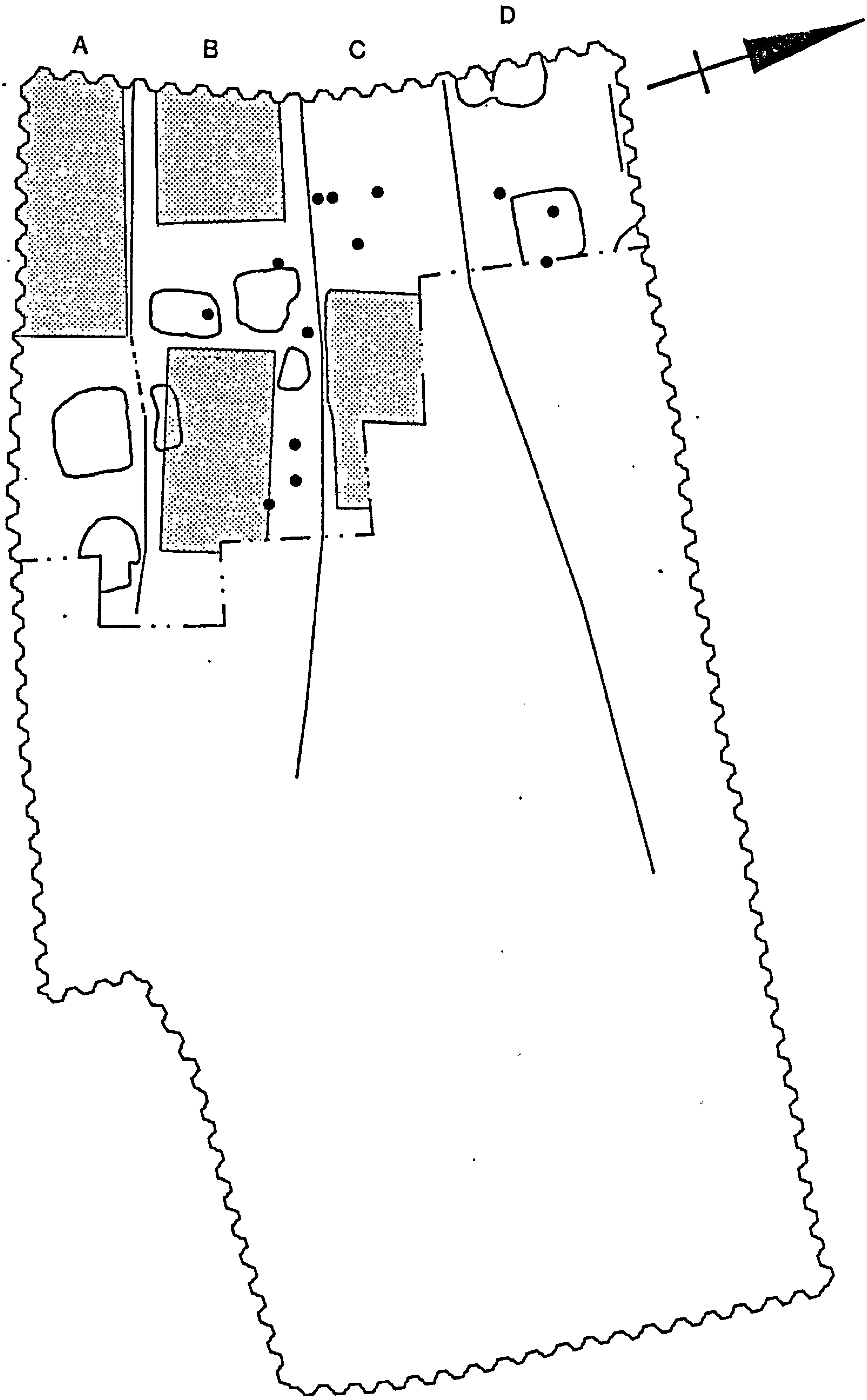


Fig.5.13 Distribution plan of knives, Period 5B

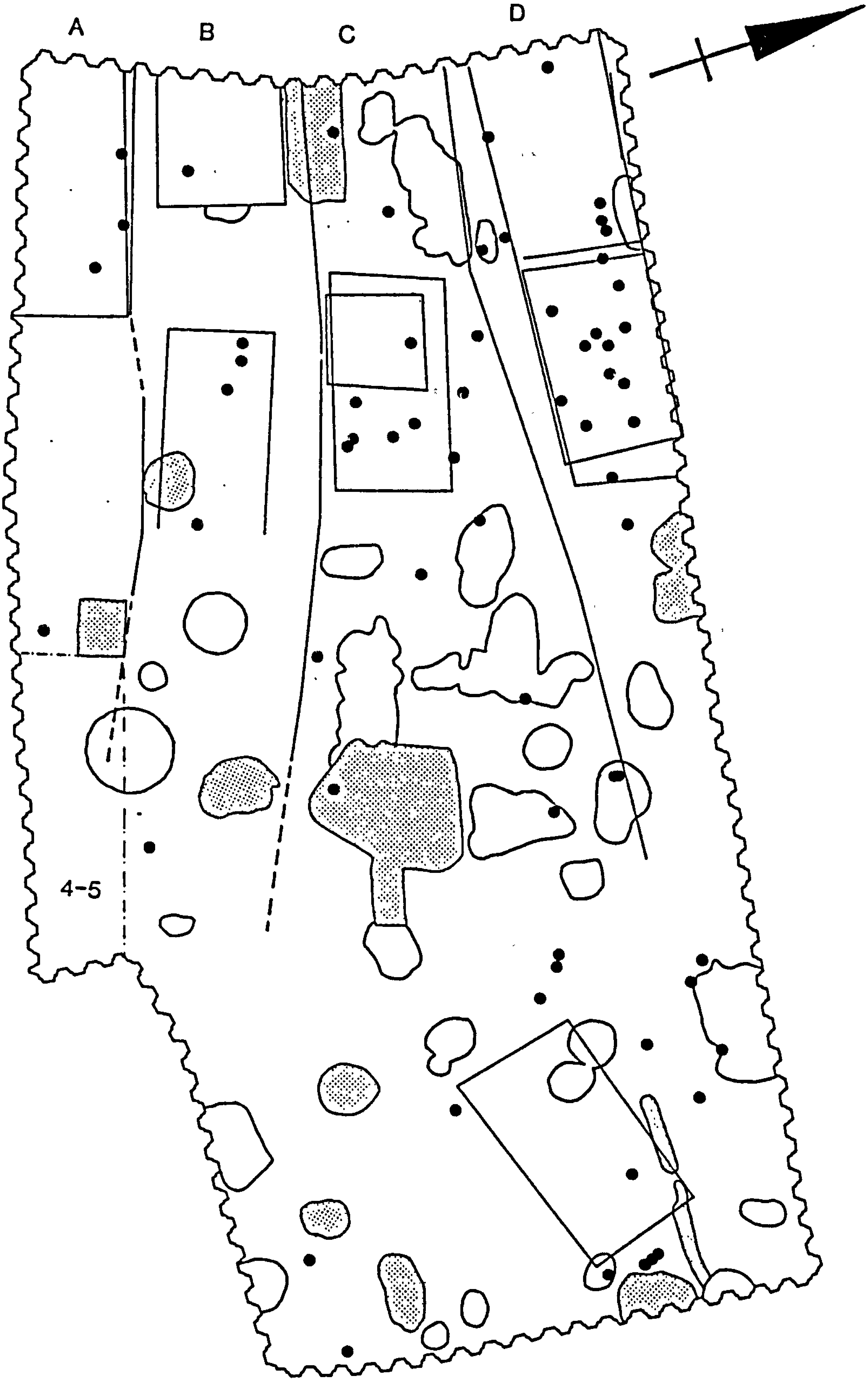


Fig.5.14 Distribution plan of dress fittings and riding equipment, Period 4B

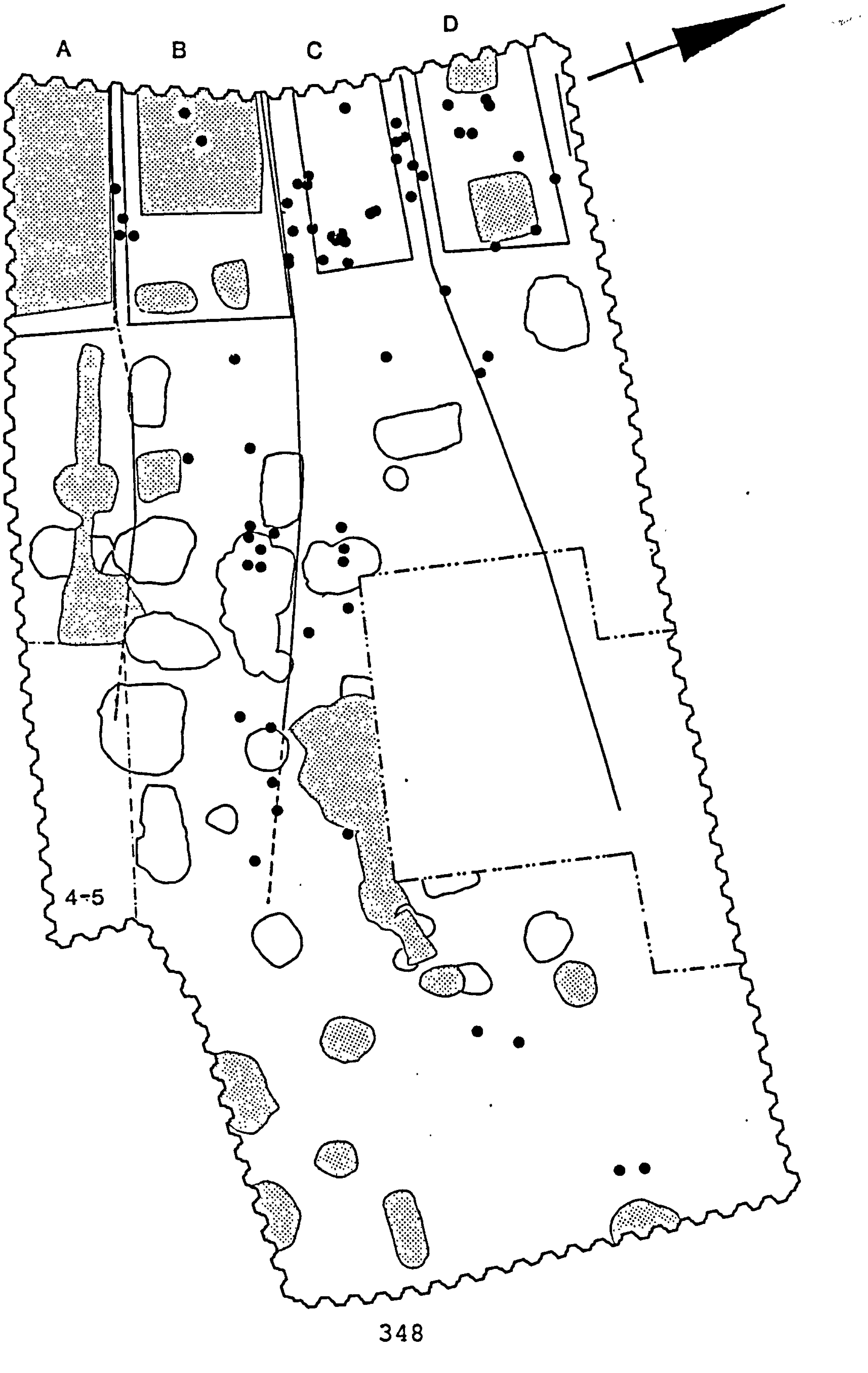


Fig.5.15 Distribution plan of dress fittings and riding equipment, Period 5A

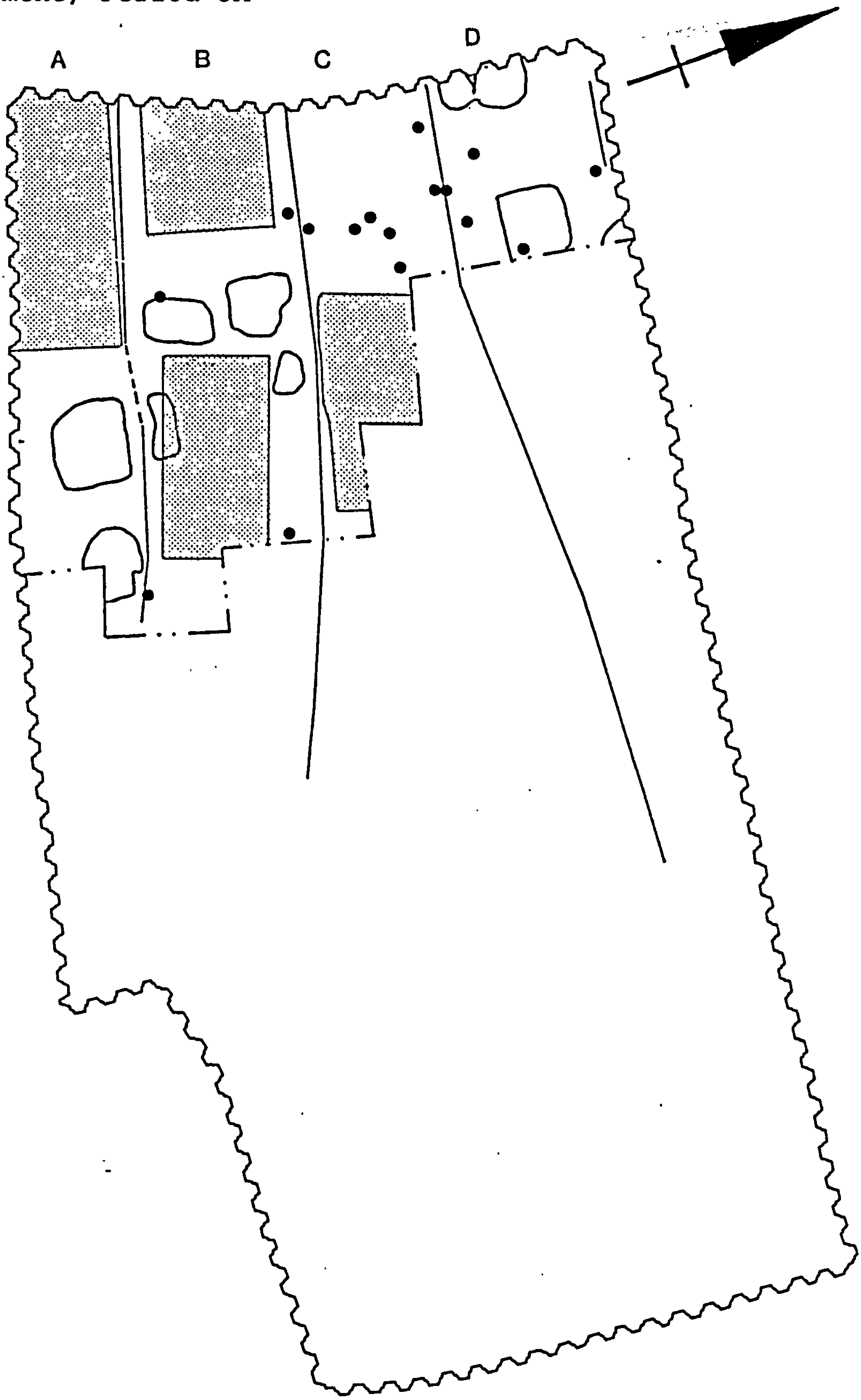


Fig.5.16 Distribution plan of dress fittings and riding equipment, Period 5B

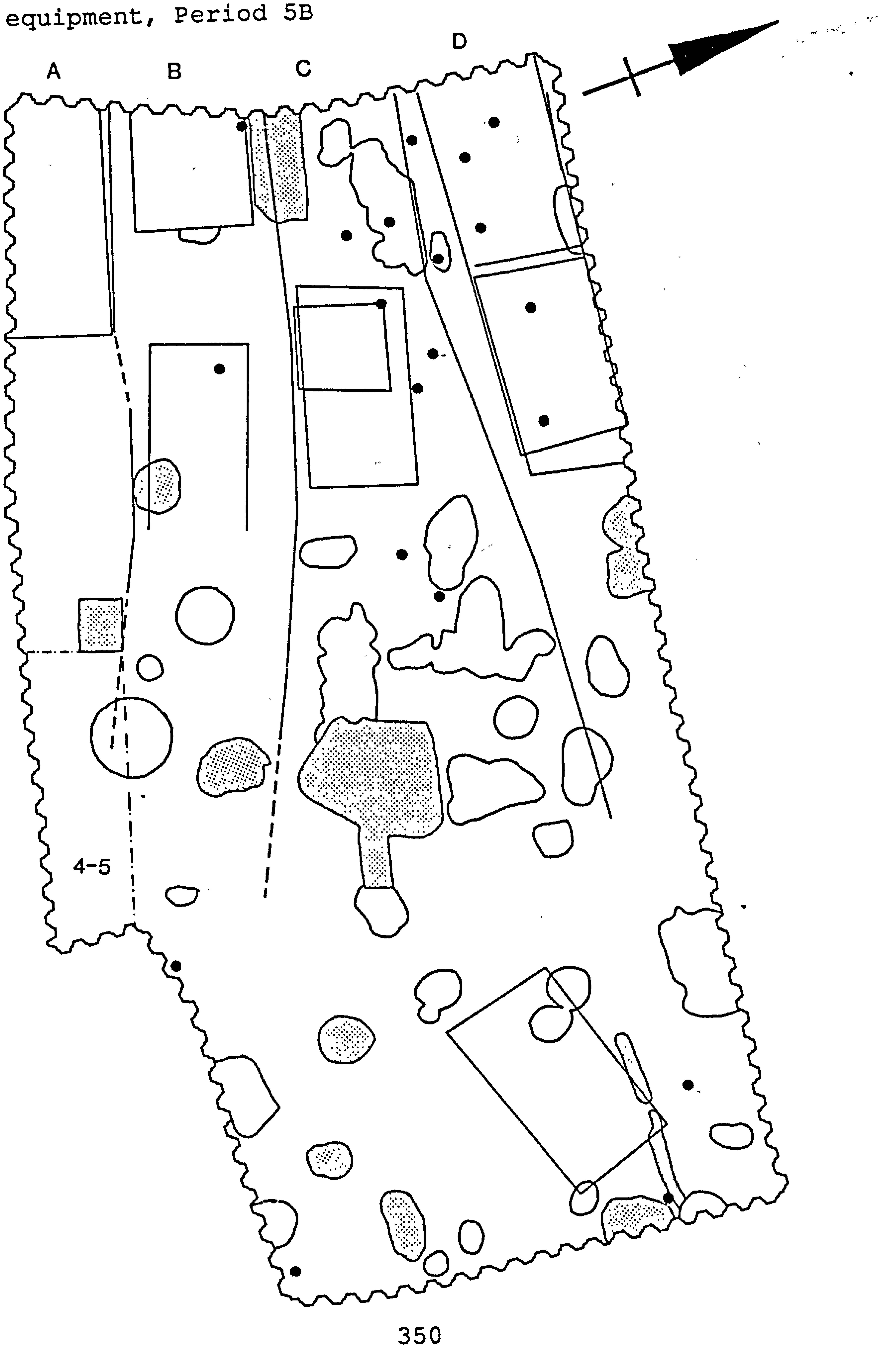


Fig.5.17 Distribution plan of plated objects, Period 4B

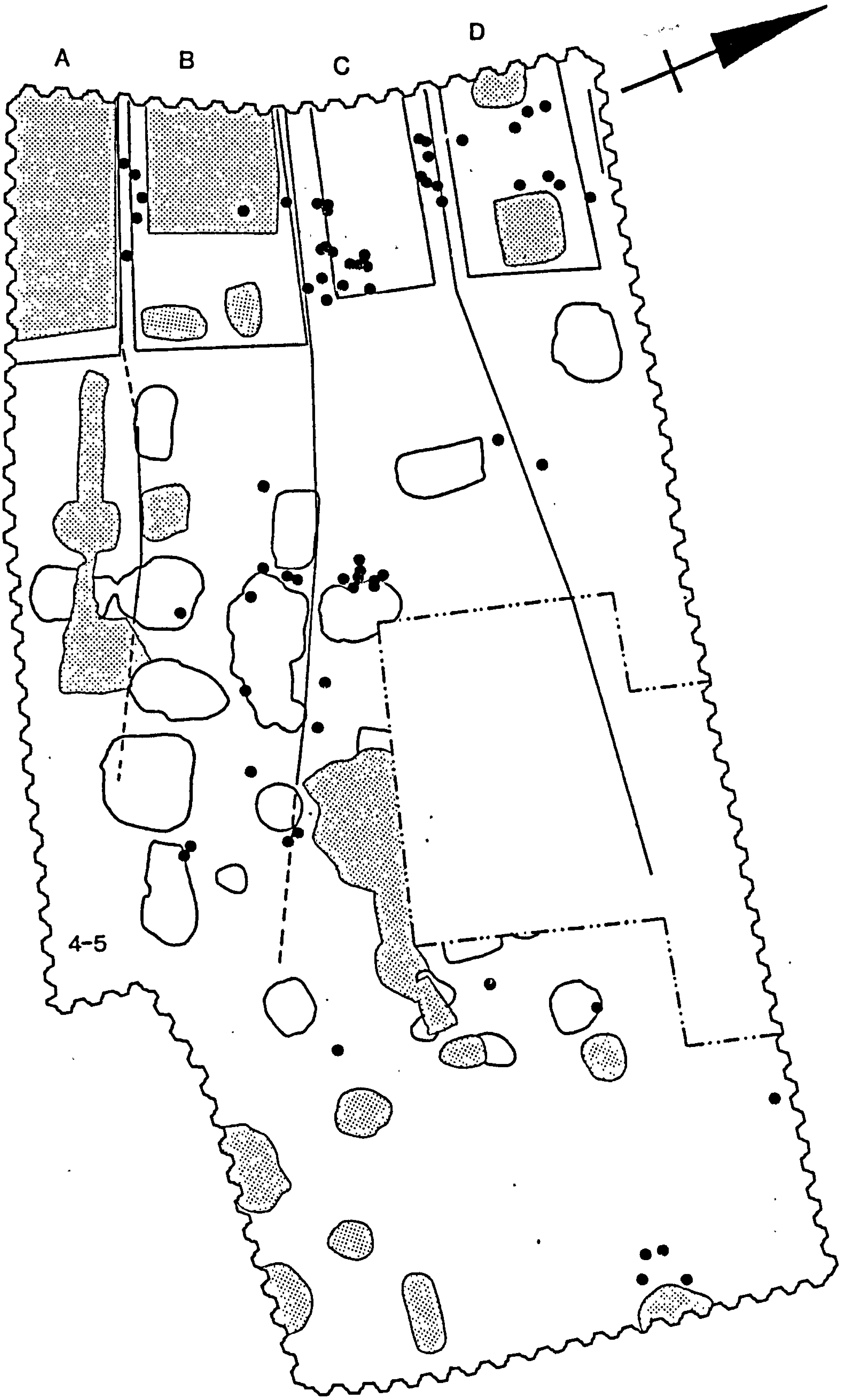


Fig.5.18 Distribution plan of plated objects, Period 5A

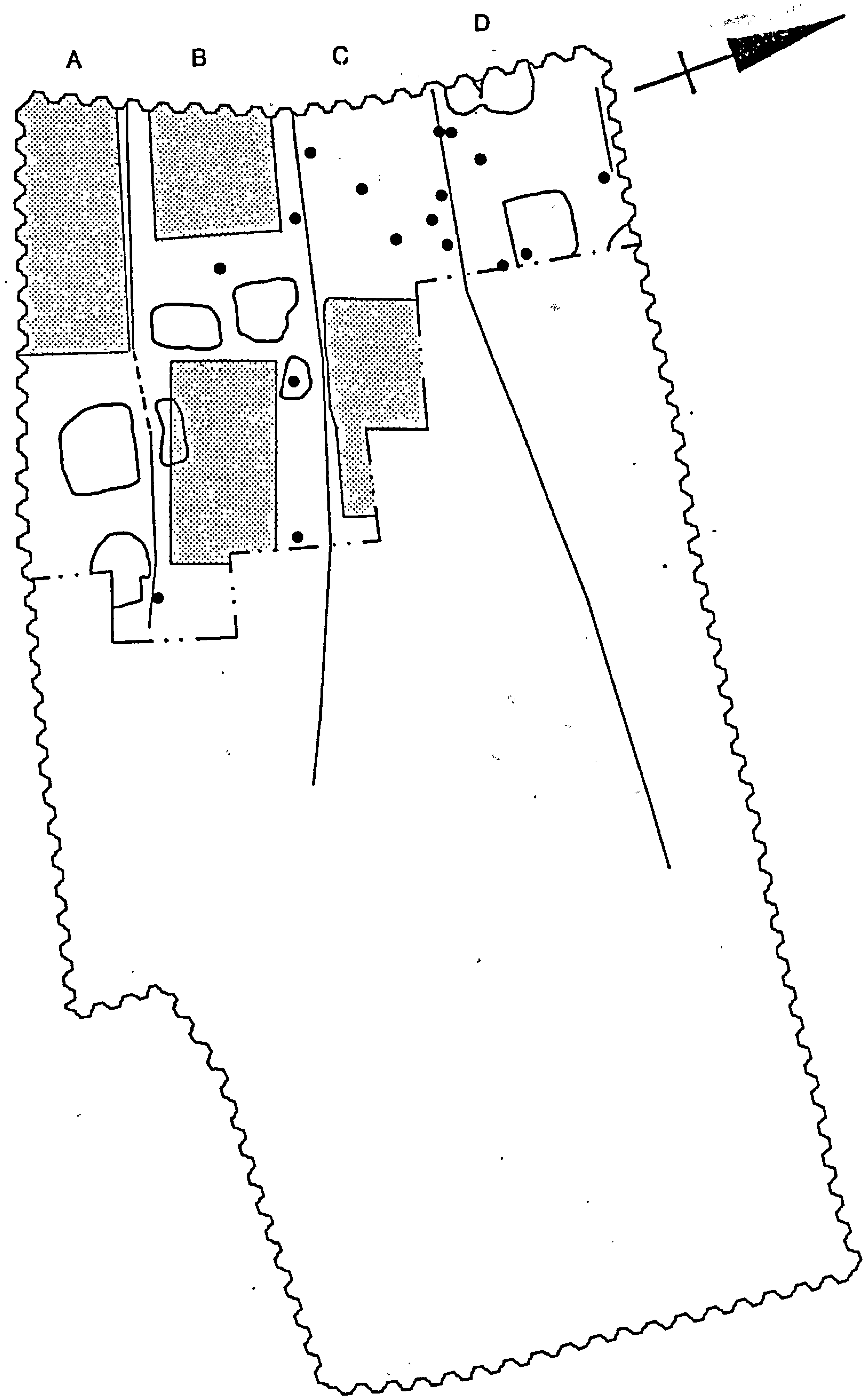
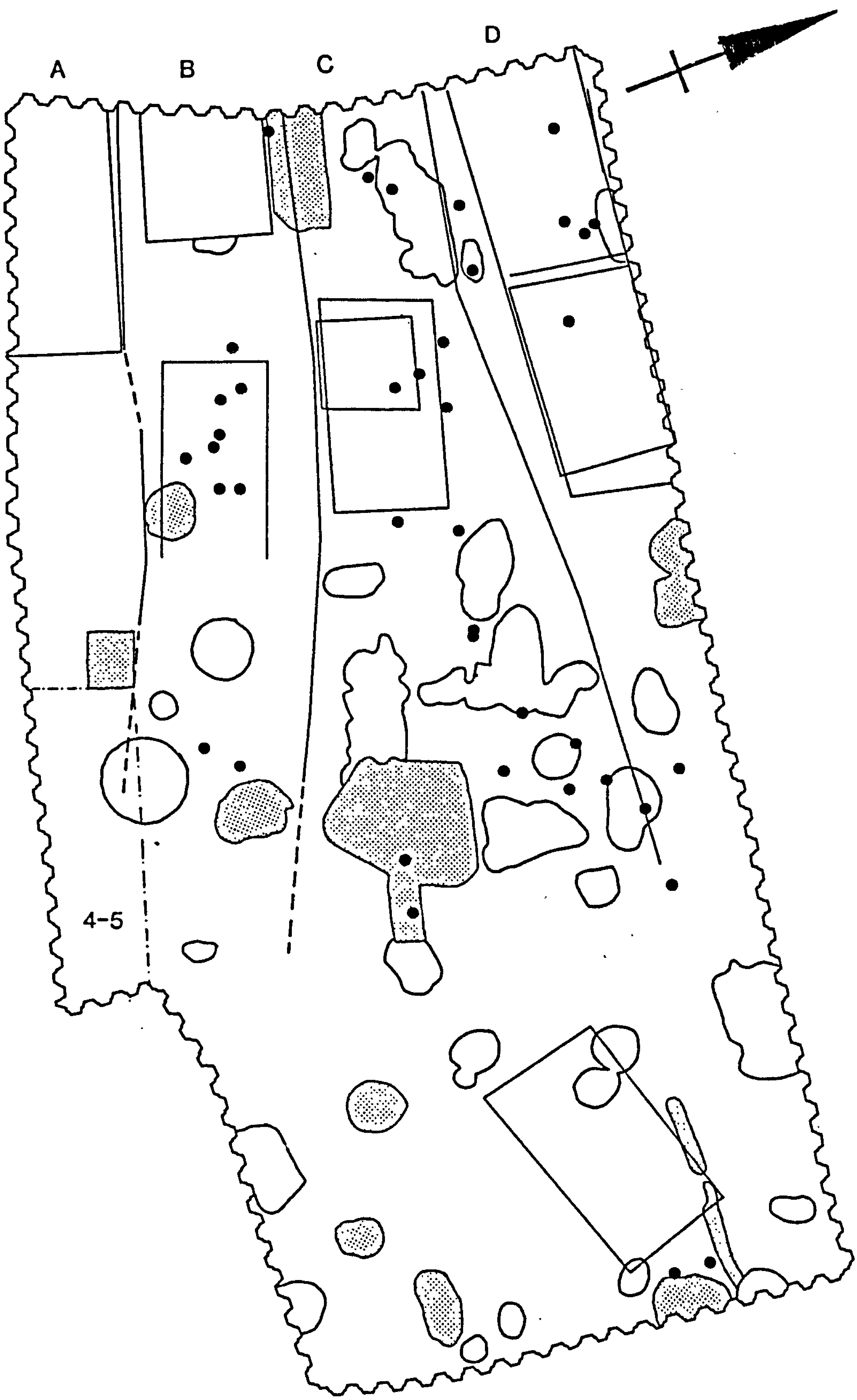


Fig.5.19 Distribution plan of plated objects, Period 5B



In conclusion, it is difficult to assess with any degree of accuracy the extent to which there has been preservation of the original discard pattern at 16-22 Coppergate, and so to identify contexts of primary status, or to understand the patterning which did survive. It is clear, however that there has been considerable redeposition which has moved artefacts both from one context to another in the same period and from contexts of one period to those of later periods. It is evident that there was a residual component in the vast majority of the Coppergate contexts in all Anglo-Scandinavian periods, but that the proportion of residual Roman iron objects and slag, except for nails and tacks in Period 3, was probably low and declined steadily through the Anglo-Scandinavian era. Apart from the nails and tacks therefore, the Coppergate ironwork can be confidently treated as an overwhelmingly Anglo-Scandinavian assemblage. Of the Period assemblages, that from Period 3, again apart from nails and tacks, may perhaps be seen as most representative of its date range (c.850 - 900) since there is presumably a substantial, if unquantifiable, proportion of residual Anglo-Scandinavian material in subsequent periods. The pottery data from Period 4B have shown, however, that the extent of residuality may vary from one part of the site to another, being, at that time, much lower at the west than the east and lower in floor layers than pit fills.

In spite of these qualifications, however, I suggest that there are elements in the chronological and spatial distribution of iron objects and ironworking residues which indicate some survival of the original discard pattern and that this pattern has some meaning for understanding activity, other than refuse disposal, on the site. In Period 4B there is some suggestion of non-random clustering of finds spots towards the west end of site in Area 1 where not only did buildings survive but pits were fewer and residuality levels were lower. There was also some evidence for marked discontinuities in the distribution of ironworking debris, as well as in other classes of material, between the tenements.

In Period 5B the original discard pattern may have survived to the same extent as in 4B, although there was less evidence for non-random patterning except for the relatively high quantity of smithing slag in Tenement C compared to Tenement B, a striking reversal of the situation in Period 4B. Since there were no hearths on the site in this period the material may have derived either from smithing taking place in the immediate area of the site or from a number of sources in the town. A good example from Period 5B of what is probably largely primary refuse from a variety of activities on the site, perhaps in and around a building still in occupation on the street frontage, is context 29263 the backfill of the easternmost Period 5B sunken building in Tenement D in which there was no Roman pottery and much of the large group of ironwork (itemised in Appendix 7) was in a relatively unfragmented condition. The assmeblage contains little evidence for metalworking in the form of slag, bar iron or tools, but is more suggestive of domestic and craft activity.

5.6 16-22 Coppergate contexts and the evidence for site activities

In Chapter 3 I described an inventory containing a wide range of iron artefacts originally used for a wide variety of functions including craft and domestic activities, as structural fittings, and in dress, riding, hunting and combat. In 5.2 - 5.4 I looked at some of the forces which had probably influenced the composition of the inventory and then in 5.5 at the extent to which the original pattern of discard had been obscured or disturbed by redeposition. Although disturbance was clearly considerable and the excavated patterns were difficult to interpret, I have concluded that enough of the original pattern survived to provide good evidence for the activities which took place on the site. A particularly good case may be made for ironworking and the evidence for this may now be summarised.

In Period 3 there is some evidence for iron production and working of other metals in the form of tools and slag, although some of this material may be residual Roman. Rather than taking place on the site, however, it is more likely that metalworking was taking place in the immediate vicinity, the site serving as an area for dumping debris. This is also how the objects and residues from Period 4A may be interpreted.

In Period 4B there was an unusual combination of categories of evidence for ironworking on the site itself which is, I suggest, as good as any that can be expected from a stratified urban site.

Although the quantity of smelting slag was relatively small in total compared to what might be expected from a specialised smelting site (1.4), the likely absence of Roman residual material and the concentration of slag from the site in Period 4B (c.50%; Table 5.5) and within the period in Tenements B and C (Tables 5.11, 5.21), especially in Area 1 (Tables 5.8, 5.18), suggests that some small scale smelting took place on or near site, even perhaps in the small clay-lined pit found in Tenement C (1.2). The smelting slag in Period 5A (another 26.5%) may be largely redeposited from Period 4B and it may be noted that a relatively high percentage (32.5%) of smelting slag in Period 5A came from pits, dug largely into 4B contexts, compared to only 7% in Period 4B (Table 5.5b); the reason for a relatively high proportion in Tenement D (Tables 5.5, 5.18) is not clear, however. The smelting slag from Period 5B appears to be relatively evenly distributed over the site (Tables 5.17, 5.24) and may also be largely residual from Period 4B.

The smithing evidence is much stronger. Not only were hearths discovered which could have been used for metalworking, but there were also large quantities of slag including the very fine hammer scale which is unlikely to occur in quantity in residual or redeposited contexts (1.9). Among the artefacts found were bar iron, blanks and scrap (3.1) and metalworking tools, most of which could have been for ironworking (3.2 - 3.9). The non-random distribution of the smithing related material and its meaningful association with the hearths can be demonstrated, at least up to a point, by analysis of spatial patterning. Particularly significant was the quantity and distribution of bar iron, blanks and scrap and slag from around the post and wattle buildings in Tenement B and to a lesser extent A, C and D. It is likely that all four structures served as smithies for ironworking.

Period 5A contexts, identified only in the street frontage area, have been interpreted as deriving from upcast from the construction of the sunken buildings occupied during Period 5B. Since it is likely that redeposition took place within the tenement boundaries, horizontal displacement of artefacts was probably slight so that the distribution of artefacts and slag may be something of a reflection of the original pattern of discard in Period 4B providing further evidence for the nature of the occupation, including iron smithing, in the underlying post and wattle buildings.

In Period 5B there were no hearths suitable for metalworking. Numerous items of bar iron, blanks and scrap were found, but their distribution was more random (Figs.5.6 - 5.7) and many of them were probably residual from Period 4B. Smithing slag was also found and in some quantity with a particular concentration in Tenement C but it must either be residual or have been brought here from elsewhere.

The products of the Period 4B smithing industry probably included a wide range of iron objects the majority of which were simple tools and structural fittings. As I noted in 3.1.5 many of the bars, strips, and plates would have required little additional work to convert them into finished objects. Some more particular suggestions may be made, however, on the evidence of a number of part-made objects combined with that of the chronological and spatial distribution.

One possible product is the needle. The total number from the site (221) is in itself remarkable; no other site of the Anglo-Scandinavian period has produced more than four (6.3.18). In addition there are a few possible part-made needles (3.18) and thin strips from which needles could have been manufactured. 99 needles and four probable part-made needles come from Period 4B. Their find spots (Fig.5.8) were concentrated at the west end of site (63% come from Area 1), especially in Tenement C in and around the post and wattle building (61% of those from Area 1 come from Tenement C). The small anvil, 2200 (3.2) also comes from the western part of Tenement C (Fig.5.5). As I have already noted, it has narrow grooves cut into the working surface and would therefore, perhaps, have been suitable for making needles.

Another group of artefacts which may include a number of site products are those with relief work and/or non-ferrous plating. There are 150 tin-plated objects from Anglo-Scandinavian contexts (Appendix 6) most of which are either dress fittings, such as buckles, strap-ends, or small chest fittings. The evidence for their being site products depends, first of all, on details of the objects themselves:

1) They share a number of distinctive formal features (4.4; 4.5) some of which are so similar as to suggest manufacture by the same workshop, if not by the same craftsman.

2) A few dress fittings are closely comparable to the plated objects in a formal sense except that they are, curiously, not plated. I have suggested that these objects were discarded immediately after forging but before plating (4.5). This must have occurred at the manufacturing site.

3) There are a few apparently part-made dress fittings notably buckle-plates (3.68) and strap-guides (3.69) and a few of the other strips and plates from the site may be embryonic dress fittings. Examples include 1860-1 from Period 4B which could be blanks for the buckle-plates of the form with opposed triangular ends (3.1.5; 3.68).

Secondly, the Period 4B find spots of dress fittings and riding equipment (Fig.5.14) and plated artefacts (Fig.5.17) were, to some extent, clustered at the west end of the site. Of 71 dress fittings, for example, 43 (61%) came from Area 1, of which over half were from Tenement C. This impression of clustering is enhanced if the material from Period 5A (Figs.5.15 and 5.18) is taken into account and Periods 4B and 5A together can be contrasted with Period 5B (Figs.5.16 and 5.19) where there were fewer examples and they appear to have been a more random distribution. It should also be noted that crucibles with residues of tin and lead and scrap tin and lead, raw materials for the plating metal, were also found on the the site associated with the Period 4B buildings (Bayley forthcoming).

Finally, the part-made barrel padlock key 3670 from Period 4B (3.64.4) may noted as a small piece of evidence for another likely site product.

Although the spatial distribution of some of the other categories of object was patterned in a similar way to the needles and dress fittings, there was little independent evidence for their manufacture on the site. Finds spots of knives from Period 4B, for example, were clustered at the west end of the site (Fig.5.11) and 46% were found in Area 1, but the only suggestion that they were site products was provided by two blanks which are possibly part-made knives (1877 and 1963; 3.1.5).

The evidence for iron smithing on the site was, as already noted, paralleled by that for non-ferrous metalworking. Although crucibles are few in Period 3 and 4A contexts, it appears to have taken place in the immediate area of the site at this time to judge by the presence of other residues and tools which include the file 2246 with copper alloy in the teeth (3.6) and the iron mould for making small animal head strap-ends (3.8). In Period 4B there was, as already noted, an abundance of crucibles with residues indicating the working of a variety of metals, along with ingots and scraps of lead, tin and copper alloy; some of the non-ferrous objects, moreover, appear part-made (Hall 1984, 58-60). The quantity of material is small compared to that relating to iron production, but non-ferrous metal was doubtless subject to rigorous curation. The preliminary work on chronological and spatial distribution also suggests non-ferrous metalworking on the site, primarily in Period 4B, especially in Tenements C and D, but also in the others and in each of the post and wattle buildings it would presumably have taken place side by side with ironworking.

Leaving the metalworking evidence aside, there is little to add here to the general impression furnished by the ironwork for a range of activities on the site. In the absence of distinctive structures and while systematic study of the other residues is still in progress, it is not possible, for example, to use the ironwork as contributory evidence for any other crafts on the site. The disappearance of metalworking from the site in Period 5B has, however, been noted and a change from a site with a marked industrial character to one with a more of domestic craft base is perhaps suggested by the objects in the probable primary refuse deposit in the backfilled sunken building in Tenement D (Appendix 7).

5.7 The implications of context analysis for the classification of the Coppergate iron objects.

The conclusions of the previous sections may be used to re-examine the classification of artefacts in two ways: firstly, in the ascription of function and secondly, in identification of chronological trends.

5.7.1 Artefact function

The strong contextual evidence for the working of iron may be used to re-evaluate a few of the objects whose function was, on purely analogical grounds, uncertain. It may, for example, be suggested more strongly that the (non-leatherworking) awls and tanged punches (3.24; 3.25) were used in metalworking for decorative work or chasing, and, secondly, that the enigmatic small vessels (3.40) were indeed used as soldering lamps.

There is a danger of a circular argument if the evidence of identification by analogy is used as part of the evidence for the nature of the archaeological context, and then the evidence of the context is used to back up artefact identification. It is clear, however, that the evidence of the certain tools and pieces of bar iron, and of the slag and of the spatial distribution of this material can be used to advance with greater confidence the identification, firstly, of some of the more idiosyncratic objects as bar iron, blanks or scrap and, secondly, of some of the incomplete or broken objects listed in Table 5.2 as discards in the process of recycling for scrap (5.2). It is also possible to suggest that other objects which do not so clearly bear the signs of being deliberately cut up were also scrap items. This would include the remainder of the sword fragments and coin die sf9351, the other having already been identified as a probable scrap item.

In view of the suggestion that the coin dies and other numismatic items may indicate minting on the Coppergate site (Hall 1986, 20-1), some further comment on these important objects and their context may be added at this point. Both the dies came from Period 4B contexts (Fig. 5.8), one found in the Tenement C post and wattle building and the other close to the Tenement D building. The occurrence of these dies on the site is at first sight curious since coinage in the period was under strict royal control. This presumably extended to the disposal of dies, although a counterfeiter would have required both obverse and reverse dies for successful forgeries. It is possible, therefore, that particular care was taken in disposal of the obverse dies, but not the reverses and it must be considered likely, in view of the other evidence for recycling of scrap at the site, that the Coppergate dies formed part of a smith's stock of iron and cannot be connected directly with minting. The quality of the metal used to manufacture the dies may well have rendered them highly prized for the production of knives or other bladed tools such that their loss was a matter of some concern.

5.7.2 Chronological trends at assemblage level

Although the ironwork from 16-22 Coppergate is a very substantial body of material, it is still the case that most artefact classes are quite small and even in ideal conditions would be too small for significant trends in formal variability to be discernable. In view of the fact that the original discard pattern has been heavily disturbed, however, the meaning of chronological distribution, whether of the artefact classes or their sub-divisions, must be treated with extra caution.

At the class level little significant patterning is apparent; most of the principal object classes occur in similar proportions in the main period assemblages (Appendix 1; Table 5.1; Table 5.25). The only notable exception are the nails which form c.70% of the Period 3 assemblage as opposed to c.37% and 38% in Periods 4B and 5B respectively . This is, as I have suggested, likely to be due to a large residual Roman component in Period 3 contexts. Once the nails are removed from the data it can be seen that the percentages of the different categories objects in Period 3 compare closely with

Periods 4B and 5B (Table 5.25), although there is a rise of the percentage of tools from Period 3 to 4B which may relate to the arrival of craft workshops on the site itself.

The Coppergate data only provides good evidence for the introduction of one class of artefact during the Anglo- Scandinavian era, the horseshoe (3.79). The 6 examples are from Period 5B or 5C contexts and of the horseshoe nails, only eight out of 48 occurred in pre-Period 5B contexts; this distribution pattern is very different from that of other large classes of iron object whose numbers peak in Periods 4B and 5B.

Table 5.25 Summary of the occurrence and chronological distribution of objects from 16-22 Coppergate excluding nails expressed as percentages of Period assemblages (over 10 objects required to qualify for entry, otherwise : na)

Abbreviations: Bar = bar iron, blanks and scrap
Tls = Tools of trades and crafts and other implements
WCT = Wool comb teeth
Knvs = Knives
Struc = Structural ironwork and fittings
Df = Dress fittings and riding equipment
Hrse = Horse equipment
Weap = Weapons

Period	Bar	Tls	WCT	Knvs	Struc	Df	Hrse	Weap
3	34.5	11	5	11.5	28	6	na	na
4A	30.5	23	na	6	19.5	10	na	na
4B	29	20.5	5	9.5	24	9	1.5	1.5
5A	33	17.5	7.5	6.5	26	9	na	na
5B	22	14	12.5	11	31.5	4	3	2
4-5	na	na	na	na	31.5	na	na	na
5CF	na	na	na	na	na	na	na	na
5CR	26.5	15.5	12	na	21	na	17	na
All	28	16.5	8	10	26.5	7	3	1

Within classes evidence for developments through time is scarce. There is a possible exception in the case of needles, however, which exhibit a trend towards the predominance of the punched eye as opposed to the Y-eyed form (3.19). In Periods 3 and 4A the head forms occur in a ratio of c.1:1, in Period 4B the ratio is 1.5:1 and in Period 5B c.4:1. Among the 40 or so medieval needles from the site the punched eye is almost universal.

5.7.3 Chronological trends: knives

The most complex pattern of development through time, appears, as might be expected, among the knives which are not only a numerous class but also exhibit considerable formal variability (3.30). Chronological trends in two respects may be noted (Tables 5.26 - 5.27).

The chronological distribution of blade back form (3.30.2) is summed up in Table 5.26. This shows that the principal forms occur in roughly the same proportions in the main periods except for back form A which is, in relative terms, slightly more common in Periods 3 and 4A than in other periods. Thirteen of back form A blades (36%) come from Periods 3 and 4A and in those periods they make up 34% of all the knives whose back forms can

Table 5.26 Chronological distribution of knives by back form

Period	A1	A2	A3	Ai	B	C1	C2	C3	Ci	D	E	I	Total
3	1	10	-	-	-	8	3	3	1	5	-	10	41
4A	-	2	-	-	1	-	-	3	-	-	-	1	7
4B	1	4	1	-	1	15	6	10	4	14	-	14	70
5A	-	-	-	-	-	3	-	4	-	2	-	5	14
5B	2	6	-	2	-	11	1	8	7	14	1	11	63
4-5	-	1	-	-	-	1	-	1	-	1	-	-	4
5CF	-	-	-	-	-	-	-	1	1	-	-	-	2
5CR	-	1	-	-	-	3	-	-	1	3	-	-	8
WB	-	1	-	-	-	1	-	-	1	-	-	-	3
US	1	-	-	1	-	1	-	-	-	3	-	-	6
Total	5	25	1	3	2	43	10	30	15	42	1	41	218

be determined, whereas in Period 4B they make up 11% and Period 5B 20%. Since the Period 3 assemblage is suggested as more representative of its date than the others because there is no residual Anglo-Scandinavian material in it and little Roman apart from nails (5.5), this trend, although slight, may indicate some real formal development through time (see 6.3.30.7 for confirmation from other sites).

The occurrence of blade surface features (3.30.6) is shown in Table 5.27. No strong trends appear and total number of examples in the major period groups are more or less similar as a proportion of knives in each group. There is, however, a lack of features A-E which modify the triangular knife blade cross-section among Period 3 knives and, again, this may be of some real significance.

Table 5.27 Chronological distribution of knife blade surface features

Key:
A: Blade faces run vertically downwards before converging on the cutting edge.
B: As A, but one face.
C: Blade faces slope outwards slightly before converging on the cutting edge.
D: As C, but one face
E: Blade faces concave before converging on cutting edge.
F: As E, but one face.
G: Chamfered back edges.
H: As G, but one edge.
J: Blade back triangular in cross-section.
K: Grooves cut into blade faces.
L: As K, but one face.
M: Notches cut into blade back.
N: Relief panels in blade back.

Feature	3	4A	4B	5A	5B	4-5	5CF	5CR	WB	US	Total
A	-	-	7	1	2	-	-	-	-	-	10
B	-	-	3	-	1	-	-	-	-	-	4
C	-	-	2	-	-	-	-	-	-	-	2
D	-	-	1	-	-	-	-	-	-	-	1
E	-	2	2	2	2	-	-	-	1	-	9
F	1	-	1	-	-	-	-	-	-	-	2
G	5	-	2	-	1	1	-	-	-	-	9
H	-	-	1	-	-	-	-	-	-	-	1
J	-	1	3	-	5	-	-	1	-	-	10
K	6	-	2	-	4	-	-	3	1	1	17
L	2	-	-	-	1	-	-	-	-	-	3
M	1	-	5	-	3	-	-	-	1	-	10
N	-	-	-	1	-	-	-	-	-	-	1
Total	15	3	29	3	19	1	1	4	3	1	79

Of greater interest, perhaps, are the trends in metallography. Table 5.28 shows how principal blade macro-structure forms (Fig.3.13; 3.30.8) were distributed on a chronological basis.

Table 5.28 Chronological distribution of knife blade macro-structure. (Totals including non-tanged knives in brackets)

	Form 0	1	2	3	4	Total
Period						
3	-	1	6 (8)	-	1	8 (10)
4A	-	1	2	-	-	3
4B	2	6	4	2	2	16
5A	-	2	-	-	-	2
5B	1	6	1 (2)	-	-	8 (9)
4-5	-	1	1	-	-	2
5CR	1	2	-	1	-	4
WB	-	1	-	-	-	1
Total	4	20	14 (17)	3	3	44 (47)

Although it is necessary to allow for the problem of residuality and the small size of the sample, two possible trends may be detected in these data: 1) the butt- or scarf-welded technique (form 2) was relatively dominant in Periods 3 and 4A compared to subsequent periods; 2) from Period 4B onwards the steel core (form 1) becomes the most common blade macro-structure. This trend acquires some further confirmation from the examination of five medieval knives from the site of which three were form 1 (see 6.3.30.7 for further evidence for these trends in material from other sites).

5.7.4 Chronological Trends: Formal Features

When the occurrence of formal features which cut across functional classes are considered, the most striking chronological trends are in the distribution of

Table 5.29 Chronological distribution of objects with relief work (excluding knives and arrowheads; see Appendix 5 for details)

Period	Nos.	% of total
3	15	15
4A	6	6
4B	46	46
5A	7	7
5B	17	17
4-5	3	3
5CF	1	1
5CR	2	2
US	3	3
Total	100	

Table 5.30 Chronological distribution of plated objects (tinned objects in brackets; see Appendix 6 for details)

Period	Nos.		% of total	
3	14	(12)	8	(8)
4A	6	(6)	3	(4)
4B	73	(67)	42.5	(44.5)
5A	22	(18)	13	(12)
5B	38	(28)	22	(18.5)
4-5	3	(1)	2	(0.5)
5CF	1	(1)	0.5	(0.5)
5CR	10	(9)	5.5	(6)
US	6	(6)	3.5	(4)
Total	171	(150)		

objects with relief work and non-ferrous plating. As Tables 5.29 - 5.30 show, a substantially higher proportion of these objects occurs in Period 4B than in the other periods. I suggest that these patterns may be related to a growing use of the techniques of relief work and plating during the 10th century in general, but also, more specifically, to the presence of workshops manufacturing small dress fittings and other objects with surface treatment and plating on the site in Period 4B.

5.7.5 Chronological Trends: Conclusion

The reasons why the evidence for chronological trends is so slight are not entirely clear, but it may be that redeposition has led to some homogenisation of the period assemblages. Alternatively the character of occupation may not have varied greatly in and around the site through the Anglo-Scandinavian era. At the level of individual object classes, while it must be stressed that recognising trends amongst relatively small groups of objects is difficult, it is also possible that the pace of change in the formal development of iron objects was slow. A survey of the comparative material from other sites of the period is now required to examine these problems in more detail.

CHAPTER 6

THE COPPERGATE IRONWORK IN ITS ENGLISH AND NORTH EUROPEAN CONTEXT

Note: see Appendix 3 for gazetteer

6.1 Introduction

For a full understanding of the character and development of the smiths' practice at 16-22 Coppergate and in 9th-11th century York generally, it is necessary to set it in the context of material from sites of similar date in either adjacent geographical areas or areas with which some cultural interaction can be documented, principally Scandinavia.

I have kept the comparison exercise focussed on 16-22 Coppergate and not usually entered into any extensive discussion of objects of which few or no examples were present on the site. I have tried to make a fairly comprehensive survey of well-provenanced material from England but have been more selective with regard to other countries. Although I have, for the most part, restricted myself to published comparanda, I have also considered some assemblages which are as yet unpublished including those from Flaxengate, Lincoln (City of Lincoln Unit), Repton (excavated by M.Biddle), Ailcy Hill, Ripon (Y.A.T.), Southampton (Southampton City Museums), Thetford (Goodall and Ottaway forthcoming), Thwing (excavated by T. Manby) and Wicken

Bonhunt (excavated by English Heritage).

It is, perhaps, unfortunate that I have not been able to handle every object referred to in this Chapter; studying from a publication can never be a substitute. Matters are made worse, however, because the standard of publication of ironwork is very variable and in many cases falls short of what is required for all but the most basic comparative analysis.

Comparing objects from one site with those from another once more raises the eternal classificatory problems of measuring, and assessing the significance of perceived similarities and differences. The validity of interpretation is also affected by the numbers of relevant objects in the sample of comparative material, their geographical distribution and the nature of the contexts from which they come. The total quantity of ironwork of the 9th-11th centuries, especially from well-dated contexts, is, moreover, relatively small compared, for example, with numbers from Roman or medieval contexts, and some artefact classes have few members.

The geographical distribution of sites producing ironwork in any quantity is uneven. As far as England is concerned, the majority are in the eastern counties. In terms of context the principal division is between occupation sites, cemeteries and chance finds which are usually assigned to the period on the basis of formal affinities or association with more closely datable objects. Aside from chance finds, the English material comes primarily from occupation sites and the Scandinavian from cemeteries. This immediately introduces a problematic element into detailed comparisons across the North Sea since the Scandinavian material may include objects specifically made for burial.

I have presented the comparative material in three parts: 1) at the assemblage level (6.2); 2) at the class level (6.3); 3) in respect of formal features which cut across functional classes and have not otherwise been referred to (6.4). The second part is the largest since, at present, it is from comparisons at the class level that the most useful interpretative conclusions may be drawn on the development of the smiths' practice and its cultural significance.

6.2 Comparison at Assemblage Level

In 5.1 I noted that comparison between artefact assemblages from sites occupied for a very brief period where there has been little subsequent disturbance may have some interpretative value. 16-22 Coppergate and the majority of sites with which it may be compared, however, were occupied for relatively long periods during which disturbance and redeposition were continual. In 5.2 I also suggested that the components of an archaeological artefact assemblage in terms of the classes present and their absolute and relative numbers will be influenced by both the nature of the activities on the site and by the curation and discard practices adopted by the people using them. Although these factors render comparisons at the assemblage level between Coppergate and other sites difficult to interpret in terms of site functions or other cultural variables, such comparisons, nevertheless, may emphasise certain distinctive features of the York material.

In Tables 6.1 and 6.2 I have summarised the assemblages from 16-22 Coppergate and some other occupation sites in England which have produced appreciable numbers of iron objects. Thetford is, at present, the only other urban site with which a useful comparison may be made. Thetford 1 is the material published by Ian Goodall in 1984 which comes from urban sites excavated to variable standards in the 1940s and 50s where recovery, particularly of small objects, was probably uneven. Thetford 2 refers to the assemblage from a large urban site and several smaller sites excavated in the 1960s (Goodall and Ottaway forthcoming); it derives largely from pits as the horizontal strata were largely removed mechanically. Both the Thetford assemblages contain material which is probably immediately post- conquest. Goltho (Goodall

1987) and Wicken Bonhunt are rural occupation sites, the former is primarily 10th- 11th century, the latter 8th-9th century.

I have divided up the assemblages into the groups of object classes established in Chapter 3. Knives have, however, been listed separately from tools as they are sufficiently numerous to form a significant part of each assemblage. Wool comb teeth have also been listed separately from tools since, as parts of composite object, they cannot be counted as tools in their own right.

Even employing these broadly defined groups it must be admitted that the numbers in the comparative assemblages are in many cases still too small for satisfactory inter-site analysis. It will be apparent, however, that all five assemblages are quite similar except in respect of bar iron, blanks and scrap which form such a large proportion of the Coppergate assemblage because the existence of the smithing industry on and near the site. The relatively high percentage of tools from Coppergate may be related to the intensity of craft activity on the site, but can also be accounted for by the discard of fragments of

Table 6.1 Numbers of objects from occupation sites of comparable date to 16-22 Coppergate.

Abbreviations: Bar = Bar iron, blanks and scrap
Tls = Tools of trades and crafts and other implements
WCT = Wool comb teeth
Knvs = Knives
Struc = Structural ironwork and fittings including objects for heating and lighting
Df = Dress fittings and riding equipment
Hrse = Horse equipment
Weap = Weapons

Site	Bar	Tls	WCT	Knvs	Struc	Nails	Df	Hrse	Weap	Total
Thetford 1	11	54	117	93	113	-	28	34	10	460
Thetford 2	12	11	31	14	20	64	4	6	1	163
Goltho Manor	2	17	17	24	27	-	5	5	2	99
Wicken Bonhunt	34	14	5	20	43	23	3	2	2	146
16-22 Coppergate	667	395	185	232	628	2178	166	66	40	4557

Table 6.2 Percentage of objects from sites comparable to 16-22 Coppergate, excluding bar iron, blanks and scrap, and nails

Site	Tls	WCT	Knvs	Struc	Df	Hrse	Weap
Thetford 1	12	26	21	25	6	8	2
Thetford 2	12	31	14	20	4	6	1
Goltho Manor	17.5	17.5	25	28	5	5	2
Wicken Bonhunt	16	5	25	48	3	2	0
16-22 Coppergate	23	11	13.5	36.5	9.5	4	2.5

tools during breaking up for recycling by smiths. Nails were, unfortunately, not recorded in the Thetford 1 or Goltho publications, but the relatively high proportion of nails from 16-22 Coppergate compared with Thetford 2 and Wicken Bonhunt may be partly due to the presence of Roman residual material in Coppergate Period 3 (5.5).

On the basis of this very limited exercise I suggest that comparative patterning in the contents of ironwork assemblages from occupation sites may, on the one hand, be difficult to interpret as indicating other than a non-specific range of craft and domestic activities. On the other hand, the comparison of Coppergate with the other four shows that the presence of distinct site functions, in this case iron working, can on occasions be detected. Only further work can reveal whether other distinct activity-related or site type-related assemblage profiles can be identified on stratified sites of the Anglo-Saxon period.

Assemblages from occupation contexts are easily distinguished from those from non-occupation contexts, such as burials or other hoards, since large, often complete objects, especially tools and weapons, will usually predominate. This is immediately apparent, and needs no detailed quantification, when the Coppergate assemblage is, for example, compared with that from

Birka (Arbman 1940).

6.3 Comparison at Class Level

6.3.1 Bar iron, blanks and scrap

Although bar iron, blanks, scrap iron and part-made objects have been found on other sites, the quantity and variety from 16-22 Coppergate cannot be paralleled on any post-Roman site in Britain. To some extent this may be because the material has not been recognised, but it must be largely because iron smithing sites have only rarely been excavated. This is also true of the rest of northern Europe and the only large body of comparable material is formed by the so-called "rod-shaped blanks" from the 6th-7th century workshop site at Helgö (Hallinder and Tomtlund 1978).

Bars, strips and plates comparable to those from 16-22 Coppergate have only been found in small numbers on sites of Anglo-Saxon date in England. The middle Anglo-Saxon site at Ramsbury, which has been primarily associated with iron smelting, produced six possible pieces of bar iron (Haslam 1980, 38-9, fig.23, 30-5). Portchester Castle is a late Anglo-Saxon site which has produced bar iron (Hinton and Welch 1976, 200, 205, fig.134, 28-37; fig.135, 38-43) and Thetford has produced some substantial blanks (I.Goodall 1984, 77, fig.115, 1-3; Ottaway and Goodall forthcoming, sf191).

The last of these is a strip 345mm long, 10mm wide and 5mm thick, making it comparable to the longer Coppergate strips. Finally, in England, the Crayke hoard, thought to be Anglo- Scandinavian, produced a number of pieces of bar and scrap iron (Sheppard 1939, 279-281).

In the Mästermyr hoard, there were, in addition to the two currency bars, a number of other pieces of iron comparable to the bars and larger strips from Coppergate and some smaller fragments (Arwidsson and Berg 1983, 18-19, pls.25, 30). Of particular interest is a block of several strips lightly forged together. This object, like 1624 from Coppergate, may have been awaiting forging into a homogeneous piece.

Other 9th-10th century sites in Scandinavia to produce smiths' raw material include the 10th century Danish fortress sites at Aggersborg and Fyrkat. At Aggersborg pieces of bar iron and ironworking residues were found (Roesdahl 1986, 76, fig.31). At Fyrkat it was possible to identify buildings probably used as smithies on the basis of slag, but only three probable blanks were apparently found (Roesdahl 1977, fig.71, a-c).

TOOLS of TRADES and CRAFTS

Metalworking Tools

6.3.2 Anvil

No anvils are known from 9th-11th century archaeological contexts in Britain, but a number of Viking Age examples have been found in Scandinavia. There are various forms recorded including the L-shaped, or beaked, anvil and one is illustrated by Petersen (1951, fig.17). There is also one from the Mästermyr tool chest (Arwidsson and Berg 1983, 15, 30, pl.21, 75) whose working arm has a rounded cross-section, but another rather more like 2200 comes from a grave at Grønneberg, Norway (Müller- Wille 1977a, fig.8). A small anvil from a Norwegian Viking Age grave with a convex working face, but also a transverse groove, or swage, running across it, comparable to those on 2200, is illustrated by Rygh (1885, no.392).

6.3.3 Hammer heads

I know of only three smithing hammer heads of 9th-11th century date from Britain which are comparable to 2201. One comes from Thetford and weighs 650g (I.Goodall 1984, 77, fig.115, 4) and another was found in the Knoc-y-Doonee ship burial (Kermode 1930a, 245; 1930b), but they are both slightly different in form to 2201 in that the surfaces of the arms opposite that from which the handle projects are slightly concave. The other, from Goltho (Goodall 1987, 178, fig. 156, 1), is more similar in form to, but rather smaller than, 2201.

Smiths' hammers are commoner in Scandinavia.

Petersen (1951, 513) refers to 253 hammers from Viking Age Norway, although this collection evidently includes examples of many forms and sizes. One of his illustrations, however, closely resembles 2201 (ibid., fig. 60). Five more smiths' hammer heads from Viking Age Norwegian graves are illustrated by Müller-Wille (1977a, Abb.9, 9-13). The Mästermyr hoard includes six hammer heads, three of which are "hand hammers" (Arwidsson and Berg 1983, 14, 30, pl.20, 65; pl.21, 66-7). One of them (no.65) weighs 724gm and is very much like 2201, although rather more elongated.

Although there are no known hammer heads directly comparable in form to 2203 with its arm of rounded-cross-section, a small hammer head similar to it and to 2202 comes from Kilmainham, Dublin (Bøe 1940, 47, fig.27) and others come from 9th-11th century contexts in Scandinavia. They have, for example, been found at Birka (Arbman 1940, Taf.185, 1), Hedeby (Jankuhn 1943, 125-7, Abb.58) and Trelleborg (Nørlund 1948, pl.46, 8-9).

6.3.4 Punches

There are few smiths' punches of comparable date to those from 16-22 Coppergate but I know of three simple tapering examples of 8th-9th century date from Six Dials, Hamwic where metalworking clearly took place (Youngs and Clark 1982, 184); sf1876 is complete and

93mm long, and sf237 and sf1112 are slightly shorter although incomplete. I know of no securely stratified examples from Britain of later 9th-11th century date except for an example from Crayke, North Yorkshire (Sheppard 1939, 280).

Large smith's punches are, however, known in graves in Norway at, for example, Elgsnes (Simonsen 1953, fig.3, D), and at Morgedal (Blindheim 1962, 34, fig.11, O). The latter has a rectangular cross-section and a simple tapering shaft. A punch of rounded cross-section closely comparable in size and form to 2220 from 16-22 Coppergate comes from a 10th century context at Århus (Andersen et al. 1971, 117, ABL).

The smaller punches from 16-22 Coppergate, such as 2218-9, are apparently without close parallels.

Finally, it is apparent from the impressions on other objects, both of iron and other metal, that many different forms of punch tip existed which have not survived among archaeological finds.

6.3.5 Chisel

The only other chisels of 9th-11th century date from England are three from Thetford (I.Goodall 1984, 77, fig.115, 5-6; Goodall and Ottaway forthcoming sf336). Two of them (1984, 6 and sf336) are, however, 20-30mm longer than 2245 and the other (1984, 5) is c.30mm shorter. Chisels are also scarce in Scandinavia although an example similar in form and size to 2245 comes from Birka (Arbman 1940, Taf.185, 13).

6.3.6 Files

The importance of files to the Viking Age craftsman is demonstrated by their frequent inclusion in smiths' graves (Blindheim 1962, 33-4, fig.11, S-T; Petersen 1951, 513; Müller-Wille 1977a, 156, 173). A file with fine teeth was also found in the Danish Tjele hoard (Munksgaard 1984, fig.1) and there are six files (two of which are described as 'rasps' apparently because of having crank-shaped tangs) in the Mästermyr hoard (Arwidsson and Berg 1983, pl.22, 32-4, pl.23, 35, 37-8). Two of the files (nos. 32 and 33) and one of the rasps (no. 38) have, in addition to blades of similar thickness to 2246, fine teeth similarly spaced. Another file (no. 35) has a blade somewhat similar to 2248 with widely spaced teeth (five per cm), although the tang is much longer. Finally, there is a file or rasp from Birka (Arbman 1940, Taf.185, 4) which has teeth at roughly the same intervals as 2247.

6.3.7 Clippers

There are a number of comparable clippers from Viking Age contexts in Scandinavia, although they are all slightly longer than 2249 and their handles usually curve in the same direction rather than towards each other. One distinctive way in which these objects vary is in the ratio of blade length to handle length. Those with blades which are relatively shorter than those of 2249 include pairs from Hedeby (Jankuhn 1943, 127, Abb. 59) and from the Mästermyr hoard (Arwidsson and Berg 1983, pl. 22, 45), while those with blades relatively longer than those of 229 include pairs from the Morgedal burial (Blindheim 1962, 34, fig.11, U), from a burial at Romfjöghellen, Norway (Müller-Wille 1977a, fig.11, 10), one handle of which has, like 2249, a looped terminal, and from Tjele (ibid. 184, fig.23; Roesdahl 1982, 106, fig. 27, P; Munksgaard, 1984, fig.1). These clippers appear to be confined to Viking Age or comparable contexts and none in any way similar to 2249 is known from medieval contexts.

6.3.8 Mould

I know of no comparable objects.

6.3.9 Coin Dies

I know of no comparable objects from the 9th-11th centuries.

Woodworking Tools

6.3.10 Axes

Axes with blades of comparable form and size to 2253 appear to be relatively common in 9th-11th century contexts, especially in Scandinavia. There is another axe from a site in Coppergate York, however, which is very similar to 2253, if slightly smaller; and with pointed projections on either side of the socket along the line of the handle (Waterman 1959, 72, fig.5, 8). Scandinavian axes of the period which resemble 2253 include three from Birka (Arbman 1940, Taf.14, 2, 5-6), and two from Trelleborg (Nørlund 1948, pl.39, 2-3)

6.3.11 Wedge

2257 appears to be virtually without parallels but there is a rather smaller wedge from a late 8th-9th century context at Thwing (1985, sf244).

6.3.12 Socketed chisel

As I have noted in 3.12 above, a number of objects which are akin in form and size to 2258 are known from 9th-11th century contexts, although their function is not always certain. The most closely comparable is from Skerne (unpublished), but also similar are objects from Elgsnes (Simonsen 1953, 115, fig.3, B) and Hedeby (Jankuhn 1943, 123, Abb.50) which, like 2258, both appear to have curved rather than straight blades.

6.3.13 Shave

There are few shaves comparable to 2259 from the 9th-11th centuries and they come from Scandinavia. Petersen (1951, 518-9) refers to a group of 23 "plane-irons" from Viking Age Norway; one is illustrated (ibid., fig. 114) but the blade would seem to be at an angle to the tangs whereas the blade of 2259 is at 90 degrees to the tangs. There are two shaves from the Mästermyr hoard, one of which is rather smaller than 2259 with a blade at an angle of c.45 degrees to the tangs (Arwidsson and Berg 1983, 35-6, pl.27, 54); the other (pl.27, 57) also has the blade at an angle, but it is unusual because it is formed to allow the creation of mouldings on timber.

6.3.14 Augers

The blades of 2262-3 and 2265, which are relatively wide with rounded ends, are best paralleled by those on the large augers from Cheddar (Goodall 1979a, fig.90, 14b), Hurbuck, Westley Waterless (Wilson 1968, fig.2) and Skerne. Other comparable, if smaller blades, may be found on augers from 21-3 Aldwark, York (MacGregor 1978, 44-5, fig.26, 8), Thetford (I.Goodall 1984, 77, fig.117, 14, 16) and Trelleborg (Nørlund 1948, pl.46, 14, 16). More elongated blades with rounded ends similar to that of 2264 can be seen on an auger from the Thule site in Lund

(Blomqvist and Mårtensson 1963, 169-70, fig.174) and probably existed on a now incomplete specimen from Thetford (I.Goodall 1984, 77, fig. 117, 15). The more pointed blades on the set of five augers from the Mästermyr tool chest (Arwidsson and Berg 1983, 34-5, pl.28, 46-50) cannot be directly paralleled at Coppergate, but the relatively short pointed blade of 2266 is very similar to that of an auger from Århus (Andersen et al. 1971, 210, ELO).

Shanks and tangs of the augers from other sites are usually very similar to the those from Coppergate, but 2266, which has no distinct shoulder between shank and tang, can be paralleled by an auger from Norway illustrated by Rygh (1885 no.418) and by one of those from Mästermyr (Arwidsson and Berg 1983, pl.28, 50). The size range of the augers from Coppergate and elsewhere is quite wide. One of the longest is from Mästermyr (no.46, 442mm), but three others (nos. 47-9) are more comparable to 2262 (327mm long) from Coppergate. Also similar in length are those from Cheddar, Hurbuck, Skerne and Westley Waterless. Of a similar size to 2264 from Coppergate (210mm long) are augers from Thetford (I.Goodall 1984, fig.117, 14) and the Århus, Lund and Trelleborg examples referred to above. 2268 which is smaller again (140mm long although slightly incomplete) is comparable to the auger from 21-3 Aldwark another of the Thetford examples (I.Goodall

1984, fig.117, 15) and the smallest from Mästermyr (Arwidsson and Berg 1983, pl.28, 50).

6.3.15 Small gouges

I know of no very close parallels for 2269-70.

Textile working tools

6.3.16 Wool Combs

Wool combs of Roman date were made of flat sheets of iron with teeth projecting horizontally from each side (Wild 1970, 25; Ryder 1983, 740). Combs similar to 2273, however, were probably in use in northern Europe by the 7th century and are known from four middle Anglo-Saxon sites of this date in Britain. The earliest are probably a group of three from a woman's grave at Lechlade, Gloucestershire, dated c.650-700 (Miles and Palmer 1986, 17). There is a pair of combs from Wicken Bonhunt (unpublished, sf379a/b) which have two rows of twelve teeth c.90mm long. Another comb comes from the Cakebread Robey site in Canterbury (unpublished, Canterbury Archaeological Trust sf790) which has two rows of teeth 103-104mm long, and an incomplete comb comes from Six Dials, Hamwic (SOU 169, sf1975). Combs of this period are also known in Scandinavia (Hoffman 1964, 258; Petersen 1951, 523-4) and there is a fragment from Dorestad (Van Es and Verwers 1980, 178, fig.130, 3).

Wool combs from the mid-9th to 11th century period come from the Milk Street site, London (excavated by the Museum of London, D.U.A. sf1564) and Harrold, Bedfordshire, where, in a Viking burial, 39 teeth c. 95mm long were found which had apparently been set in a wooden board to a depth of 15mm (Eagles and Evison 1970, 39-42, fig.12, i-k). There were also a few iron spikes and an antler handle thought to be from a linen heckle (although a wool comb is as likely) found at Jarlshof, Shetland (Hamilton 1956, 115-6, fig.57, 8).

Wool combs (or flax heckles) of the Viking Age occur in Scandinavia in some numbers and fifty Norwegian examples were recorded by Petersen (1951, 523-4); one (fig. 171) is illustrated. More recent finds include a comb from Århus (Andersen et al. 1971, 138-9, ELA) and one from Fyrkat (Roesdahl 1977, 28, fig.21) which is rather simpler than the Århus or Coppergate combs in that it consists only of a rectangular iron plate with a single row of teeth set in it.

6.3.17 Wool Comb Teeth

Just as wool combs similar to 2273 are known in 7th -11th century contexts, teeth likely to come from wool combs have also been found on sites of the period.

6.3.18 Needles

Very few iron needles dating from the 9th to 11th centuries have been found except at 16-22 Coppergate. In Britain there are only three sites of the period which have produced examples. There are four from Thetford (I.Goodall 1984, 79, fig. 119, 32; Goodall and Ottaway forthcoming, sf77, sf396, sf435), two of the unpublished group are Y-eyed and the other has a punched eye. There are others from Flaxengate, Lincoln (F76, Fe421) and Goltho (Goodall 1987, 177-8, fig.156, 26), both of which have a punched eye. In Scandinavia one was found at Århus which has a punched eye (Andersen et al. 1971, 221, EJJ) and three, whose head forms cannot be determined, were found at Birka (Arbman 1940, Taf.169, 7-9).

6.3.19 Shears

The surviving bows of the 16-22 Coppergate shears are similar to other 9th-11th century examples from Britain and Scandinavia. Slightly looped bows similar to that of 2689 occur on a pair of shears from Cheddar (Goodall 1979a, 266, fig.90, 198) and Thetford (I.Goodall 1984, 87, fig.126, 107). More pronounced loops similar to those of 2690-1 and 2696 are found on another pair of shears from Pavement, York (Waterman 1959, 104, fig. 25, 6) as well as shears from Thetford

(I.Goodall 1984, 87, fig.126, 108-10), Goltho (Goodall 1987, 181, fig.117, 68-9) and Scandinavia, including those from Trelleborg (Nørlund 1948, pl.49).

The concave, sloping and rectangular shoulders between blade and stem are also common on other shears of the period but there is only one other example of shears with stepped shoulders from a site of comparable date to 16-22 Coppergate. They come from Lagore Crannog (Hencken 1950, fig. 45, C) and have a double step. There is otherwise nothing unusual about the form of the Coppergate blades, except for the bevelled cutting edge of 2696, which can only be paralleled on a pair of shears from Fyrkat (Roesdahl 1977, 97, fig.134).

6.3.20 Tweezers

I know of no close parallel for 2702 with what appears to have been a pierced terminal above the head. A pierced terminal with a small ring set in it can, however, be seen on a small pair of tweezers from Birka (Arbman 1940, Taf.171, 12) which is very similar in size and form of arms to 2703. Another possibility in the case of 2703 is that its head developed into a form of tang which was set in a decorative non-ferrous knop. These knops can, again, be seen on a number of small tweezers from Birka (Arbman 1940, Taf.172, 1a-4a; Taf.173, 3a, 8). Hedeby has also produced a pair of tweezers similar in terms of size and arm form to 2703, although it has a pierced relief terminal at the head (Müller-Wille 1973, 34, Abb.8, 10)

2701 and 2704 which have arms welded together at the head to form what may have been a tang are also hard to parallel, although there is a comparable object, but with L-shaped arms, from Thwing (sf87.163).

6.3.21 Harbick

3410 may be compared with an object from Goltho (Goodall 1987, 178, fig.156, 25), but there are no others known to me from the 9th-11th centuries except, perhaps, for an object from Thetford which has two hooks at either end of a wide central plate (I.Goodall 1984, 79- 80, fig.119, 31).

Leatherworking Tools

6.3.22 Leatherworker's Awls

Awls with arms of diamond-shaped cross-section are rare in the 9th-11th centuries but two were found on the 6-8 Pavement site in York, where it seems leatherworking was being practised (MacGregor 1982, 80, fig.41, 424-5), and two others come from Lund (Blomqvist and Mårtensson 1963, fig.186).

6.3.23 Creasers

The only other creasers of mid 9th-11th century date from Britain known to me were found at Thetford (I.Goodall 1984, 81, fig.120, 41-2); they have a single arm of triangular cross-section.

Other awls and tanged punches

6.3.24 Awls

An awl with arms of rectangular cross-section was found at 6-8 Pavement, York (MacGregor 1982, 80, fig.41, 422); other examples come from Thetford (I.Goodall 1984, 81, fig. 120, 35-40), one of which (no.37) was 140mm long, and from Goltho (Goodall 1987, 178, 27-8).

An awl of Anglo-Scandinavian date with an arm of rounded cross-section was again found at 6-8 Pavement, York (MacGregor 1982, 80, fig.41, 436). Other examples come from Northampton (Goodall 1979b, fig.119, 56, 272-3) and North Elmham (Goodall 1980a, 510, fig. 266, 45). Three awls of 10th century date from Århus have an arm of rounded cross-section (Andersen et al., 1971, 220) but two of them (BCS, EYA) have an elaborate faceted panel between the arms. Two objects with arms of equal length were found at Trelleborg (Nørlund 1948, pl.46, 6- 7), which are relatively large, being 90 and 120mm long, and have one arm of rectangular and one of rounded cross-section separated by a shoulder.

6.3.25 Tanged punches

Tanged punches, i.e objects with tapering arms of unequal length, are relatively uncommon, but there is one from Portchester Castle similar in form and size to 2229 (Hinton and Welch 1976, 197, fig.130, 3). Two objects from Thetford, described as awls (I.Goodall 1984, 81, fig. 120, 34, 40) may also be noted. They appear to have arms of unequal length, and the shorter arm of one (no. 34) is flattened as if to take a handle, while the longer arm has a rounded cross-section. Another specimen of 10th century date, 115mm long, comes from a 10th century context at Århus (Andersen et al. 1971, 220, CGR) and a small punch with its handle surviving was found at Hedeby (Müller-Wille 1973, 26, Abb.2, 10); its working arm has a rectangular cross-section and appears to be squared off.

I also referred to four relatively large objects with arms of equal length as tanged punches. Exact comparanda for them are hard to find although 2232 is very similar to a punch from Thetford (I.Goodall 1984, 77, fig.116, 9).

Agricultural Tools

6.3.26 Spade iron

Few other spade irons have been found in post-Roman contexts earlier than the 12th century. Amongst the earliest is probably a fragmentary example from a middle Anglo-Saxon context at Hamwic, Southampton

(Addyman and Hill 1969, 65, fig. 24, 13). There are two of 10th-11th century date from Thetford (I.Goodall 1984, 81, fig.121, 44-5) which are of a similar width to 2748, but have more of a U-shaped form with the sheathing running some way up the sides of the blade.

6.3.27 Sickle

Insufficient survives of the Coppergate example to allow meaningful comparisons.

6.3.28 Pitchfork prong

There are no pitchforks of the 9th-11th century known to me.

6.3.29 Bells

The manufacture of bells with brazed surfaces has a long history. A Roman specimen was, for example, found at Maiden Castle, Dorset (Wheeler 1943, fig.97, 2). A similar iron bell is also known in an early Anglo-Saxon context at Sutton Courtenay, Berkshire (Leeds 1923, 181, pl.27, fig.2b).

There are quite a number of iron bells of various sizes known from 9th-11th century contexts especially from Ireland (Bourke 1980) and Scandinavia (Petersen 1951, 512, fig.47). Some were clearly riveted along the seams rather than brazed, but there is a large bell from

Repton (sf3812) of possible 9th century date which was made in the same way as 2752-3, from one sheet of iron with its seams bonded with brazing metal. A small iron bell of the period comes from the probable 9th century farm site at Gauber High Pasture, Ribblehead, North Yorkshire (King 1978, 22); it has brazed seams.

6.3.30 Knives

6.3.30.1 Introduction

For the other classes of object considered in this Chapter there are usually relatively few comparative objects from other sites, but knives from middle and late Anglo-Saxon (or equivalent period) sites are numerous and offer an opportunity to set the 16-22 Coppergate material in context in a more detailed manner. I will first consider the subject in terms of the individual formal attributes identified in 3.30.2 - 3.30.5, and then look at the pattern of variability in the Coppergate assemblage as a whole in comparison with that in other assemblages of the 8th-11th centuries.

6.3.30.2 Blade back forms

The earliest examples of blade back form A occur in the 7th centuries as, for example, on knives from graves at Winnall (Meaney and Hawkes 1970, fig.10, 2) and Polhill (Hawkes 1973, 210, fig.57, 572; 212, fig.58, 592, 598) or on occupation sites such as Yeavering (Hope-Taylor 1977, 187, fig.88, 7). Numerous examples of the form, particularly form A2 where the rear part of the back rises, occur in 8th-9th century contexts at Hamwic where they form nearly half the knives in the sample of 70 I have examined (see 6.3.30.7 below).

Both form A1 and A2 continue to be common in the mid 9th-11th centuries. Form A1, where the rear part of the back is horizontal, occurs on weapons such as that from Battersea, London (Wilson 1964a, 144-6, pl.22, 36), and on smaller knives including specimens from North Elmham (Goodall 1980a, 510, fig.265, 19) and Thetford (I.Goodall 1984, 81, fig. 123, 56). The form is scarce in Scandinavia, but known at Trelleborg (Nørlund 1948, pl. 28, 16) and Fyrkat (Roesdahl 1977, 82, fig.98). Examples of form A2 include the Honey Lane (London) and Sittingbourne saxes (Wilson 1964a, 150-1, pl. 24, 43; 172-3 pl. 30, 80) and knives from sites such as Little Paxton (Addyman 1969, 86, fig. 16, 2-3), Cheddar (Goodall 1979a, 264-5, fig.90, 18, 31), Northampton (Goodall 1979b, 288, fig.118, 36) and North Elmham (Goodall 1980a, 510, fig. 265, 21). Scandinavian examples are again scarce, but there are two from Århus (Andersen et al. 1971, 158-9, AAM, CUM). After the mid-11th century the form appears to be only rarely used.

The variation in overall length and length of blade of back form A knives at Coppergate is comparable to that of similar knives of the period elsewhere. The vast majority of 9th-11th century angle-back blades appear to belong to small domestic or craft knives, and other examples as long as 2756, 2799 and 2809 from Coppergate are rare.

Blades with backs similar to 2810, where the angle is very small and the rear part of the back is slightly downward sloping, are not common but a middle Anglo-Saxon example comes from Maxey (Addyman 1964, 60, fig.16, 1, 3) and an 11th century example from Flaxengate, Lincoln (F75, Fe 2168).

Blades with back form B, where the front part is markedly concave, are also rare. I know of only one of similar size to 2811; it is of 10th century date and comes from Flaxengate, Lincoln (F75, Fe 2494). The only examples of small knives comparable to 2800 with form B that I know of come from Hamwic, Six Dials (sf 1975) and Thetford (I.Goodall 1984, fig. 125, 103; Goodall and Ottaway forthcoming, sf13).

Back form C1 can be found on knives of the early Anglo-Saxon period at, for example, Shakenoak Farm (Brown 1972, 86, fig. 36, 145-6; fig. 37, 150; fig. 38, 158, 160) and middle Anglo-Saxon period at, for example, Wicken Bonhunt (sf28-9, sf350). Mid 9th-11th century examples include two large knives, c.165 and 195mm long, from Portchester Castle (Hinton and Welch 1976, 200, fig.133, 22, 24) and others from Little Paxton (Addyman 1969, 86, fig.16, 1) and Thetford (I.Goodall 1984, 81, figs. 123- 4).

I have only been able to identify other blades with form C2 at Hamwic.

Knives with back form C3 which are, like the Coppergate examples, also relatively slim, curve only slightly at the front and often have tangs about twice the length of the blade, are common on other sites of the 9th-11th centuries. Good examples have been found at Thetford (I.Goodall 1984, fig.124, 87; fig.125, 97), Flaxengate, Lincoln (Fe 2205, Fe2562), and in Scandinavia at Birka (Arbman 1940, Taf.181, 4) and Trelleborg (Nørlund 1948, pl.27, 2-4).

There are also many examples of knives with convex backs (form D) from mid 9th-11th century contexts from sites in northern Europe other than 16-22 Coppergate.

Although there were no examples from Coppergate, I have identified a blade form in a late Anglo-Saxon context at Wicken Bonhunt (sf283) where the rear part of the back is convex before it slopes straight down to the tip. I refer to this as blade back form F.

6.3.30.3 Cutting edges

As I noted in 3.30.3, classifying cutting edge form is difficult to do accurately, but edges which are straight from choil to tip or which only curve up slightly at the tip (forms e-f) presumably indicate little wear whereas edges which have an elongated S-shape (forms c-d) have presumably been subject to heavier wear and sharpening. The S-shape is a very common feature of knives of the mid-9th-11th centuries from other sites in northern Europe and, as suggested in 3.30.8, it may be related to the extensive use of the sandwich technique of blade construction which allows a greater degree of sharpening than the butt-welded technique.

6.3.30.4 Blade surface features

In 3.30.4 blade surface features were divided into two basic groups: those which modify the usual triangular blade cross-section form; and those which were cut into the blades. Except for the grooves on the blade faces these features have, however, rarely been found on knives from other sites.

I know of only one other example of a blade whose faces run vertically downwards before sloping inwards to the cutting edge; it comes from Fyrkat (Roesdahl 1977, 82, fig. 98). I also know of only two other blades of 9th-11th century date whose faces are concave below the back. They come from Wicken Bonhunt (sf287) and

Flaxengate, Lincoln (F74, Fe232).

An example of the chamfering of the back which may be set beside the nine from Coppergate comes from the nearby ABC Cinema site in York on a blade of form A1 (1987.21 sf856). Another comes from a 10th-11th century context at Flaxengate, Lincoln (F75, Fe1795); it has an angle-back.

The linear grooves cut into blade faces have been frequently recorded on knives from other sites. Good examples of early and middle Anglo-Saxon date come from Shakenoak Farm (Brown 1972, 86, fig.65, 146), Polhill (Hawkes 1973, fig.58, 585) and Wicken Bonhunt (sf28, 33, 346, 348) Blades of mid 9th-11th century date with grooves include another large angle-back blade from York (Waterman 1959, 73, fig. 7, 1) and other large knives from Portchester (Hinton and Welch 1976, 200, fig.133, 23-5).

The inlay of blades is primarily late Anglo-Saxon period and its occurrence is summarised in Table 6.3. This shows the practice is known in the middle Anglo-Saxon period, but it is not until the mid 9th-11th centuries that elaborate patterns appear. All of the knives and saxes listed in Table 6.3 have back form A blades apart from the Northolt sax (C1) and the knife from Sussex Street, Winchester which is incomplete. Finally, it may be noted that medieval contexts at 16-22

Coppergate have also produced a small pivoting knife (sf5054; Cat. Fig.20) which has two inlaid grooves on each face which may well be Anglo-Scandinavian in origin.

Table 6.3 Middle and late Anglo-Saxon inlaid knife and sax blades from England

* = sax

Site and Reference	Description
Middle Anglo-Saxon	
Hamwic:	
St. Mary's Street SOU99.153	Groove on each face with twisted Cu wire
Six Dials SOU169.266	Grooves on each face with herringbone twisted Cu? wire
Six Dials SOU169.	Two grooves on each face with herringbone twisted ?Cu wire
Northolt Manor * (Evison 1961)	Area near rear of blade with zigzag pattern inlaid with ?Cu
Late Anglo-Saxon	
Cambridgeshire: (Lethbridge and O'Reilly 1932)	
No.1 *	Two grooves and a triangle at the angle (on each face?) with twisted wire
No.2 *	Two grooves and a triangle (on each face?) at the angle inlaid with
Canterbury:	
St.Augustine's Abbey (Saunders 1978, fig.11, 13)	Groove on one(?) face with plaited silver inlay
Cheddar (Goodall 1979a, fig.90, 31	Three grooves on each face with Cu S-twisted wire
Hurbuck * (Wilson 1964a, pl.19, 22)	One face has groove with twisted Cu and Ae wire
Keen Edge Ferry * (Evison 1964)	Two grooves on each face inlaid with twisted copper wire

Table 6.3 continued

Site and Reference	Description
London:	
Honey Lane * (Wilson 1964a, pl.24, 43	One face: 3 grooves with alternating Ae and Cu wire in herringbone, grooves merge into inlaid triangle at angle. Other face: one groove inlaid with Cu wire, at angle crossed by inlaid nick.
Peninsular House (Museum of London D.U.A. sf82)	Groove on each face with twisted Cu wire
Thames at Battersea * (Wilson 1964a, pl.22, 36)	On each face three grooves with twisted Ae and Cu or Ae and Ag wire herringbone, one face an inlaid inscription; on other inlad lozenges. Back has 9 notches with Ae and Ag wire.
Thames * (Wilson 1964a, pl.26, 50)	On each face 3 grooves with twisted Cu and Brass in herringbone
Thames at Putney (Clark 1980)	On each face Cu-alloy and Ag herringbone wire + pendant loops; + inscriptions
Thames (Museum of London A27086, Tylecote and Gilmour 1986, 135-7)	3 grooves inlaid with twisted Cu and Ae? wire and joined by inlaid groove near angle.
Sittingbourne * (Wilson 1964, pl.30, 80)	Inlaid panels of Ag, and Cu and lengths of twisted Ag and Ae wire forming chequered pattern and herringbone; pendant triangles; inscriptions.
Wicken Bonhunt sf286 (Musty et al. 1973)	Rectangular and trapezoidal panels inlaid with Cu and Ae, grooves inlaid with twisted wire; pendant triangles.
Winchester:	
Cathedral Green (Biddle forthcoming, 2654)	Groove on each face with twisted Cu and Ag wire; one face inlaid triangle, other has inlaid pendant semi-circles
Abbey View Gardens (AVG sf1084)	Each face 2 grooves with twisted non-ferrous metal
Sussex Street (SXS 79 Sf800)	Wide central groove inlaid with Cu? and Ae, flanked by thinner grooves with twisted wire
York:	
16-22 Coppergate, 2809	Groove on each face inlaid with Cu wire

The transverse notches cut into the backs of blades are hard to parallel, but there are two at the shoulder of the Sittingbourne sax and nine groups of inlaid notches along the back of the Battersea sax (Wilson 1964a, 144-6, pl.22, 36). One of the large knives from Portchester (Hinton and Welch 1976, 200, fig.133, 24) has one at the shoulder. The only examples of notches on smaller blades that I know of come from Thetford, on a knife of back form C1, which has two at the point where the back begins to curve down (Goodall and Ottaway forthcoming, sf817), Lincoln, on a knife of back form A from Flaxengate, which has three (F75, Fe1834), and from Repton, which has nine at intervals along the back (sf1843).

6.3.30.5 Tangs and handles

Handles are rarely preserved or recorded on knives from other sites of the middle or late Anglo-Saxon periods, although wooden handles are known on a knife from Hungate, York (Richardson 1959, 83, fig.18, 8) and on other knives from York (Waterman 1959, 73, fig.7, 8-9). Bone handles also occur on knives from York (ibid., fig.7, 10-12). Thetford has produced four knives with wooden handles (I.Goodall 1984, 81, fig.123, 67; fig.124, 76, 83; fig.125, 96) and one with a horn handle (Goodall and Ottaway forthcoming, sf474). I know of no inlaid handles comparable to 2812, but knives with non-ferrous wire bindings come from graves at Repton (sf1248) and Peel Castle (Graham-Campbell forthcoming).

6.3.30.6 Metallography

Testing these conclusions reached in 3.30.8 and 5.7.4 against comparative data is not easy as relatively few knives from other sites have been sectioned metallographically (Table 6.4). In the early Anglo-Saxon period quality measured in terms of hardness appears to be variable, the butt- weld appears to be the most common, especially if the form 0 blades are taken to be butt-welded blades from which the cutting edge has worn or corroded away. The middle Anglo-Saxon material is dominated by the sample from Hamwic; quality appears to be almost universally good and the butt-welded cutting edge is dominant amongst blades sectioned. There is virtually no evidence for the sandwich weld at this time. Radiography has also revealed an example of pattern-welding from Hamwic which is the earliest I know of on a small blade as opposed to a weapon. The late Anglo-Saxon material appears to confirm the impression of quality given by the Coppergate data and the trend towards greater use of the sandwich-weld.

Table 6.4 Details of 5th-11th century knives and saxes examined metallographically from sites other than 16-22 Coppergate (see 3.30.8).

Abbreviations:

* = sax
Back = blade back form
Met. = metallographic macro-structure (after Tylecote and Gilmour 1986; see 3.30.8)
pw = pattern-welded
CE Hv = Cutting edge Vicker's hardness (see 1.7)
QT = quenched and tempered

Site	Back	Met.	CE Hv	QT
early Anglo-Saxon				
Barham Down *	C1?	4	248	n
Polhill: G77, no.590	A1?	0	150	n
G90, no. n.av.	n.av.	0	150	y
Poundbury:				
125	C?	2	520	y
126	D	1a	185-330	n
508	A1?	2	330	y
605	C3?	2	553	y
809	A1	3	214	n
603	I	2	615	y
786	I	0	210	n
West Stow:				
716216	n.av.	0?	n.av.	n
716210	n.av.	2	n.av.	n
716248	n.av.	0	n.av.	n
716232	n.av.	0	n.av.	n
716300	n.av.	3	300	n
middle Anglo-Saxon				
Hamwic:				
SOU30.173	n.av.	2	548	y
SOU31.340	C2	3	572	y
SOU31.663	E	2	322	n
SOU99.38	I	2	572	y
SOU99.92	A1	0	170	n
SOU169.417	C1	2	603	y

Table 6.4 continued

Site	Back	Met.	HV	QT
SOU169.421	A2	2?	160	n
SOU169.540	I	2	644	y
SOU169.558	A2	2?	813	y
SOU169.610	C1	2	333	y
SOU169.1617	Ci	2	677	y
SOU169.2407	A1	0?	168	n?
SOU169.2502	C1	2	460	y
SOU169.2516	C1	1?	345	y
Ramsbury:				
no. 14	C1	2	830	y
late Anglo-Saxon				
Canterbury:				
Norman Staircase sf118	C3	3	560	y
" " sf159	n.av.	1	632	y
Linacre Gardens sf527	n.av.	1e?	152	n
" " sf539	A2	0	206	n
" " sf557	C1	4?	162	n
sf577	n.av.	1	344	n
Dorset *	A2	2 pw	775	y
Kempsford, Thames a *	C1?	1c	737	y
Kempsford, Thames b *	Ai	2 pw	204	n
Leyton *	C1?	1	831	y
Reading, Thames *	n.av.	2 pw	152	n
Winchester:				
2670	Ai	2	636	y
2675	A1	1	633	?
2689	C1/3	1	533	?
2701	C1	2	102	n
2705	C1	1	290	y
2839	I	0	113	n
2800	I	1	313	?

References:
Barham Down : Tylecote and Gilmour 1986, 124-9
Canterbury : Wall forthcoming
Dorset : Tylecote and Gilmour 1986, 140-4
Hamwic: McDonnell 1989 and unpublished b-c.
Kempsford : Tylecote and Gilmour 1986, a:131-4, b:137-40
Polhill : Cox 1973

Table 6.4 continued:
References:
Poundbury : Tylecote and Gilmour 1986, 37-41; 1987; Davies 1987
Ramsbury : Tylecote et al. 1980; Tylecote and Gilmour 1986, 42-4
Reading : Gilmour 1986, 134-5 (S22)
West Stow : Tylecote and Gilmour 1986, 42
Winchester : Tylecote and Gilmour 1986, 44-50; Tylecote forthcoming

Pattern-welding was principally used for swords and other weapons (6.4.3) but a number of pattern-welded knives have come to light in recent years (Table 6.5).

Pleiner (1983, 84-9) summarised the evidence for knife blade macro-structure from the 8th-13th century on the basis of eastern European and Scandinavian data and his findings correspond in general terms with the British pattern described above. He suggests, for example, that the sandwich-welded technique originated in the 8th-9th centuries, but was especially popular in the 10th-11th centuries.

It is, unfortunately, difficult to test my conclusions on the relationship of back form to metallography because of there are few data from other sites. On the one hand, however, there is some indication that the close relationship of back form A to the butt-welded cutting edge holds, especially if form 0s are damaged form 2s. On the other hand, changing preferences in manufacturing technique may be an equally strong determinant of metallographic macro-structure. While middle Anglo-Saxon knives with back form C1 are strongly associated with form 2, there is, however, a large blade with back form A1 from a mid 11th century context at Winchester (2675) which is sandwich-welded. Finally, a very striking feature of metallographic data for the middle and late Anglo-Saxon periods is that pattern-welding, both in saxes and small knives occurs exclusively with blades with back form A (Table 6.5).

6.3.30.7 Comparative assemblages

It will be apparent from the preceding discussion that it is difficult to identify knife attributes which are confined to restricted time periods or to establish how form develops through the middle and late Anglo-Saxon periods, although there does appear to be a trend towards a greater diversity and elaboration of blade surface features and an increased use of pattern-welding. A more sophisticated way of assessing developments in knife variability, however, is to consider assemblages from different sites taking into account the complete pattern of formal and dimensional variables. To do this I have selected six relatively well-provenanced assemblages from occupation sites of middle and late Anglo-Saxon date for comparative purposes and I have only used knives whose back forms

Table 6.5 Middle and Late Anglo-Saxon pattern-welded knives and saxes from Britain

* = sax

Site and/or reference	Date	Back form
Dorset * (Tylecote and Gilmour 1986, 140-4)	LS	A2
Hamwic Six Dials SOU31.670	8th-9th	A2
Hurbuck * (Wilson 1964, 135-6, pl.19, 22)	LS	A1
Keen Edge Ferry * (Evison 1964)	LS	Ai
Kempsford * (Tylecote and Gilmour, 1986, 137-40)	LS	A2
London:		
Pudding Lane (Ganiaris & Gilmour unpub.)	late 11th-early 12th	A2c
Thames at Hampton (Tylecote and Gilmour 1986, 135-7)	LS	A2
Peel Castle, Isle of Man (Graham-Campbell forthcoming)	10th	A1
Thames at Reading * (Tylecote and Gilmour, 1986, 134-5)	LS	I
Repton * sf3628	late 9th	A2
Thetford (I.Goodall 1984, 83 no.103a)	LS	A2?
York, 16-22 Coppergate:		
3859	late 10-11	A2
10636	late 9th	A1

could be identified. Full details of the knives appear in Appendix 8.

Unfortunately none of these assemblages is anything like as large as that from 16-22 Coppergate and so the significance of any patterning must be treated with caution. Nevertheless, certain trends appear which I suggest will, at least, warrant further investigation.

In Tables 6.7a-b the composition of the assemblages in respect of blade back form is shown. Two features of these data warrant discussion, although the virtual absence of back form D, the convex back, from all assemblages except Coppergate should also be noted. It is, however, of particular interest, firstly, that there appears to be a marked difference, of a factor of roughly two in percentage terms, between two of the middle Anglo-Saxon sites, Hamwic and Thwing, and two of the later sites, Coppergate and Thetford, in the occurrence of back form A, the angle-back. Wicken Bonhunt, as an early site, seems to be anomalous here with only three examples, although there are a few unstratified examples from the site. The highest percentage comes from Repton, whose date range is earlier than the rest of the late Anglo-Saxon sites, but it should also be noted that for the late 9th century, Period 3, at Coppergate the percentage of back form A is 34 (5.7.3). On the basis of these figures it can be

Table 6.6 Knife assemblages used for comparison with 16-22 Coppergate

Site and Reference	Nos.	Date	Source of data
Hamwic: Two published by Addyman and Hill (1969) remainder from Six Dials or sites in St. Mary's Street	70	8th-mid 9th	X-radiographs and objects in some cases. Sample chosen to include mainly unbroken blades
Thwing	31	8th-mid 9th	X-radiographs and objects
Wicken Bonhunt	19	8th-late 9th	X-radiographs and objects
Repton	23	mid9th-10th	X-radiographs and objects
Thetford (I.Goodall 1984; Goodall and Ottaway forthcoming)	67	10th-11th	Objects and drawings
Goltho Manor (Goodall 1987)	20	10th-11th	Original drawings

Table 6.7a Occurrence of blade back forms on knives from 16-Coppergate and comparative assemblages

Site	A1	A2	A3	Ai	All A	B	C1	C2	C3	Ci	All C	D	E	F	Total
Hamwic	10	18	2	3	33	1	21	8	1	3	33	2	1	-	70
Thwing	4	11	-	2	17	-	9	1	2	1	13	-	1	-	31
Wicken Bonhunt	1	2	-	-	3	-	4	3	2	3	12	3	-	1	19
Repton	1	11	-	-	12	-	5	1	1	3	10	1	-	-	23
Thetford	8	7	-	1	16	2	29	3	13	0	45	4	-	-	67
Goltho	4	-	-	-	4	-	7	0	7	0	14	2	-	-	20
Coppergate	5	25	1	3	34	2	43	10	30	15	98	43	1	-	178
Total	33	74	3	9	119	5	118	26	56	25	225	55	3	1	408

Table 6.7b Occurrence of blade back forms on knives from 16-22 Coppergate and comparative assemblages as percentage of those assemblages.

No figure given where less than 5 items occur (na)

Site	A1	A2	Ai	All A	B	C1	C2	C3	Ci	All C	D
Hamwic	14	26	na	47	na	30	11.5	na	na	47	na
Thwing	na	35.5	na	55	na	29	na	na	na	42	na
Wicken Bonhunt	na	na	na	na	na	na	na	na	na	63	na
Repton	na	52	na	56	na	20	na	na	na	40	na
Thetford	12	10.5	na	24	na	43.5	na	19.5	na	67	6
Goltho	na	na	na	na	na	35	na	30	na	65	na
Coppergate	3	14	na	19	na	24	5.5	17	8.5	55	24
Total	8	18	2	29	1	29	6.5	13.5	6	55	13.5

suggested that the angle-back form was at its most prevalent in the 8th and 9th centuries, but began to go out of favour in the early 10th century, although as is clear from the Coppergate assemblage, examples continue to occur in contexts of 11th and also 12th century date where they need not necessarily be residual. Within the group of blades with back form A it is not possible to determine trends in the relative occurrence of forms A1 and A2, except that the latter is more frequent throughout.

The average angle at which the blades of form A slope down to the tip appears to be much the same in the middle and later Anglo-Saxon periods (Table 6.8), although there is a markedly higher figure from Repton where the assemblage includes a number of blades with very sharp angles associated with sharply upward sloping backs. It is not clear, however, whether angles became markedly greater during the 9th century before declining once again in the 10th; the Coppergate Period 3 average is the same as for the site as a whole.

Table 6.8 Average angle of knife blades with back form A in comparative knife assemblages
(for sites with more than 5 examples)

Site	Angle (degrees)
Hamwic	16
Thwing	18.5
Repton	29
Thetford	16.5
Coppergate	19

The second feature of Tables 6.7a-b requiring comment is the occurrence of blade back form C3, where the blade back slopes down before curving down to the tip. In 3.30.2 I suggested that this blade form may arise from wear of knives which originally had back form C1, where the rear part of the blade back is horizontal. They evidently start to appear in the late Anglo-Saxon assemblages and may therefore be evidence that knives with blade form C were on average more heavily worn before discard in the later Anglo-Saxon period than in the middle Anglo-Saxon.

The extent of wear on cutting edges is, as I noted in 3.30.3, extremely difficult to measure and classify, but it was suggested that knife blades were originally manufactured with cutting edges which were either straight or straight before curving upwards slightly at the tip (forms e-f), whereas a characteristic result of wear was an elongated S-shaped cutting edge (forms c-d). When the assemblages are compared (Tables 6.9a-b) it is striking that in percentage terms Thetford and Coppergate have between two and a half and three times the number of blades with S-shaped cutting edges as Hamwic, and on some of the later blades the S-shape is very pronounced (form d) whereas on the Hamwic blades it is always slight. Hamwic has, by contrast, a higher percentage of blades with straight cutting edges or cutting edges which are straight before curving upwards slightly at the tip.

Table 6.9a Cutting edge form on knives in comparative assemblages (where determinable)

	Form						
	a	b	c	d	e	f	Total
Site							
Hamwic	23	0	13	0	10	22	68
Thwing	1	3	11	0	2	4	21
Wicken Bonhunt	3	1	4	0	5	1	14
Repton	2	2	6	0	6	3	19
Thetford	12	0	29	7	2	12	62
Goltho	4	2	6	0	1	1	14
Coppergate	30	7	74	5	13	32	161

Table 6.9b Cutting edge form on knives in comparative assemblages as percentage of those assemblages (Hamwic, Thetford and Coppergate only)

	Form					
	a	b	c	d	e	f
Site						
Hamwic	34	0	19	0	14.5	32.5
Thetford	19.5	0	47	11.5	2.5	19.5
Coppergate	18.5	4.5	46	3	8	20

I suggest, in conclusion, that the evidence both of the occurrence of the blade back form C3 and wear on the cutting edges indicates differing patterns of wear on blades at Hamwic as opposed, in particular, to Coppergate and Thetford.

The metallography data from Coppergate (3.30.8) and other sites (6.3.30.6) suggest that the 10th century witnessed an increasing preference for the sandwich-welded blade, as opposed to the butt- or scarf-welded blade, which allowed greater wear of the cutting edge before it became ineffective. The metallography of Hamwic knives appears to show virtually no evidence of the sandwich-welded blade (Table 6.4). It is possible, therefore, that formal differences in blade back and cutting edge form between Hamwic on the one hand, and Coppergate and Thetford on the other, may to some extent reflect and be explained by the influence of chronological trends in metallographic structure.

In Table 6.10 the averages of the three principal dimensions and the ratios between them are shown. Overall length varies relatively little except at Repton where there are a relatively high number of short blades The length of blade figures are again low for Repton, but there also appears to be a slight trend towards shorter blades at the later sites, i.e. Coppergate, Goltho and Thetford. A similar distinction appears in the length to length of blade ratio which is higher at the later sites and where Thetford, in particular, is strikingly different from the middle Anglo-Saxon sites.

Table 6.10 Average dimensions and ratios of knives in comparative assemblages. Data applies to knives only with relevant parts unbroken or relevant feature present

(sample size in brackets)

Abbreviations: L = length, L:LB = ratio of length to length of blade, LB = length of blade, WB = width of blade, LB:W = ratio of length of blade to width of blade, L:L1 = length of blade : length of blade from shoulder to point where back changes line (back forms A, B, C, F)

(Dimensions in millimetres, taken to nearest .5mm)

Site	L	L:LB
Hamwic (47)	118	1.52
Thwing (6)	113.5	1.54
Wicken Bonhunt (11)	112.5	1.50
Repton (11)	88.5	1.38
Thetford (34)	125	1.97
Goltho (9)	118	1.71
Coppergate (79)	121	1.75

Site	LB	WB	LB:W
Hamwic (68)	80.5	13.5	6.04
Thwing (20)	82.5	15	5.56
Wicken Bonhunt (13)	73.5	13.5	5.40
Repton (16)	61.5	16	4.28
Thetford (61)	69.5	13	5.38
Goltho (15)	66.5	14	4.75
Coppergate (128)	71	14	5.21

Site	L:L1
Hamwic (68)	1.71
Thwing (18)	1.80
Wicken Bonhunt (11)	1.78
Repton (13)	1.75
Thetford (48)	1.75
Goltho (11)	1.79
Coppergate (97)	1.74

One interpretation of this patterning is that there was a real difference in the way knives were manufactured such that in the later Anglo-Saxon period they had, on average, relatively longer tangs and shorter blades than the middle Anglo-Saxon knives. Alternatively, the later knives may have had similar proportions to the earlier knives, but began life on average slightly longer and after greater wear became roughly the same length, but with their blades relatively shorter. The patterning can, perhaps, best be illustrated by Figs. 3.10, 6.1 and 6.2. Fig.6.1 shows the correlation between length and length of blade of knives from Hamwic, Thwing and Wicken Bonhunt (middle Anglo-Saxon only). There is clearly a close correlation between the variables and this may be compared with the Coppergate data in Fig.3.10 where the distinct nature of a group with length to length of blade ratio of over 2:1 is revealed. A similar gap between the clustering of two groups of knives is shown in Fig.6.2 for Thetford and Goltho. There are no knives with a ratio of 2:1 or more from the three middle Anglo- Saxon sites, but the introduction of the group which has the feature into the Coppergate, Goltho and Thetford assemblages accounts for the differences in dimensional patterning. As noted in 3.30.8 the existence of these knives with relatively long tangs may be due to wear which is to some extent a function of metallography. Additionally or alternatively, it may indicate a change in manufacturing practice in response, perhaps, to a need for functional specialisation.

Some support for the latter proposal may derive from the fact there is no difference in the average ratio of length of blade to length from the shoulder to the point where the back curves or slopes away to the tip. On average the rear part of the blade, before the point at which line changes, occupies 55-57% of its length at all sites. Had there been a reduction of length by wear on blades which started out with similar dimensions then a higher ratio should, perhaps, have been recorded on blades from the later sites, i.e. the rear part of a blade would have occupied a greater percentage of its length.

KEY

Open circles = Hamwic

Closed circles = Wicken Bonhunt

Triangles = Thwing

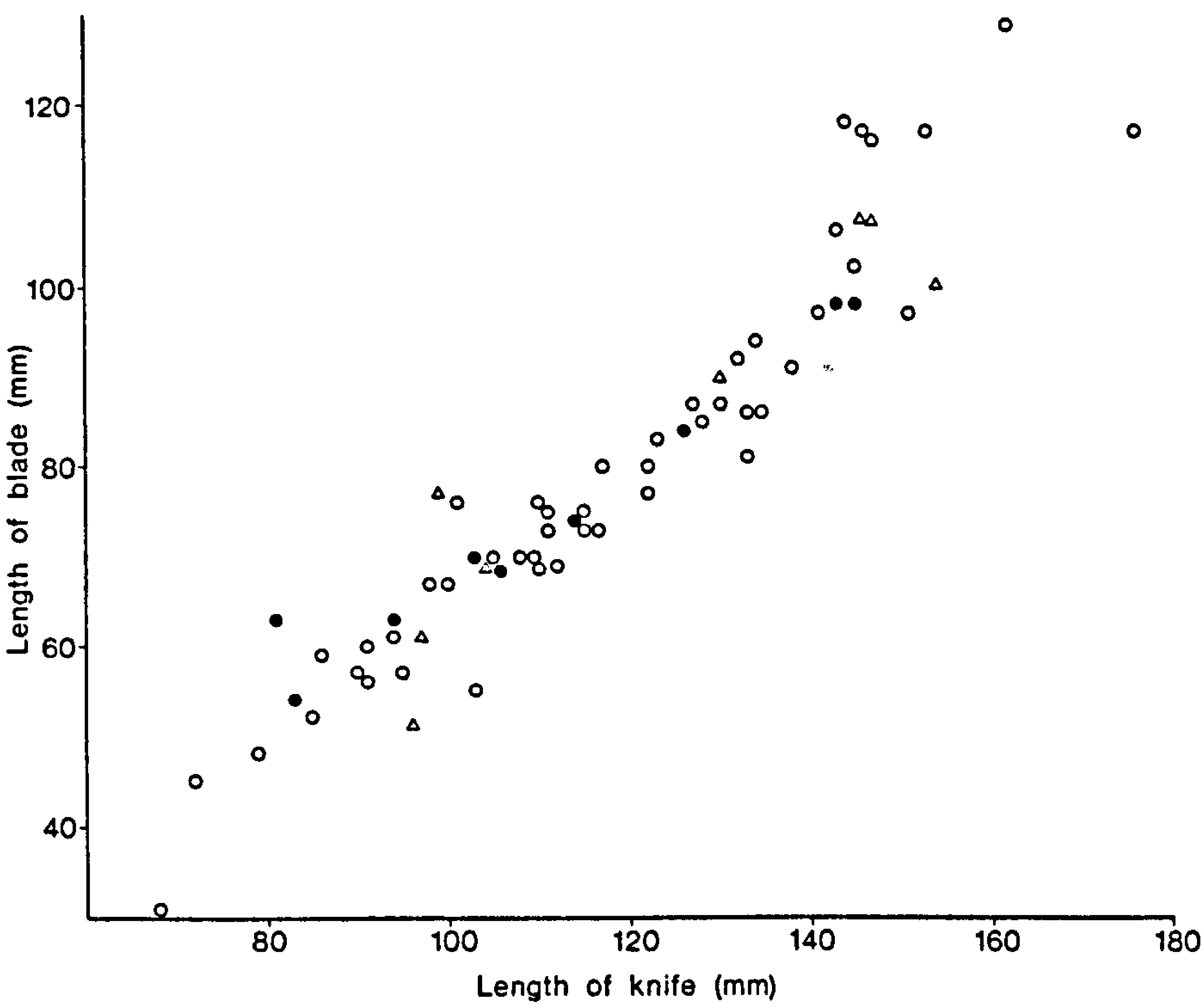
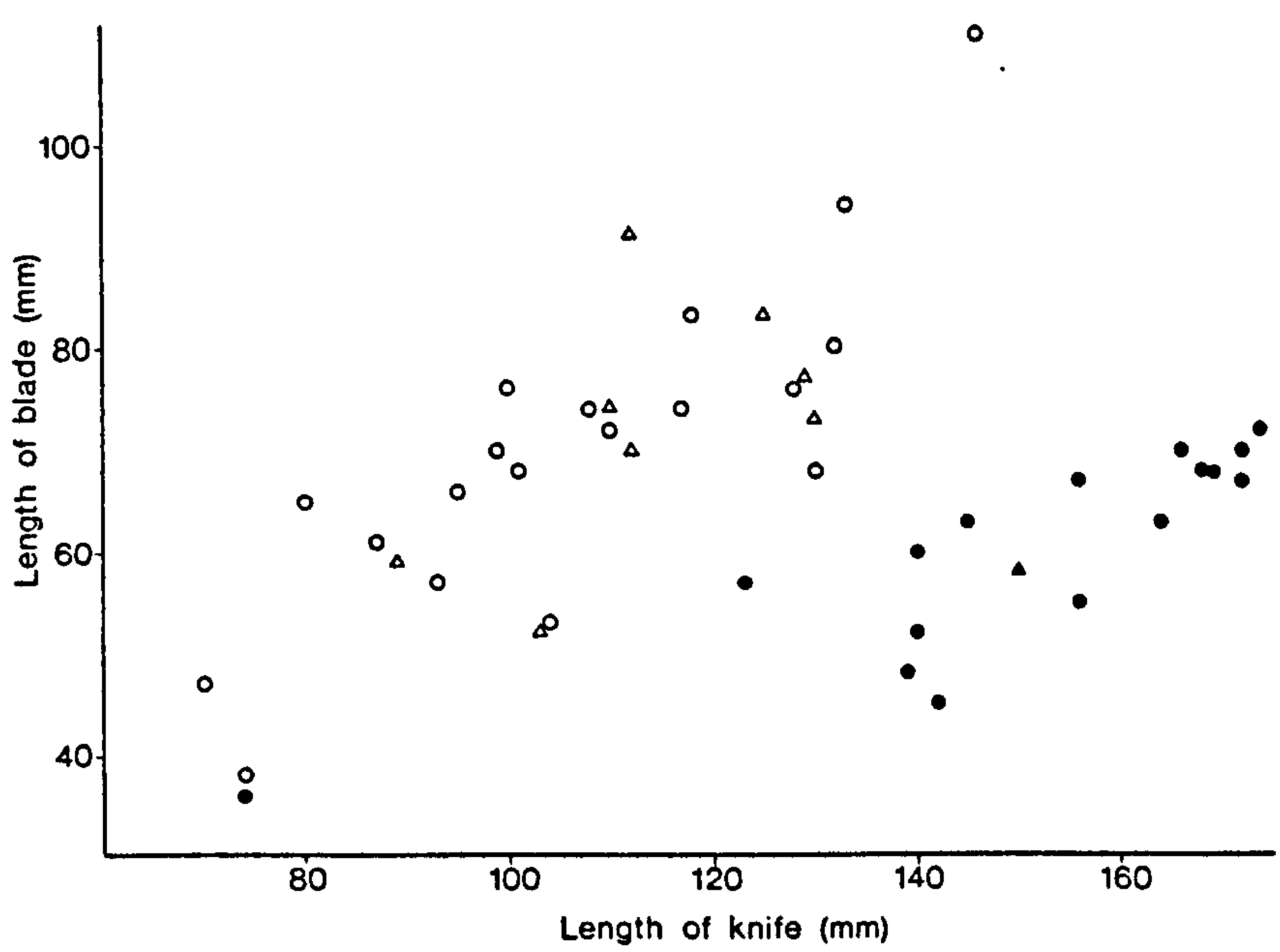


Fig.6.1 Scattergram showing the correlation between length of knives and length of blades for middle Anglo-Saxon knives from Hamwic, Thwing and Wicken Bonhunt



KEY

Circles = Thetford; closed = knives with ratio of length to length of blade over 2:1

Triangles = Goltho; closed = knives with ratio of length to length of blade over 2:1

Fig.6.2 Scattergram showing the correlation between length of knives and length of blades for late Anglo-Saxon knives from Goltho Manor and Thetford

The average width of blades varies very little between the assemblages. The Repton figure is the highest, perhaps because of the high proportion of blades with back form A which, as the Coppergate data show (3.30.4), have a slightly greater average width than blades with other back forms. The length to width ratios show only a slight distinction between the middle Anglo-Saxon sites and the later sites, especially Coppergate and Goltho which are lower. The low figure from Repton is probably again related to the high proportion of blades of back form A which, as Coppergate has shown, tend to be on average relatively broader (i.e. have a lower length to width ratio) than those with other forms (3.30.4). Hamwic, however, has a similar proportion of knives with back form A to Repton yet a markedly higher ratio which cannot be explained by greater wear. On the contrary, if, as is suggested, later blades were, on average, worn more heavily, they should, perhaps, be relatively slimmer. It may be suggested, therefore, that middle Anglo-Saxon blades were made, on average, very slightly slimmer than later blades.

I am not able to discuss, in detail, the comparative occurrence of the blade surface features which are such a distinctive aspect of the formal variability of the Coppergate knives. This would require full cleaning of the Hamwic, Goltho and Thetford material. It is striking, however, that, although some of the features I observed at Coppergate, especially the grooves along the backs of the blade faces, do occur at Repton, Thwing and Wicken Bonhunt, there is not the same diversity; the grooves along the back have the 1-1 pattern as standard and there are none of the York variations. More striking, however, is that Goltho and Thetford appear to be virtually devoid of any surface features; I find it hard to believe that they do not remain to be found under corrosion. Hamwic blades exhibit grooves and examples of inlay (Table 6.3), and a full comparison with Coppergate will be of some interest.

In conclusion, comparison of the seven knife assemblages reveals patterning in the formal and dimensional data which suggests, firstly, that, individual features may have a long life and, secondly, that knives with most combinations of features could be made at more or less any time in the middle and late Anglo-Saxon periods, except that there are no knives which are over twice the length of their blades in the middle Anglo-Saxon assemblages. It may, however, be possible to distinguish assemblages of the 8th and early 9th centuries from those of the later 9th - mid 11th centuries. There is, I suggest, some consistency in the way the assemblages discussed here divide up. Blades with back form A are more common in assemblages dated up to the early-mid 10th century than in those dated to the 10th-11th centuries; back forms C and D become correspondingly more common in the late Anglo-Saxon period, especially back form C3. Cutting edges appear more worn in the later Anglo-Saxon assemblages. In terms of dimensions and proportions later Anglo-Saxon knives have, on average, slightly shorter blades; later blades are also slightly shorter in relation to their tangs and this accounted for, primarily, by a distinct sub-set of blades with tangs over twice the length of the blades.

To some extent dimensional differences may be due to greater wear on later knives which, in turn, is related to metallographic structure, but it is hard to escape the conclusion that differences in both dimensions and shape are due to cognitive factors including responses to new specialist requirements. This is, however, not to rule out other factors affecting the sample extrinsic to the knives themselves, such as the nature of occupation on the different sites. A more exhaustive statistical analysis may also reveal patterning which modifies the conclusions reached here.

Other Knife Forms

6.3.31 Pivoting knives

The pivoting knife appears to be largely confined to contexts of the 8th to 11th century, although there are four from medieval contexts at 16-22 Coppergate. The earliest examples I know of are three from Hamwic, Six Dials (sf13, sf278, sf1557) which are probably similar to how incomplete Coppergate blade 2975 was formed, but differ from 2976-8 in that, although they have backs with a straight central section, the longer blade's back slopes downwards and the shorter blade has a slightly convex back. English examples of probable 10th-11th century date similar in form to 2976- 8 from Coppergate have been found at Little Paxton (Addyman 1969, 86, fig.16, 4), Canterbury (Graham- Campbell 1980a,135, no.473), Northampton (Goodall 1979b, 268, fig.118, 31; Oakley 1979, 315, fig.141, 78) and Thetford (I.Goodall 1984, 81, fig.122, 48-9; Goodall and Ottaway forthcoming sf323).

Since no pivoting knives have yet been found on medieval sites without occupation of the pre-Norman period it is possible that the five from medieval contexts at Coppergate have been redeposited from Anglo-Scandinavian contexts. Of these sf5054 (Cat. Fig.20) has grooves with inlaid twisted copper wire which is characteristic of a pre-Norman date (6.3.30.4) and it may be compared with two inlaid examples from pre-Norman contexts at Winchester (Biddle forthcoming nos. 2644 and 2648)

6.3.32 Folding knives

Closely comparable knives to 2979 come from Thwing (sf46, 8th-9th century) and Carlisle Cathedral (sf218, 9th-10th century). They have a case which develops into a spike and, like 2979, grooves along the middle of each face. The overall lengths of case and spike are 165mm and 99mm respectively. No other cased folding knives with spikes are known to me but there is a folding knife in an iron case of late 9th century date from a grave at Repton (sf7115). Other examples come from elsewhere in northern Europe including an 8th-early 9th century specimen from Bendorf (Gabriel 1981, 246, Abb. 8, 2a-c).

6.3.33 Blade with pierced ends

Other comparable knives to 2982 are not common but include one from the early Anglo-Saxon site at Sutton Courtney, Berkshire, (Leeds 1923, pl.27, L), a group of three from the middle Anglo-Saxon site at Burrow Hill, Suffolk (Fenwick 1984, 40, fig.4), three from 8th-9th century contexts at Thwing and two from Repton which are probably 9th-10th century (sf3331 and sf5708). I know of none from post-Conquest contexts.

6.3.34 Knife with serrated cutting edge

There appears to be no close parallel for 2983.

6.3.35 Other Blades

2984, the possible draw knife, may be compared with a blade with similar terminals at each end from Lough Gur Crannog (O'Riordain 1949, fig.11, 145).

Other Tools and Implements

6.3.36 Forks

The most closely comparable objects to 2989 of Anglo-Scandinavian date come from Coppergate, York (Waterman 1959, 73, fig. 5, 10), although this has a bronze coated moulding at the base of the prongs, and Thetford (I.Goodall 1984, 95, fig.133, 196). There are also substantially larger forks of similar form from Birka (Arbman 1940, Taf.185, 10) and Hedeby (Jankuhn 1943, 128, Abb.62).

6.3.37 Fish Hooks

Fish hooks occur on other sites of the 9th-11th centuries in northern Europe but are not common. There is another from York, rather larger than those found at 16-22 Coppergate, which has a looped eye (Radley 1971, 49, fig.11, 15). The only other examples from Britain are a relatively large, eyed-hook (105mm long) and a couple of fragments from Jarlshof (Hamilton 1956, 153, no.77, pl. 23). Scandinavian hooks include two 10th century hooks from Århus (Andersen et al. 1971, 118, DEY and EIZ), of which the former is barbed and similar in form and size to the Coppergate hooks. The second Århus hook, however, is substantially larger, as is one from Trelleborg (Nørlund 1948, pl. 44) and one of two 11th century hooks from the Thule site in Lund (Blomqvist and Mårtensson 1963, fig. 163; Graham-Campbell, 1980a, pl. 17). There is, however, another 11th century eyed-hook from the Thule site which is similar in size to those from Coppergate (Blomquist and Mårtensson 1963, 163-4, fig.163).

6.3.38 Spoons

There are few other close parallels for the six tin-plated iron spoons but a number of single-bowled and double-bowled examples are known.

A double-ended spoon made of copper alloy which is unstratified, but probably Anglo-Scandinavian, was found at 16-22 Coppergate (sf3805) and a mid 9th century double-ended silver spoon with spatulate bowls was found at Sevington, Wiltshire (Wilson 1964a, 61, pl.29, 67), although it is about twice the length of the Coppergate spoons.

Small spoons with single bowls are slightly more common. Of particular interest is a copper alloy spoon of Anglian (late 8th-early 9th century) date from the 46-54 Fishergate site in York (1985.9, sf1075). It is possible that this was double-ended since it is broken at one end of the stem; on the other hand it may have been more like a Hamwic spoon (Addyman and Hill 1969, pl.8, e4) which has a looped terminal. There is also an Anglian copper alloy spoon from Whitby (Peers and Radford 1943, 62, fig.12, 7) and a silver spoon of 8th century date was found in the St.Ninian's island hoard on Shetland (Wilson 1973, 57, 113-4, pl.26, a) which is more elaborately decorated and larger than the 16-22 Coppergate spoons.

The only iron spoon of 10th-11th century date I know of, aside from those from Coppergate, is a single-bowled specimen from Birka bearing traces of gilding, whose bowl is rather larger than those of the Coppergate examples (Arbman 1940, Taf.151, 4; 1943, 224). Other single-bowled spoons of 10th-11th century date include a copper alloy example from Thetford (A.Goodall, 1984, 69, fig. 112, 48) and a silver example from Pevensey Castle, Sussex (Simms 1932; Wilson 1964a, 61). The bone spoons from Winchester (Collis and Kjølbye-Biddle 1979) are about twice the length of the Coppergate spoons, but their bowls are similar in form, especially to 3000.

6.3.39 Cooking pan

The only directly comparable object to 3004 comes from Winchester (Biddle and Quirk 1962, 184-6, fig. 8). Its handle, made from a double spirally twisted rod, still survives but it was apparently welded on to a projection from the bowl side rather than nailed on.

6.3.40 Other vessels

Reference to comparanda for 2251-2 will be found in 3.40.

6.3.41 Scale Pan

I know of no other iron examples.

6.3.42 Perforated Disc

I know of no parallel for 3009

6.3.43 Styluses

Styluses are relatively rare finds in stratified post-Roman contexts; they are usually non-ferrous, but the heads always appear to be triangular. There are, for example, six non-ferrous examples from Whitby (Peers and Radford 1943, 64-6, fig.15, 1-4, 6-7) and one from Jarrow, Co. Durham (excavated by Professor Cramp, JA69VV).

STRUCTURAL IRONWORK and FITTINGS

Many classes of structural ironwork and fittings exhibit little formal variability except in respect of size which, to a great extent, is directly related to their practical function. Following the discussion in Chapter 3, I will refer below largely to attributes which are not obviously practical.

6.3.44 Nails and Tacks

Nails with flat heads were clearly in common use in middle and late Anglo-Saxon periods (3.44.6), but exhibit little variability to judge by the large collections that I have inspected from Repton, Thetford, Thwing and Wicken Bonhunt. Rounded or roughly rounded heads and shanks of rectangular cross-section appear almost universal.

6.3.45 Clench Bolts

Clench bolts are known in Romano-British contexts and again in Britain from the 7th century onwards, but no development in form is apparent. Roves of rectangular and diamond shape occur side by side throughout the middle and late Anglo-Saxon periods, the only exceptions being the unusual elongated examples on Hadstock church door (Hewitt 1980, 21).

6.3.46 Staples

Staples are again common finds of middle and late

Anglo-Saxon date and the sub-classes identified at 16-22 Coopergate are all well known elsewhere; otherwise they exhibit little variability except in respect of size (3.46).

6.3.47 Fittings

Large pierced strips and plates are common site finds of the 9th-11th century and were employed for a number of purposes which were probably the principal determinants of their form (3.47).

Parallels for the small pierced or unpierced objects from Coppergate are relatively few. There are, however, a few strips with relief work and plating from elsewhere in both middle and late Anglo-Saxon contexts (see Appendices 9-10 for details) at sites including Hamwic, Lincoln and Goltho.

Among the more distinctive objects in this class from Coppergate are those with the simplified animal heads, which also occur on two small U-eyed hinges (3.50.3). They cannot be directly paralleled elsewhere, but there is an iron strip with a somewhat similar terminal from 6-8 Pavement, York (MacGregor 1982, 87, fig.46, 414), and a very simplified animal head appears on a plated iron strip from Thetford (I.Goodall 1984, 89, fig.130, 160). The tradition of using animal heads as decoration on box and casket fittings appears widespread, however, in 9th-11th century northern Europe. Animal heads occur for example on stapled hasps at 16-22 Coppergate (3.52) and elsewhere, and as decorative fittings on caskets such as those from Cammin, Poland and Bamberg, West Germany (Wilson and Klindt-Jensen 1966, 124-6, pls.54-5).

6.3.48 Disc fittings

I know of no close parallels for these objects.

6.3.49 Spirally- Twisted strips and Fittings

Spiral twisting is common feature on ironwork from the Roman period onwards and no guide to the date or cultural affinities of the Coppergate objects (see also 4.3).

6.3.50 Hinge Fittings

6.3.50.1 Hinge Straps

In 3.50.1 I described the simple mechanism of hinge straps of the Anglo-Saxon period and this can be found on numerous examples largely from chests re-used as coffins in cemeteries including Dacre (Ottaway forthcoming), Repton, Thwing and Ailcy Hill, Ripon. There is a range of simple strap forms, but among the commonest are those which, like 3345 from Coppergate, narrow to a tip which was then curved over to secure them to a lid. 3345 is, however, rather larger than any other hinge strap of the period that I know of. 3386 also has a very common strap form in narrowing from the head to a rounded pierced terminal. 3333 and 3383, being parallel-sided, again have many parallels including, in addition to those from the cemeteries, parallel-sided straps from a middle Anglo-Saxon context in the mill at Tamworth (sf IR16) and from an occupation context at late Anglo-Saxon St.Neots (Addyman 1973, 91, fig.19, 1). I know of no exact parallel, however, for the waisted body of 3307.

A feature shared by 3307, 3333, 3356, and 3386, and most other straps of the period from the backs of chests is the end-loop formed by drawing the strap out rather than piercing it. This appears to be hardly known after the 11th century when pinned hinges become standard for chests.

I cannot parallel 3419 with its spirally-twisted body, but spiral twisting is known on chest fittings such as hasps and corner brackets from elsewhere. 3300, although simple in form, has no close parallels.

6.3.50.2 Hinge Pivots

Few other hinge pivots are known from 9th-11th century contexts, although there is a group of eight from Thetford (I.Goodall 1984, 89, fig.129, 138-45), which appear similar in terms of size and form to those from 16-22 Coppergate, and another example from North Elmham (Goodall 1980a, 513, fig.266, 66).

6.3.50.3 Hinges with U-shaped eyes

There are very few U-eyed hinges from other sites of the 9th-11th centuries, although they become common in the medieval period. There is, however, an example of the strap and terminal form from a middle Anglo-Saxon context at Wicken Bonhunt (sf301). More comparable in size to the large U-eyed hinges from Coppergate are two of the strap and terminal variety, whose straps have bifurcated terminals, which come from an 11th century context at the ABC Cinema site, York (1987.21, sf583, sf585).

Small hinges with U-shaped eyes

The animal heads on 3475 and 3478 are closely comparable to those on small fittings 3322-3 (3.47), but the only other contemporary small and decorative U-eyed hinge that I know of comes from Thetford (I.Goodall 1984, 89, fig.130, 162)

6.3.50.4 Small hinges with looped eyes

Small hinge fittings with looped eyes, triangular straps and rounded, pierced terminals similar to 3480 are known from several sites. An English example comes from Goltho (Goodall 1987, fig. 180, 94) and in Scandinavia they come from Trelleborg (Nørlund 1948, pl.24, 9; pl.25, 13), Fyrkat (Roesdahl 1977, fig.196) and the hoard from Tjele (Leth-Larsen 1984, 92, fig.3). I know of no direct parallel for 3479.

6.3.50.5 Pinned hinge fitting

There is an object similar to 3482 from a Roman context at Coppergate (sf13734), but I know of no parallel in post-Roman contexts.

6.3.50.6 Handle hinge fittings

There is a very similar object to 3483 and 3485 from 5, Coppergate (MacGregor 1982, 84, fig.44, 605), but I know of no parallel for 8892.

6.3.51 Corner Brackets

Although only three corner brackets were found at 16-22 Coppergate, they are relatively common finds, especially on chests. The commonest form has, like 3488, arms with parallel sides and oval or rounded pierced terminals.

6.3.52 Hasps

Hasp 3489 made in part from a spirally-twisted strip may be compared with a number of other examples of the 9th-11th centuries with this feature including specimens from, for example, Thetford (I.Goodall 1984, 89, fig.131, 164) and Repton. There are others from Scandinavian sites, including Kaupang (Blindheim et al. 1981, pl.37) and Lund (Mårtensson 1976, fig.362).

I know of no hasps from either Britain or Scandinavia which are comparable to those of the second form from Coppergate represented by 3490-3.

A somewhat similar stapled hasp to 3496 with the simplified animal head terminal comes from a medieval context at 16-22 Coppergate (sf5338; Cat. Fig.31). It is also slightly curved, has two brass animal head terminals and the main body is composed of three strips, of which the two outer are spirally twisted. The form of the heads suggests that this object is also Anglo-Scandinavian in origin. No comparable stapled hasps are known from medieval contexts but they have been found on Viking Age sites in Scandinavia. There are examples from Birka (Arbman 1940, Taf.260, 1a-b, 2a-b; Taf.263, 1a-b; Taf.264, 1, 2a; Taf.272, 3a-b) and on chest 149 in the Oseberg ship (Grieg 1927-8, fig.65). Another two were found in the hoard from Tjele (Leth-Larsen 1984, 93, fig.4) which were made from spirally twisted iron strips and have copper alloy animal head terminals. Stapled hasps comparable to 3495 come from Birka (Arbman 1940, Taf.271, 2) and other sites in Scandinavia, including Hedeby (Müller-Wille 1973, 34,

Abb.8, 15) and Sønder Onsild (Roesdahl 1976, fig. 11).

The flat stapled hasps (3497-8) are hard to parallel exactly but a similar object, undecorated, comes from North Elmham (Goodall 1980a, 510-1, fig.265, 12).

6.3.53 Handles

Simple drop handles similar to 3504 come from the 6-8 Pavement site, York (MacGregor 1982, 84, fig.44, 606), a casket in the grave from Ketting, Denmark (Brøndsted 1936, 133-5, fig.41) and the box from Kammergrab 21 at Thumby-Bienebek (Müller-Wille 1976b, 41, Taf.36). 3507, with its rolled tips, is similar to a small handle from the Thule site, Lund (Blomqvist and Mårtensson, 1963, fig. 130), and there are a number of handles with rolled arm tips from Birka (Arbman 1940, Tafn.264-272).

6.3.54 Chain Links

No discussion of these objects is warranted here.

6.3.55 Rings

Numerous iron rings of various sizes and cross-section forms are known from other sites of the 9th-11th centuries. Comment need only be made on 3529 formed from a spirally twisted strip which is virtually identical to a ring from Lund, whose function is unknown, dated 1020-

50 (Mårtensson 1976, fig.158).

6.3.56 Ring and Strap Fittings

For notes on other ring and strap fittings see 3.56.

6.3.57 Vessel Suspension Fittings

Similar fittings to 3547-8 consisting of a U-shaped loop with a pierced terminal at each end may be seen on a bucket from the Oseberg ship (Grieg 1927-8, fig.302).

6.3.58 Hooks

6.3.58.1 Wall hooks

I know of no comparable objects from middle or late Anglo-Saxon contexts, although they are common in the medieval period.

6.3.58.2 S-hooks

The relatively small S-hook 3567 is comparable to an example from Thetford (I.Goodall 1984, 95, fig.133, 198).

3561 which was probably part of the suspension gear of a cauldron or similar vessel may, as noted in 3.58.2, be compared with a larger example in a Viking Age chain from Nosaby, Sweden (Müller-Wille 1980, 138, Abb.8, 13). Another hook very similar to 3561 and of late 9th or 10th century date was found at North Elmham (Goodall 1980a, 514, fig.267, 89).

6.3.58.3 Other hooks

The large hook 3562 may also have been part of suspension gear and there is a very similar hook attached to a length of chain from Trelleborg (Nørlund 1948, pl.19). Another similar, but even larger, hook was found at Thetford (I.Goodall 1984, 95, fig.133, 200).

The probable pot hook 3565 is somewhat similar to an example found in a late Anglo-Saxon context at North Elmham (Goodall 1980a, fig.267, 91) and a very much larger example comes from a middle Anglo-Saxon context at Ramsbury (Haslam 1980, 37-9, fig.21, 21).

6.3.59 Lynch Pins

I know of no comparable objects to 3572-3 from a late Anglo-Saxon context.

6.3.60 Ferrules

Ferrules of various forms have been found in small numbers on several other sites of the 10th-11th centuries. There are six from Thetford (I.Goodall 1984, 97, fig.135, 215-20) five of which are similar in form to 3576 and 3585, but they are generally larger than the Coppergate specimens, in some cases substantially so.

More comparable in terms of size to the Coppergate ferrules are two Viking Age specimens from the Brough of Birsay, Orkney (Curle 1982, 66, ill. 41, 470 and 472).

6.3.61 Tubes

No comparanda require discussion.

6.3.62 Tubular object

As noted in 3.62, I know of no comparable object to 3592.

Locks and Keys

6.3.63 Locks

Fixed Locks

6.3.63.1 Sliding bolts from locks with tumblers

Although locks with sliding bolts were used in the Roman period (Almgren 1955, fig.60, 7) the origins of the form found at 16-22 Coppergate with projections in the centre of one side are obscure. The earliest evidence for it known to me is a complete lock from the cemetery at Ailcy Hill, Ripon (sf0567), thought to date from the 8th or 9th centuries. In the mid 9th-11th centuries the bolts remain uncommon, although a lock bolt, tumbler and spindle in a wooden case and two other bolts come from 6-8 Pavement, York (MacGregor 1982, 80-

3, fig.42, 430-2; fig.43) Another virtually complete mechanism was found on a coffin of Anglo-Scandinavian date from York Minster (Kjølbye- Biddle forthcoming, M1667C). Thetford has produced five bolts (I.Goodall 1984, 95, fig.131, 174-8) and a very small specimen, evidently from a small box with iron fittings comes from Wicken Bonhunt (sf 316). I only know of two Viking Age examples from Scandinavia which were found in a 10th century context at Århus (Andersen et al. 1971, 139, EOT; 166, EUY).

6.3.63.2 Sliding bolts from locks with springs

Amongst the earliest post-Roman examples I know of are those from the largely 7th century Buckland cemetery, Dover (Evison 1987, 100-1). A number of examples dated to the 8th-9th century come from chests re- used as coffins at Dacre (Ottaway forthcoming), Ailcy Hill, Ripon and Thwing. Probable Anglo-Scandinavian examples come from coffins found at York Minster (Kjølbye-Biddle forthcoming, M438, M1667D). Scandinavian examples are rare, but an example dated to the "early Viking period", comes from a chest re-used as a coffin found at Forlev, Sjaelland, Denmark (Brøndsted 1936, 191-2, fig.102), and one with the slot comes from a casket from Birka (Arbman 1943, 166, Abb.116-7). I know of no examples of this form of lock bolt datable after the mid 11th century except for sf5088 (Cat. Fig.35) from Coppergate which is probably residual.

6.3.64.3 Lock bolt with attached spring

Locks with this form of bolt were used in the Roman period but 3608 is the only one recorded from a 9th-11th century context in Britain.

6.3.64.3 Padlocks

The complete barrel padlock (3610) from a Period 3 context is one of the earliest from post-Roman contexts in Britain, although it is pre-dated by padlocks from Kentish 7th century graves recorded by Faussett (1856, pl.10, 8-10).

The projecting plates at ends of the case of 3610 which hold the free arm tube make it similar to the Kentish locks and to 10th-11th century barrel padlocks from Northampton (Goodall 1979b, 268, fig. 116, 3), Flaxengate, Lincoln (R.White 1980, fig.16) and to one of Viking Age date from Norway (Petersen 1951, fig.250). Later medieval padlocks have the plates recessed into the case.

Goodall (1980b, 125) has suggested that pre-12th century barrel padlocks usually have, like box padlocks also, the free arm tube attached directly to the case and that their separation by a plate is a later development. 3610, however, has a plate between the case and free arm tube, and the detached free arm tube 3612 also has a thin plate attached to one side which presuambly separated it from its case. The other padlocks cited above, including those from the Kentish graves, all have the tube attached directly to the case but there are, however, too few examples yet known to show that 3610 and 3612 are anomalous.

The decorative applied strips on 3610 can be paralleled on other locks of the period, although on none of them is there anything like the same elaboration. The two projecting fins on the Northampton lock (Goodall 1979b, 268, fig.116, 3) are not unlike the projecting triangular plates on 3610 and that lock also has applied strips around the key and bolt hole. The wavy line strips in two of the panels on 3610 occur on the Lincoln padlock (R.White 1980, fig.16) and on an 11th century lock from Lund (Mårtensson 1976, 403, fig.359). The spirally-twisted strips can be seen on an Anglo-Scandinavian box padlock from Hungate, York (Richardson 1959, 82-3, fig.18, 4). The padlocks from Kent, Hungate, Lincoln, Lund and Northampton are also, like 3610, coated in brazing metal.

6.3.64 Keys

6.3.64.1 Keys for locks with sliding bolts and tumblers

Hollow stem keys

Hollow stem keys whose basic form is the same as those from 16-22 Coppergate are common in contexts of the 8th-11th centuries in Britain and northern Europe. 8th or early 9th century examples come from Hamwic (Addyman and Hill 1969, 65-6, fig.24, 14-5) and three of similar date have been found at Dorestad (Van Es and Verwers 1982, 178-9, fig.133, 1-2, 4).

Keys of the late 9th-11th century from England include two from Hungate, York (Richardson 1959, 83, fig.18, 13-4), and two from 6-8 Pavement, York (MacGregor 1982, 82, fig.42, 434-5). There are also eight from Thetford (I.Goodall, 1984, 95, fig.132, 184-91), one of which (no.186) has grooves on the bow and two of which are plated (nos.188-9). Three similar keys found at Flaxengate, Lincoln (F76, Fe210, F75, Fe2604, F75, Fe2593), include one which has three groups of three grooves running around the stem. Keys from Norwich (Margeson and Williams 1985, 33, fig.28, 6) and Thetford (Goodall and Ottaway forthcoming, sf6) have the unusual C-shaped bit seen on 3620 and 3648 from Coppergate.

Numerous sites of the same period elsewhere in northern Europe have produced hollow stem keys. A key from Hedeby (Jankuhn 1943, 128, Abb. 64a) has groups of two and three grooves cut radially into the faces of the bow in similar fashion to those on 3653 from Coppergate.

Birka has produced a small key which also has this feature and a hole in the centre of the bit like 3614 from Coppergate (Arbman 1940, Taf.270, 2). A Swedish group of five 11th century keys comes from the PK Bank site in Lund (Mårtensson 1976, 400, figs.354-5). These keys have ward-cut patterns similar to those from 16-22 Coppergate and the key in fig. 355 has notches around the outer edge of the bow very similar to those on 3641. In Denmark, Trelleborg (Nørlund 1948, 293, pl.21) has produced ten keys, one of which is c.250mm long making it by far the largest key of this form known and four of the others are comparable in size to the largest of the Coppergate keys; one has a circular hole in the centre of the bit.

In 3.64.1 I suggested that there was something of a hierarchy within the hollow stem keys based on a correlation of decoration and complexity of bit with three specimens standing out. When keys from other sites are considered there is some evidence that this hierarchy exists elsewhere and keys with double-chambered ward-cuts or numerous simple ward-cuts are often accompanied by plating and relief work on the bow or stem. These more complex keys are also usually of medium size, i.e. not amongst the very longest or shortest.

Solid stem keys

Keys with solid stems and bits with projecting teeth are common in middle and late Anglo-Saxon contexts (see 6.3.64.2 below), but examples with C-shaped or flat bits like 3618 and 3621 are unknown to me.

6.3.64.2 Key for locks with sliding bolts and springs

Keys with bits like that of 3654 which have either one tooth or, more usually two or three teeth, are well known in northern Europe from the 8th until the 11th century. They have solid stems and frequently have roughly pear-shaped bows and slightly tapering stems (LMMC, 134, type 1). The only parallel for the stem and terminal of 3654 on a key with this bit form that I know of, however, comes from Six Dials, Hamwic (SOU 169, sf984).

L-shaped or T-shaped slide keys are common in Roman and in 5th-9th century contexts in Britain and northern Europe. I know of none from certain 10th-11th century contexts, however, except for one L-shaped key with a looped terminal from Århus (Andersen et al. 1971, 184-5, CDT). There is also an example from an unstratified, but possibly Anglo-Scandinavian, context at Parliament Street, York (Tweddle 1986, 193-4, fig.91, 715).

6.3.64.3 Key for lock bolt with attached spring

3661 is from a Period 5B context at Copperate and so may be early 11th century, but parallels appear to be of 9th-10th century date. They include specimens from Hedeby (Jankuhn 1943, 130, Abb.65), Birka (Arbman 1940, Taf.267, 1-3; Taf.268, 2a), Trelleborg (Nørlund 1948, pl.23, 4) and Århus (Andersen et al. 1971, 184-5, CDO).

6.3.64.4 Padlock Keys

Barrel Padlock Keys

Keys with stems similar to those of 3664-5 and 3668-9 which widen slightly towards the head and have a looped terminal occur from the early Anglo-Saxon period onwards in Britain. There are examples from Shakenoak Farm (Brown 1972, 90, fig.40, 179, 181, 186). 10th-11th century examples come from Thetford (I.Goodall 1984, 95, fig.132, 180-2) and North Elmham (Goodall 1980a, 509, fig.265, 1). A key with a bit consisting of two short teeth similar to that of 3663 was found in a 10th century context at Århus (Andersen et al. 1971, 185-6, EXT).

Very similar keys to 3666 in terms of size and form come from a late 9th-10th century context at Goltho (Goodall 1987, 183, fig.158, 111) and from the PK Bank site in Lund (Mårtensson 1976, 402, fig.358). Other barrel padlock keys with bits in line with the stem are also known from sites in Scandinavia of the 9th-11th centuries, including Trelleborg (Nørlund 1948, pl.22, 4) and the Thule site in Lund (Blomquist and Mårtensson 1963, fig.120-1) but, like box padlock keys, they do not appear to occur before this period. It is possible, therefore, that both the barrel and box padlock with the T-shaped slot may be innovations of roughly the same time, perhaps the early 9th century.

Box Padlock Keys

Although box padlocks are known from from 9th-11th century contexts, including Hungate, York (Richardson 1959, 82-3, fig.18, 4), they are uncommon and so are the keys. There is a probable box padlock key of copper alloy from the Anglian monastery at Whitby (Peers and Radford 1943, fig.17, 1) but, apart from the Coppergate examples, I know of no other box padlock keys of 9th-11th century date from Britain, although there are a number of Viking Age examples from Scandinavian sites including Birka (Arbman 1940, Taf.274, fig. 3), from where there is one very similar to 3673 in terms of bit, ward cut pattern and stem form. The same ward cut pattern also exists on a key from Trelleborg (Nørlund 1948, pl.22, 3) and the stem form on two keys from Århus (Andersen et al. 1971, 186-7, EQA and DLK) and one from Fyrkat (Roesdahl 1977, 27-8, fig.20b). A 16-22 Coppergate key from a medieval context (sf1911; Cat.

Fig.35) is also similar; it has spirally-twisted convex strips running from the base to the top of the stem and is tinned. Sf1911 is therefore very likely to be 9th or 10th century and residual in its context.

OBJECTS for HEATING and LIGHTING

6.3.65 Candle Holders

Socketed candle holder 3675 may be compared with one of similar date from North Elmham (Goodall 1980a, 514, fig.267, 92). I know of no parallel for 3676 with its roughly-shaped bowl. I know of no other prickets of the 9th-11th centuries, although they become more common in contexts of the 12th century and later.

6.3.66 Strike-a-lights

3681-2 are very similar to a strike-a-light, also, like 3681, with a pierced shank, from an 11th century context at Thetford (I.Goodall 1984, 95, fig.133, 197).

Strike-a-lights very closely comparable in size and form to 3684 are relatively common on Scandinavian sites of the 9th-11th centuries. There are examples from Birka (Arbman 1940, Taf.144, 4-7), Århus (Andersen et al. 1971, 141, EXQ) and Kaupang (Blindheim et al. 1981, 218, pl.71, f4).

DRESS FITTINGS and RIDING EQUIPMENT

6.3.67 Buckles

Iron D-shaped buckles, many of which, like those from Coppergate, have slightly flattened and widened curved sides and a scarf joint on the straight side, are common finds from sites of the mid 9th-11th century. They are frequently found in Scandinavian Viking Age graves as part of either bridles or riding equipment, usually spurs. Examples of various sizes come from Birka (Arbman 1940, Taf.22 and Taf.26, 3), three of which have grooves on the curved side and appear to be plated; Süderbrarup (Aner 1952, 65, 70-1, Abb.3, 2-3; Abb.9, 5, 9-10; Abb. 10, 2-3, 5-6); the Ladby ship (Thorvildsen 1957, fig.59, 142, 363, 607, 611) and the Hedeby ship burial (Müller- Wille 1976a, 84-90, 109, Abb.43, 4-7).

D-shaped buckles also occur in settlement contexts of the period both in England, at Thetford (I.Goodall 1984, 98, fig.137, 235-40), and in Scandinavia, at Trelleborg (Nørlund 1948, pl.35, 1-3, 5) and Hedeby (Müller-Wille 1973, 32, Abb.7, 2). Three small D-shaped buckles associated with a buckle-plate and strap-guide come from 10th century contexts at Århus (Andersen et al. 1971, 215-7, EKR, EKS and EVX) and there is an example of a similar combination from Northampton, with punched decoration on the curved side (Goodall 1979b, 273, fig.121, 121).

Buckle frames whose sides are straight and ends are convex are, like those with oval frames, hard to find elsewhere. Rectangular frames are not as common as D-shaped frames in 9th-11th century contexts, but examples occur at Thetford (I.Goodall 1984, 98, fig.137, 241-2), Hedeby (Müller-Wille 1973, 32, Abb.7, 3) and Fyrkat (Roesdahl 1977, 32-3, fig.26c).

The five-sided buckle frame (3738) comes from a Period 4B (mid 10th century) context, but is similar to a frame from 6-8 Pavement, York (MacGregor 1982, 87-8, fig.46, 417) dated to the late 9th century.

6.3.68 Buckle-plates

Small buckle-plates made from folded plates in iron and non-ferrous metal are common finds in 9th-11th century contexts in Britain and Scandinavia. In addition to those from Coppergate, three examples with different forms have been found on spurs from elsewhere in York (Waterman 1959, 76, 104, fig.8, 6-7; fig.25, 8) including one which is rectangular with grooves cut in the inner end and one which has the triangular notch and rounded corners at the inner end very similar to 3754, 3762, 3826 and 3834. Other examples come from Cheddar (Goodall 1979a, 271, fig.91, 19) and Northampton (Goodall 1979b, 273, fig.121, 121). A rather more decorative variant with punched impressions in the sides, a pattern not directly paralleled at York, and again associated with a spur terminal comes from Cheddar (Goodall 1979a, 270-1, fig. 91, 56).

The members of the distinctive group of buckle-plates which are relatively elongated with opposing triangular ends appear to be almost unique to Coppergate. Possibly the only close parallel for these very distinctive objects is a copper alloy example from Ardskinish (Grieg 1940, 61, fig.34). A group of six bow brooches from Birka, however, made in both iron and copper alloy are also similar in form in having relief work panels between two triangular ends (Arbman 1940, Taf.57, 1-6; Arrhenius 1984, 39-44) and a similarly shaped group of five copper alloy fittings was found in a grave in Västmanland, Sweden (Simonsson 1969, 73, fig.5).

6.3.69 Strap-guides

Strap-guides of the 9th-11th centuries are more usually found in non-ferrous metal than iron but I know of a small group of iron comparanda for the nine examples from Coppergate.

10th-11th century strap-guides of the bi-lobate form come from Flaxengate, Lincoln (Fe75, 2552), attached to a spur from Northampton (Goodall 1979b, 273, fig.121, 121) and associated with a buckle and buckle-plate from the Ladby ship (Thorvildsen 1957, 65, fig.56, 622).

The strap-guide associated with spur 3832 which is domed and roughly oval with a relief saltire cross on the surface is similar to a 10th century strap-guide from Århus (Andersen et al. 1971, 216, EVX). The cross motif in rather more elaborate form can also be seen on two domed copper alloy strap-guides from the burial at Balladoole, Isle of Man (Bersu and Wilson 1966, 36-7, pl. 7)

A strap-guide (sf5010; Cat. Fig.37) from a medieval context at Coppergate should also be noted at this point. Since it resembles strap-end 3789 in its decorative relief treatment it is probably Anglo-Scandinavian in origin.

6.3.66 Strap-ends

I know of no close parallels from other sites of the 9th-11th century for the five iron strap-ends from Coppergate. The method of manufacture which involves welding two strips together, leaving one end open to grip the strap, can, however, be seen on iron strap-ends of middle Anglo-Saxon date from Ramsbury (Evison 1980, fig.20, 6) and Hamwic, Six Dials (SOU15 sf008; SOU31 sf150). The Ramsbury example is inlaid with silver and has a very simplified animal head form and those from Hamwic are plated with non-ferrous metal. Non-ferrous strap-ends of the middle and later Anglo-Saxon period were also made to grip the strap in the same way and animal head designs can frequently be seen on them. Of particular interest here, however, is a lead alloy strap-end from 16-22 Coppergate (sf7306; Hall 1984, 103, fig.119) which has an interlace pattern on the principal field, but an animal head terminal similar to 3790-1, the most striking feature being a raised strip across it with diagonal notches cut into it exactly comparable to 3790 and to that on the head of strap-guide 3780. This lead alloy specimen is, like the two made in iron, probably a product of the site workshops. A small 9th century bronze strap-end from York should also be noted (Wilson 1964b, pl.19b). It has a very simplified animal head at the tip which is again somewhat similar to those on 3790-1.

6.3.71 Riveted Dress Fittings

There are no obvious parallels from other sites for 3795-6, although their form is comparable to that of some of buckle-plates from Coppergate (3.68) and also to the buckle-plate from Ardskinish, the fittings from Västmanland, Sweden and the brooches from Birka referred to above (6.3.68).

6.3.72 Clip

I know of no parallel for this object.

6.3.73 Pins

Pins with spherical heads originate in the middle Anglo-Saxon period, possibly in the 6th century (MacGregor 1982, 92), and appear to remain current until the 10th; iron examples are, however, rare. A specimen with a non-ferrous head, however, comes from a middle Anglo-Saxon context at Wicken Bonhunt (sf375).

Polyhedral headed pins, often with ring-and-dot patterns, are well known in the middle Anglo-Saxon period. They also occur in Anglo-Scandinavian contexts at 16-22 Coppergate and two others from York were recorded by Waterman (1959, 78, fig.11, 7, 12), but I know of no other iron examples.

The ringed pin (3802) falls into one of the most common types identified by Fanning (1983, 330) which, he suggests, were developed in Ireland in pre-Viking times and adopted by the Norse invaders. Ringed pins of the 9th- 11th centuries are usually non-ferrous, but iron examples are known from other sites in northern Europe. One other tinned iron specimen has been found in York at All Saints Pavement (Tweddle 1986, 229, fig.101, 1233), but all the remaining examples from York are non-ferrous and include four from 16-22 Coppergate (Roesdahl et al. 1981, 126, YTC10, 12; Hall 1984, 104, fig.120a-b) and two recorded by Waterman (1959, fig.11, 13-14). Another iron example, of very simple form and apparently unplated, was found at North Elmham (Goodall 1980a, 516, fig.267, 118). There are also numerous iron examples from Ireland from, for example, Lough Gur Crannog (O'Riordain 1949, fig.10; fig.21, 111-2) which for the most part appear to have the simple head and ring form seen on 3802. Finally, three of the Birka ringed pins are made of iron (Arbman 1940, Taf.45, 3-5; 1943, 16, 136, 205), one of which is recorded as plated.

I know of no close parallels for the remainder of the iron pins from Coppergate.

6.3.74 Armlets

I know of no iron armlets comparable to the Coppergate examples from other 9th-11th century contexts.

6.3.75 Dress Hooks

Similar fittings to the dress hooks from Coppergate are known from other sites of the 7th-11th century, but are usually made of non-ferrous metal. A number of triangular examples are known which can be assigned to the 9th-10th century on the basis of their context including examples from 16-22 Coppergate (Hall 1984, 104, fig.120b), 6-8 Pavement, York (MacGregor 1982, 87-8, fig.46, 450). Two plain iron examples of the period have been found at Flaxengate, Lincoln (F75, Fe1969; F75, Fe1699) along with probable blanks and others in copper alloy which, it is suggested, were manufactured on the site (Perring 1981, 41).

6.3.76 Looped-eye dress fittings

I know of no close parallels for the three small examples from Coppergate (3823-5) except for the the small copper alloy buckle from Whitby (Peers and Radford 1943, fig.12, 17) refrred to in 3.76.

6.3.77 Spurs

Straight arms on spurs are typical from the 8th to, perhaps, the early 12th century when they begin to curve downwards to fit under the wearer's ankle bone.

The triangular cross-sections on the arms of 3826 and 3836 and the D-shaped cross-sections on those of 3834, 3828 and 3832 appear to be common on spurs of 10th-11th century date, but I know of no parallels for the octagonal cross-section of the arms of 3827. The projecting bosses on 3834 may be compared with those on three other spurs from York (Waterman 1959, fig.8, 5-7). Incised grooves and relief panels comparable in general terms to those on the arms of 3826, 3836 and 3838 are common on spurs of the 10th-11th century. The closest parallels to 3826 and 3836 in this respect come from Thetford (Ellis 1984, 101-2, 104, fig.140, 267), London (Rhodes 1975, fig. 12, 142) and Birka (Arbman 1940, Taf.38, 1a, 4a).

The usual terminal form with a central slot corresponds, in general terms, to LMMC type c(i) but close parallels may be found on other York spurs (Waterman 1959, 76, 104, fig.8, 5-7; fig. 25, 8) and on spurs from Cheddar (Ellis 1979, 270-1, fig.91, 56), Northampton (Goodall 1979b, 273, fig.121, 120), Norwich (Jope 1949-52, fig.14, 3), Flaxengate, Lincoln (F74, Fe1108; F75, Fe2545;) and Thetford (Ellis 1984, 102, fig.140, 266-270). Petersen (1951, fig.35) also illustrates a spur with this terminal form from Norway. Numerous other terminal forms are known from the 9th-11th century, but they usually involve riveting directly on to the leathers rather than employing a buckle-plate articulated in the slot. I suggest that the distribution of the slotted form may indicate a regional tradition as, apart from the Cheddar and Norwegian examples, it appears to be concentrated on sites on the eastern side of England.

The surviving terminal of 3836 is rather different from the others as it takes the form of an outward curving oval loop. The only parallel that I know of for this on a British spur comes from a grave from Harling, Norfolk (Rogerson forthcoming). Similar loops, however, appear, albeit inward curving, on spurs of 8th-9th century date from central and south Germany (Stein 1968, fig.4, 3-4; Koch 1982, 65) and on a spur of the same period from Bendorf, Schleswig-Holstein (Gabriel 1981, 246, Abb.2). The goad of 3836 also suggests an early date as it is relatively short, has a rounded cross-section and has three grooves running around the base. The goad of 3838 is very similar but without the grooves. This form corresponds to LMMC type 1 and appears to be confined to 8th or 9th century spurs (Koch 1982, 68). It can be seen, for example, on a spur from Six Dials, Hamwic (SOU169, sf2184); similar goads may also be seen on 8th- 9th century German spurs (Stein 1968, fig.4, 3-4; Koch 1982), but especially comparable are those from Dunum, Lower Saxony (Schmid 1970, Abb.8, 1a, 1b) and Domburg (Capelle 1976, pl.60, 79; pl.10, 85-6). The combined evidence of terminal and goad suggests that 3836 may be a spur rather earlier than the others from Coppergate, probably 9th century.

The remainder of the necks and goads are more readily comparable to other English examples of the 10th-11th centuries. The two bi-conical elements on the necks and goads of 3832 and 3834 can be seen on another York spur (Waterman 1959, 76, fig. 8, 5), and possibly on a spur from Thetford (Ellis 1984, 104, fig.141, 272).

Something similar to the neck and goad of 3826, which expands slightly in the middle and has a goad which is flat and widens before stepping in to the point, can be seen on a spur from Thetford (Ellis 1984, 101, fig. 140, 269), but more comparable perhaps is a 10th century spur from Århus (Andersen et al. 1971, 213, EKP). The goads on 3827 and 3839 correspond, to some extent, to LMMC type 2, although they expand slightly before stepping in to the tip. Similar goads occur on spurs from Pavement, York (Waterman 1959, 104, fig.25, 8) and Northampton (Goodall 1979b, 273, fig.121, 120).

HORSE EQUIPMENT

6.3.78 Bits

The simple double-eyed snaffle links from Coppergate correspond in general terms to LMMC type 2 dated to the "early-medieval" period and they can be seen on complete or near complete snaffle bits of middle Anglo- Saxon date from Thwing (sf87.192, sf87.194) and Wicken Bonhunt (sf 381). 10th-11th century examples have been found at Thetford (I.Goodall 1984, 100, fig. 138, 253, 255-7). Tri-partite bits with mouthpiece links comparable to 3844 appear to be an innovation of the late 9th or 10th century and are well known in Scandinavia in, for example, the Ladby ship (Thorvildsen 1957, 58-65, 70-1, figs. 42, 47, 51), graves at Thumby-Bienebek (Müller-Wille 1987, Tafn. 74-5, 93) and graves in Norway (Petersen 1951, figs. 14, 16, 18-9). In England they are rare, but there are complete examples from York and Winchester (Waterman 1959, 74-5, fig.8, 1-2) and cheek pieces come from Thetford (I.Goodall 1984, fig.138, 249-52; Ottaway and Goodall forthcoming, sfs15, 189, 259A).

I know of no direct parallel for cheek piece 3848 but 'bar bit' cheekpieces with two opposing projections from a ring are known from other 9th-11th century sites. LMMC designates them type B and notes that they occur in Scandinavia from the 9th century onwards. Examples from Britain were found in the burials at Hesket, Cumbria (Cowen 1934, 178) and Balladoole, Isle of Man (Bersu and Wilson 1966, 19-20, fig.11), both dated to the 9th - 10th century.

Bridle attachment link 3849 is directly comparable to examples on tri-partite bits from Winchester (Waterman 1959, 75, fig.8, 2) and from a Viking grave near Rouen, northern France (Arbman 1961, pl.36) which both have the domed protrusion. Similar links also exist as part of another bit from York (Waterman 1959, fig.8, 1) and as part of bits from Thumby-Bienebek (Müller-Wille 1987, Taf.75) and Norway (Petersen 1951, fig.19). Links with the same function, but different form come from Goltho (Goodall 1987, 184, fig.160, 160-1).

Also relevant to the subject of bridle fittings is sf1143 from a 12th century context at Coppergate (Cat. Fig.39). It is a tinned mount with double grooves arranged as chevrons, which is looped over at its head and linked to a small triangular plate with a stud projecting from one face. The stud would have attached the object to a leather bridle strap hanging down from the bridle attachment link as is shown by a comparable object from Bridle 1 in Kammergrab 37 at Thumby-Bienebek (Müller-Wille 1987, Taf.81, 16-7).

6.3.79 Horseshoes

All the 16-22 Coppergate Anglo-Scandinavian horseshoes and all but nine horseshoe nails date to the late 10th or eleventh centuries (5.7.2).

The dating and nature of the 16-22 Coppergate material is important because the form of the pre-Norman horseshoe has been the subject of some debate, most of it without the advantage of sound archaeological evidence (MacGregor 1982, 83). Recently Clark (1986, 2) has characterised pre-Norman horseshoes as having, compared to later examples, relatively wide and thin branches and large rectangular countersinkings for the nails; this can cause the outer sides to be slightly wavy although they are often smooth. This appears to be largely confirmed by the 16-22 Coppergate material. The earliest British horseshoe of the post-Roman period that I know of is, however, not referred to by Clark. It was excavated in a middle Anglo- Saxon context at Wicken Bonhunt (sf437); it has smooth outer sides, but the holes are not countersunk.

Other horseshoes from pre-Norman contexts include those from an Anglo-Scandinavian context at 6-8 Pavement, York (MacGregor 1982, 83-4, fig.44, 437), the Ironmonger Lane and Milk Street sites in London (D.U.A. sf153 and sf222), Portchester Castle (Hinton and Welch 1976, 197, fig.131, 9), Cheddar (Goodall 1979a, 267, fig.91, 7, 94) and Flaxengate, Lincoln (F75, Fe1574); they all have smooth, or roughly smooth, outer sides and roughly rectangular countersunk holes.

Although relatively few horseshoes can be dated to the pre-Norman period, large numbers have been found on sites of the later 11th and 12th centuries. The archaeological evidence therefore appears to be that widespread shoeing of horses was an innovation of the Norman period. The form of the Norman horseshoe is characterised by its pronounced wavy outer sides which is largely the result of the use of narrower, if thicker, iron bars than had been usual previously, and narrower more elongated countersinkings (Clark 1986, 2). It is possible, however, in view of the form of 3851 from 16-22 Coppergate that these features had begun to emerge in the first half of the eleventh century.

WEAPONS

6.3.80 Arrowheads

Leaf-shaped arrowheads comparable to the group from 16-22 Coppergate are very uncommon in Britain, although a pair of tanged examples from York were recorded by Waterman (1959, 72-3, fig.5, 9). Other tanged examples have been found in a 10th-11th century contexts at Carlisle Cathedral (unpublished sf270), in the Viking grave at Sonning, Berkshire (Evison 1969, 333, 343, fig.1, g-k), at Walton, Buckinghamshire (Farley 1976, 248-9, fig.39, 6) and at St. Martin-at-Palace-Plain, Norwich (Williams 1988, fig.59, 21). Two socketed examples come from Thetford (I.Goodall 1984, 105, fig.144, 298; Goodall and Ottaway forthcoming sf17). By contrast, the form, almost exclusively tanged, occurs in large numbers in Scandinavia in both the Vendel and Viking periods. Large collections come, for example, from Birka (Arbman 1940, Taf.10-11; Wegraeus 1986) and Trelleborg (Nørlund 1948, pl.41-2).

Although the basic leaf-shaped blade form is common, there are no parallels for the pairs of sloping ridges on 3922 from Coppergate, and the only blade with ridges and panels comparable to 3912 and 3925 is that from York recorded by Waterman (1959, 72-3, fig.5, 9). It may therefore be that these arrowheads represent distinctive local variants of the leaf-shaped form.

The unusually slim arrowhead 3916 is similar to a number from Trelleborg (Nørlund 1948, pl.42-3).

The relatively thick blade 3926, whose cross-section in the centre is hexagonal, can be paralleled by a tanged arrowhead from Norway (Rygh 1885, no.536) and two from 10th century contexts at Århus (Andersen and Madsen 1985, 79-80, fig.55, AFB, PZ). The blade of 3918 is, as noted in 3.80, similar to Wegraeus type D2 (1972, fig.4, 4; 1986, 22-3, Abb.4, 2), but otherwise I know of no exact parallels.

The two small socketed arrowheads 3919 and 3921 are similar to examples from 10th-11th century contexts at St.Neots (Addyman 1973, 93, fig.19, 9), Thetford (Goodall 1984, 105, fig. 144, 299-301) and Trelleborg (Nørlund, 1948, pl.43, 7).

In the present state of knowledge it is difficult to trace the development of arrowhead form in Britain in the post-Roman period. It is possible, however, that there was something of an abrupt change in the later 9th century with the introduction of the leaf-shaped form as I know of no examples from England which come from earlier contexts, although early and middle Anglo-Saxon arrowheads are very scarce (Manley 1985). In the later 11th century there also appear to be abrupt changes. One new form is relatively short with pronounced shoulders at the base of the essentially triangular blade (LMMC type 1) and another is elongated and tapering, presumably developed for warfare. Both forms are socketed. The former occur on Norman occupation sites, including 16-22 Coppergate, and the latter are more common on castle sites.

6.3.81 Spearheads

Small spearheads similar to 3931 are rare, but there is another from Red Castle, Thetford (Knocker 1967, fig.13, 7).

6.3.82 Swords

The tri-lobate pommel-knop 3943 belonged to a Petersen (1919) type L sword of which one feature is the composite pommel. Type L swords date to the 9th or early 10th century and are relatively common in eastern England and examples with similar tri-lobate pommels to 3943, with applied non-ferrous decoration intact, have been found on swords from Fiskerton, Norwich, Wensley, (Wilson 1965b, pls.2c, 3a, 6b, 7a) and Gilling (Watkin 1986). Others have, however, been found in the south (Evison 1969, fig.1, e-f) and also in Norway (Rygh 1885, no.505) and the Netherlands (Bjørn and Shetelig 1940, 124, fig.82) where they are thought to be English imports.

Although it comes from a composite pommel, 3937 does not have the usual tri-lobate form of the type L pommel. It resembles, to some extent, the non-composite semi-circular pommels on two type X swords from York (Waterman 1959, 71-2, fig. 5, 1-2) dated to 10th or early 11th century. 3940 is again very much akin to the type X pommel on the York swords (ibid.).

Straight lentoid guards, like 3941, can be seen on a number of 9th-10th century swords from Britain and Scandinavia, although British swords of the period commonly have the curved guard of the Petersen type L sword. There is, however, a guard very similar in form to 3941 on a Petersen type H sword from the Sonning, burial (Evison 1969, 330, 343, fig.1, a-b) dated to the 10th century.

The incomplete straight guard 3934 was probably similar to the plain guards appearing on the two type X swords from York referred to above.

The blade fragments have no diagnostic features.

6.3.83 Caltrop

I know of no comparable objects to 3944 from the Anglo-Scandinavian period and it may be residual Roman.

6.4 Comparison across class boundaries

In Chapter 4 I described the formal and metallographic features which underlie the Coppergate ironwork and looked at their occurrence across class boundaries. On studying the comparative material described above it was clear that these features were equally current elsewhere suggesting that in many ways the working methods of smiths practice varied little from place to place in Britain and north-west Europe.

Devices to deal with more specialist practical requirements were also widely known as can be seen by discussion under various headings above. It remains, however, to consider, firstly, some of the less obviously practical aspects of formal variability which fall under the general heading of surface treatment, and, secondly, aspects of metallographic structure.

6.4.1 Surface Treatment: relief work

The use of relief work is well known on iron objects from sites contemporary with 16-22 Coppergate and there is a list of examples from Britain and elsewhere in Appendix 9. These objects show that, as at Coppergate, there is a relatively restricted range of formal units and motifs; the extent of the smiths' expression being restricted by the nature of his material and tools (4.4). Grooves, impressed dots, punched notches and very simple three-dimensional mouldings prevail. More complex motifs comparable to the simplified animal heads from Coppergate are much rarer. The location of relief motifs is again similar on comparative objects, occurring primarily on visible surfaces and at the limits of components or the junctions between them. The range of object classes on which relief work occurs is also very comparable to

Coppergate: small fittings, presumably for boxes, caskets and similar objects; dress fittings; spurs and keys were particularly favoured. Surface treatment of locks, in the form of applied strips, is also common. Relief work on tools and implements, except for knives (6.3.30.4), is again very rare.

In 4.4 I suggested that close similarities between objects from 16-22 Coppergate indicated that certain relief motifs were peculiar to smiths in York. This impression is strengthened by the evidence of other objects from York, especially the spurs published by Waterman (1959, fig.8, 5-7) which have bosses so similar to those on the arms of 3834. It is also apparent that motifs referred to in 4.4, such as the animal heads, fine lines along the perimeter of objects and chevrons or saltires picked out in double grooves, do not occur, or only very rarely occur, on objects elsewhere. Since there are no other assemblages of the 9th-11th century which have the numbers of iron objects with surface treatment that 16-22 Coppergate has, except perhaps Birka, it is difficult to identify 'style centres' elsewhere, although they doubtless existed. Equally, it is difficult, at present, to assess the development of the use of relief work on iron objects over time on the basis of the relatively small body of comparable data available. It is striking, however, that early and middle Anglo-Saxon sites in Britain have as yet produced few examples of relief work on iron, although doubtless more will come to light, especially from Hamwic when the finds are fully conserved and studied. In conclusion, the impression that the data create at present is that there was an increase in the use of relief work on iron objects in the 10th century and that it remained popular into the 11th and beyond.

6.4.2 Surface treatment: Non-ferrous plating

Similar patterns in the use of non-ferrous plating to those identified at 16-22 Coppergate (4.5) appear in the material from elsewhere and in Appendix 10 there is a list of examples. Plating is, however, probably more widespread than has been hitherto suspected partly because X-radiography has not been used regularly, although plating can sometimes be identified on the basis of visual inspection

The occurrence of plating elsewhere again corresponds closely to the Coppergate pattern, with small fittings from boxes, keys and locks, dress fittings and spurs being especially favoured. Perhaps the only unusual plated object is the harbick from Goltho which was probably treated to prevent iron corrosion marking the cloth which it would have held during shearing. The high degree of correlation of plating with surface treatment is again apparent, as is, up to a point, the correlation of the two main plating media with certain classes of object. Tin was preferred for box or chest fittings, dress fittings and spurs, and copper alloy for bells and locks for which it also served as a solder.

The development of the plating of iron, as opposed to non-ferrous metal, before the late Anglo-Saxon period is not well understood. The use of copper alloy brazing is known on bells and locks of the Roman period and again occurs in the early Anglo-Saxon period (6.3.29), but I cannot find securely dated examples of tin-plated iron before the 8th century. The Hamwic and Thwing finds are therefore of great interest as they appear to show that iron tinning was a well-developed craft process in the 8th-9th centuries, but one without obvious antecedents. By the 10th-11th centuries plating is obviously widespread.

6.4.3 Metallographic Structure

(Tables 6.11, 6.12)

There seems little doubt that in metallographic terms the quality of Roman ironwork was generally poor (Tylecote 1986, 177, Tylecote and Gilmour 1986, 50), although the principal techniques of smithing in terms of the introduction of carbon to iron and manipulating the properties of iron and steel were known, if not widely used.

Table 6.11 Early - middle Anglo-Saxon iron objects from Britain examined metallographically

Site and reference	Date	Description
Barham Down, Kent (Tylecote and Gilmour 1986, 124-9)	6th-8th	Sax
Clifton-on-Trent (Tylecote 1986, 196)	?7-8th	Spearhead
Ely Fields (Maryon 1948; Tylecote 1986, 195, table 95)	6-7th	Sword
Mote of Mark (Swindells and Laing 1980)	5th	3 Bars
Polhill, Kent (Cox 1973)	7th	2 Knives
Poundbury, Dorset (Tylecote and Gilmour 1986, 37-41; Tylecote 1987)	?6th-7th	5 Knives
Ramsbury, Wilts (Tylecote et al. 1980)	8th-9th	Knife, 2 Awls, 2 Drawknives, Pot hook, Nail, Clench Bolt
Reading (Coghlan 1956, 93)	6-7th	Axe
Tamworth (Trent 1975)	8th-9th	Mill bearing
West Stow (Tylecote and Gilmour 1986, 42)	5th-7th	5 Knives
Various sites: (Tylecote and Gilmour 1986 148-254)	5th-9th	23 swords
(Härke and Salter 1984)	5th	3 Shield Bosses

Table 6.12 Mid 9th-11th century iron objects from Britain examined metallographically

Site and reference	Date	Description
Canterbury (Wall forthcoming)	LS	5 Knives
Crayke (Coghlan 1956, 94-6)	LS	Socketed gouge
Stratford, Essex (Coghlan 1956, 94, 124)	late 9th	Axe
Kempsford (Tylecote and Gilmour 1986, 59-65)	LS	Axe
Kempsford (Tylecote and Gilmour 1986, 113-23)	LS	3 Spearheads
Lincoln, Canwick Common (Lang and Williams 1975, 205-7)	9th-10th	Sword
Lincoln, river Witham (Maryon 1950)	LS	Sword
London, Westminster (Anstee and Biek 1961)	LS	Sword
Reading (Coghlan 1956, 94)	LS	Spearhead
Thetford (McDonnell unpublished a)	LS	Spearhead
Winchester (Tylecote and Gilmour 1986, 44-50, 59-65 74-5; Tylecote forthcoming)	9th-11th	8 Knives, Axe, Spade shoe
York: 16-22 Coppergate (see Appendix 2; McDonnell forthcoming)	mid 9th -11th	94 objects
Midland Bank (Black 1986)	11th	Axe
Various sites (Tylecote and Gilmour 1986)	9th-11th	5 Saxes, 10 swords

Table 6.13 Details of 5th-11th century bladed tools other than knives examined metallographically from sites in England other than 16-22 Coppergate

Abbreviations:
Met. = Metallographic macro-structure form (see 3.30.8)
CE hv = Cutting edge maximum Vicker's hardness (see 1.7)
QT = quenched and tempered (no or yes)

Site	Object	Date	Met.	CE Hv	QT
Reading	Axe	ES	3	154-165	n
Ramsbury no.17	Drawknife	MS	2	740	y
" no.18	Drawknife	MS	0	312	y?
Crayke	Socketed gouge	LS	3	870	y
Stratford	Axe	LS	4	450	y
Kempsford	Axe	LS	2	483	y
Winchester	Axe	LS	1c	390	y
York, Midland Bank	Axe	LS	1c	481	y

References:
Crayke : Coghlan 1956, 94-5; Tylecote 1986, 198

Kempsford : Tylecote and Gilmour 1986, 59-65

Ramsbury : Tylecote et al. 1980

Reading : Coghlan 1956, 93

Stratford : Coghlan 1956, 94, 124

Winchester : Tylecote and Gilmour 1986, 59; Tylecote forthcoming

York, Midland Bank : Black 1986

In general terms the story of the post-Roman period is one of a gradual spread of sophisticated techniques and a general raising of standards, although little is known of the metallography of iron in the earliest Anglo-Saxon period in Britain. The three shield bosses examined by Härke and Salter (1984) provided relatively little information on the level of smithing capabilities as no attempt had been made to harden them in any way, but the bars from the Mote of Mark (Swindells and Laing 1980) showed some evidence for knowledge of carburisation. The sample of material available from probable 6th-7th century contexts is again small but includes both swords and a few knives. Tylecote (1986, 199) suggests that the standard was higher in terms of blade hardness at this time than in the Roman period, but appreciation of the properties of the material and application of sophisticated techniques, including efficient quenching and tempering, appears to have been variable. Two of the Poundbury knives were clearly of high quality as was the Barham Down sax. By contrast, lack of technical understanding was demonstrated by one of the Polhill knives which, although it had been quenched, contained little carbon rendering this a useless exercise. Another poor tool was the axe from the Kennet at Reading. It had a piled structure and the smith had been quite successful at carburising it, but the edge has lost most of its carbon as a result of cold-hammering in a mistaken attempt to harden it.

Good evidence to support Tylecote's assertion of an improvement in the level of achievement before c.700 may be found in weapons. Eighteen out of twenty-two 5th-7th century swords examined by Tylecote and Gilmour (1986, 148-242) and those from Sutton Hoo and Ely Fields (Maryon 1948; Tylecote 1986, 193), were pattern-welded. Although predominantly ferritic iron, they indicated skilled production and good knowledge of materials. The cutting edges, butt-welded to the pattern-welded core, were not necessarily particularly hard, however, since they had not usually been quenched, although their carbon content was probably too low for this to have been effective.

In the middle Anglo-Saxon period in Britain, the quality of blades appears to be almost uniformly high. As far as knives are concerned, however, this impression is based almost entirely on the metallography of specimens from Hamwic (McDonnell 1989; unpublished b-c; 6.3.30.6). The quality of the Hamwic blades is indicated by their hardness values which result from efficient quenching and tempering. From X-radiography I have also identified an example of pattern welding on a knife from Hamwic which, as I noted in 6.3.30.5 is the earliest example I know of on a blade of relatively small size. Throughout Europe the 8th, 9th and early

10th centuries were the heyday of pattern-welding (Tylecote 1986, 194; Ypey 1980, 1983) and in Table 6.14 there is a list of examples from Britain. Many pattern-welded weapons, including, for example, the Dorestad sword (Ypey 1980, 202-3), were also of good quality in terms of the homogeneity and carbon content of the metal.

Analysis of the 16-22 Coppergate material has demonstrated that the quality of edged tools, especially knives, which appears to have been reached in the middle Anglo-Saxon period, was maintained between the later 9th and 11th centuries. Efficient heat treatment of iron, including quenching and tempering, was widespread and resulted in some very high hardnesses, although some failures still occurred.

Table 6.14 Middle and Late Anglo-Saxon pattern-welded iron objects from Britain (See also Table 6.5)

Knife and sax blade back form in brackets

Site and reference	Date	Object
Dorset (Tylecote and Gilmour 1986, 140-4)	LS	Knife (A2)
Hamwic, Six Dials SOU31.670	8th-9th	Knife (A2)
Hurbuck Wilson 1964a (135-6, pl.19, 22)	LS	Sax (I)
Keen Edge Ferry (Evison 1964)	LS	Sax (Ai)
Kempsford (Tylecote and Gilmour 1986, 121-3)	LS	Spearhead
Kempsford (Tylecote and Gilmour 1986, 137-40)	LS	Knife (A2)
Kentmere, Cumbria (Tylecote 1986, 196)	LS	Spearhead
Lincoln, river Witham (found 1848; Maryon 1950)	LS	Sword
Lincoln, river Witham (found 1954; Tylecote 1986, 195)	LS	Sword
Little Bealings, Suffolk (Evison 1964, 32)	LS	Sax (I)
London, Pudding Lane (Ganiaris & Gilmour unpublished)	late 11th -early 12th	Knife (A2c)
London, Thames at Brentford Museum of London A.24419 (Tylecote and Gilmour 1986, 234-6)	LS	Sword
London, Thames at Hampton (Tylecote and Gilmour 1986, 135-7)	LS	Knife (A2)

Table 6.14 continued

Site and reference	Date	Object
London, Westminster (Anstee and Biek 1961)	LS	Sword
Malton (Yorkshire Museum Accession no. 1986.27)	LS	Spearhead
Northampton, St.Peter's Street (Goodall 1979b, fig.118, 32)	LS	Spearhead
Peel Castle, Isle of Man (Graham-Campbell forthcoming)	10th	Knife (A1)
Reading, Thames (Tylecote and Gilmour 1986, 134-5)	LS	Sax
Repton sf3628	late 9th	Sax (A2)
Skerne (Humberside Co. Council undated)	LS	Sword
Strathspey, Elgin (Brøgger 1930, 199-201)	early 9th	Sword
Thetford (I.Goodall 1984, 83, no.103a)	LS	Knife (A2)
Thetford (Gilmour 1984, fig. 145, 305)	LS	Sword
Thetford (Ottaway and Goodall forthcoming sf261; McDonnell unpublished a)	LS	Spearhead
Windsor, Thames (B.M. 1929,2-6,1; Tylecote 1986, 195, table 95)	LS	Sword
York, 16-22 Coppergate:		
2756	late 9th	Knife (A1)
2892	late 10th-11th	Knife (A2)

The examination of knives at Coppergate and elsewhere has provided evidence both for high quality work and for a greater diversity of metallographic structures in the 10th century with the widespread use of the sandwich-welded cutting edge (6.3.30.6) an important innovation. Other classes of edged tools in 10th-11th centuries were also, as a rule, manufactured to a good standard. This is, for example, the case with axes (Table 6.13). Another exceptionally fine tool was the Crayke socketed gouge or chisel (Sheppard 1939, 280) described by Tylecote (1986, 198) as: "...one of the most satisfactory pieces of early smithing and heat treatment so far found..."

In spite of the quality of tools, the peak of the smith's achievements remained the production of weapons. Tylecote and Gilmour (1986, 213-54) examined ten swords of the late Anglo-Saxon period and others are listed in Table 6.12. Pattern-welding was common, but not universal, and cutting edges were in general very hard as a result of excellent heat treatment, although poor specimens are also known including the Palace of Westminster sword and the blade from Coppergate (3936; 3.82.1).

By the end of the 10th century pattern-welding began to die out on weapons and piled, laminated structures become more popular (Lang and Williams 1975, 207) perhaps because they allowed a harder more durable blade to be manufactured.

6.6 Conclusion

The two principal and related problems which this chapter has sought to address are: 1) the degree to which the smiths' practice at 16-22 Coppergate and in 9th-11th century York is similar to that of smiths elsewhere and thus the degree of interaction which existed between the smiths of York, and, by extension, its inhabitants as a whole, and those of other geographical areas in England and north-west Europe; 2) the nature and direction of developments within the smiths' practice in York and England generally over the 9th-11th centuries. To draw conclusions on the meaning of the somewhat heterogeneous data presented above is, however, no easy task and, because of the scarcity of specimens in many object classes and the uneven distribution of sites producing ironwork, such conclusions can only be of a rather generalised nature.

The assessment of the degree of similarity between artefacts and assemblages will usually, as recognised from the earliest era of classification (2.2), rely primarily on the identification of those more specialised or formally complex manifestations of the craftsman's art which are unlikely to have been developed in more than one centre, as opposed to those adaptations of the raw material to serve more fundamental practical requirements which could potentially be achieved wherever the craft was undertaken (Renfrew 1984, 394). Secondly comparative exercises should ideally be based on some form of measurement of difference and similarity. In the case of 9th-11th century ironwork, however, the nature of the data precludes this except, perhaps, in the case of knives which are sufficiently numerous and diverse to allow some useful statistical comparisons. Nevertheless, I suggest that the detailed, if discursive, comparisons in this chapter provide evidence for a close relationship between the practice of the Anglo-Scandinavian smiths in York and elsewhere in eastern England in terms of the range of object classes and sub-classes they manufactured and in the variability within them. This is not to say that the smiths of York did not have their own individual peculiarities since 16-22 Coppergate has also provided examples of objects, such as the spoons (3.38), disc fittings (3.48) and riveted dress fittings (3.71), for which I know of no comparanda elsewhere. Certain formal features especially in the sphere of relief surface treatment may also be peculiar to York's smith (6.4.1).

Since such a substantial proportion of the 9th-11th ironwork from England comes from Coppergate, it is also possible to use the material as the basis for a brief assessment of the relationship between English and Scandinavian smithing practice which historical evidence for interaction, as a result of warfare and settlement, would suggest was particularly close at this time and a number of areas may be identified where potentially significant formal similarities exist.

In general it is difficult to use tools to examine the problem of interaction since not only are numbers of examples, at least from England, relatively small, but their forms are often simple and much of the apparent variability may be predominantly related to solving specific practical problems. As is apparent from more recent times, however, apparently humble tools such as sickles and billhooks can be used to express regional cultural identity as witnessed by ironmonger's catalogues advertising products defined by county and regional names. It may therefore be significant that the large hammer heads from Coppergate (2201; 3.3) and Goltho (Goodall 1987, fig.156, 1), and the clippers from Coppergate (2249; 3.7) are very similar to Scandinavian specimens (6.3.3; 6.3.7). Knives are potentially a source of considerable data on interaction given that they are relatively plentiful and,as I have shown in 6.3.30.7,can be shown to reveal patterning of considerable diversity and subtlety. There are, however, insufficient Scandinavian examples published to a good standard to allow a cross-North Sea comparison of the form undertaken in 6.3.30.7 in this study.

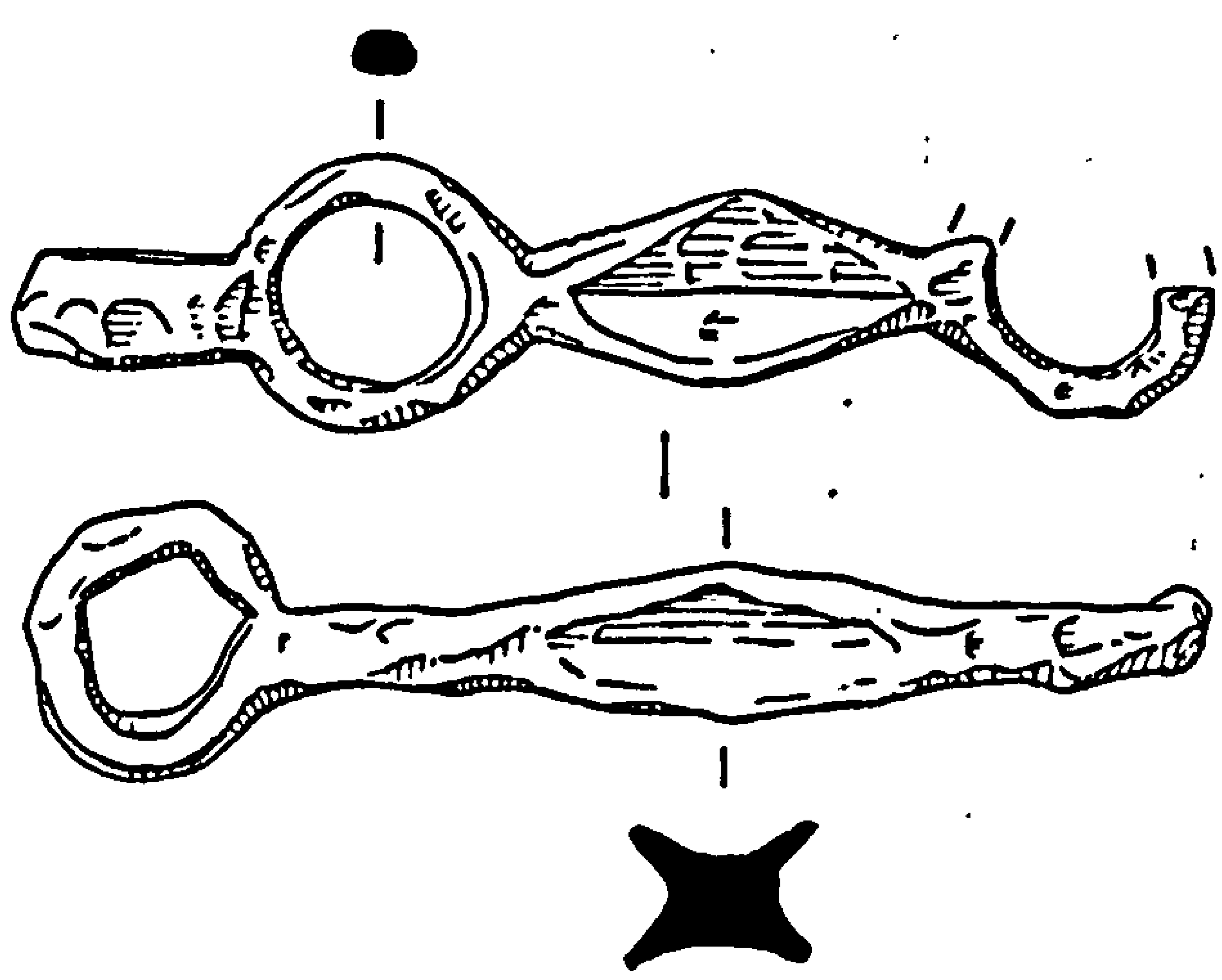
The lack of large occupation assemblages from Scandinavia and the simple form of most specimens precludes the use of the majority of structural ironwork and fittings for a study of interaction, but note may be made of the simplified animal head terminals on some small fittings (3.47), hinges (3.50.3) and stapled hasps (3.52.1) from Coppergate which, especially in the latter case find their best equivalents in Scandinavia. It is also striking that the patterns of grooves and notches decorating the hollow stem key bows at Coppergate find close parallels at Birka and Lund; although very simple features they suggest some common north European tradition of manufacture.

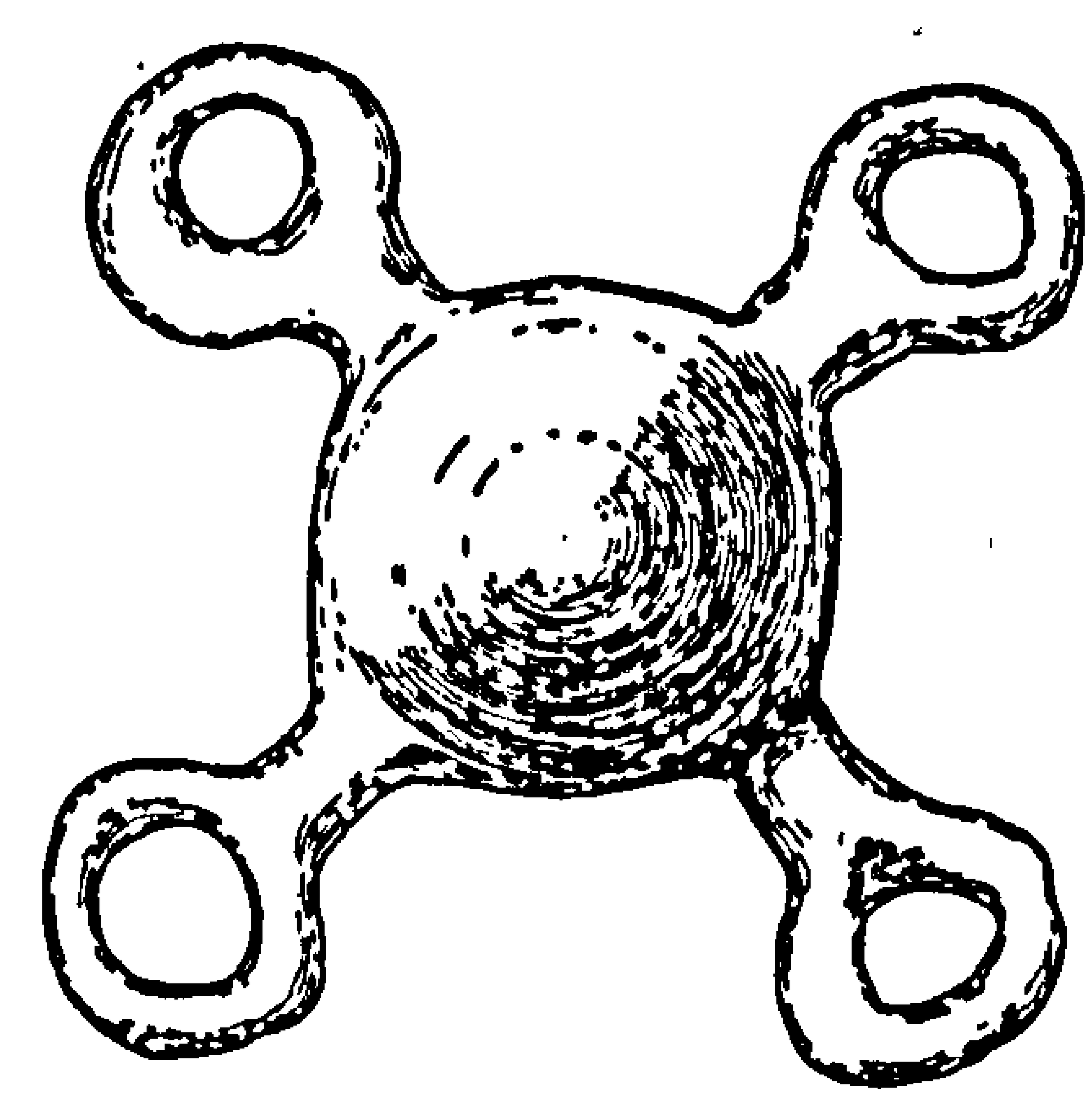
It is perhaps in the field of dress fittings and riding equipment that the greatest possibility for identifying interaction with Scandinavia lies, although in the absence of furnished burials the number of objects from England as a whole is small. Among the more striking examples of similarity between a group of Coppergate objects and one from Scandinavia is that of the unusual buckle-plates and riveted dress fittings with their opposed triangular ends separated by a relief panel (3.67; 3.71), and the bow brooches from Birka (6.3.67; 6.3.71; Arbman 1940, Taf. 57; Arrhenius 1984, 39-44). Riding equipment also gives hints of interaction across the North Sea. Snaffle link 3844 from Coppergate (3.78) is from a tri-partite bit, a form which is common in Scandinavian graves from the late 9th - early 10th century onwards. The tri-partite bit is, as noted (6.3.78), scarce in Britain, although known from complete examples, including that from York (Waterman 1959, 74-5, fig.8, 1), and from components found in York and elsewhere, notably Thetford, but it remains a possibility that it was introduced from Europe through Scandinavia. Of particular interest in this context is a snaffle link from Thetford (Ottaway and Goodall forthcoming, sf15, Fig.6.3) which has a cruciform cross-section exactly comparable to an example from Norway illustrated by Petersen (1951, fig.14) and a pair from Kammergrab 37 at Thumby-Bienebek (Müller-Wille 1987, Taf.75). The form of bridle attachment link 3849 from Coppergate can also, as implied in 6.3.78, be paralleled in Scandinavia or areas raided by the Vikings. Other bridle fittings which may indicate interaction perhaps include two unusual iron bossed-bridle fittings from Thetford (I.Goodall 1984, 100, fig.139, 262-3; Fig.6.3) for which the only close comparanda I know of come from western Sweden (Wideen 1955, 69, fig.37).

A Scandinavian origin has been claimed for the stirrup (Müller-Wille 1987, 43; Seaby and Woodfield

1980, 87), although few English examples come from securely dated archaeological contexts. By contrast, I know of no evidence for the introduction of spurs from Scandinavia and could find no closely comparable examples in Scandinavia to those from Coppergate or elsewehere in England, although the occurrence in Norway of a spur with the unusual buckle terminal so prevalent at York and Thetford may again be noted (6.3.77).

Figure 6.3 Snaffle bit link and bridle fitting from Thetford (x 1/2)





Given the success of the Viking armies it is perhaps in respect of weapons that the influence of Scandinavian smithing practice would be expected to be most apparent in England. Of particular interest in the context of the Coppergate site is the arrowhead as it has produced the largest 9th-11th century group from England. As noted in 6.3.80 the leaf shape, which predominates at Coppergate, is very scarce in Britain compared to Scandinavia and, although little is known of the middle Anglo-Saxon arrowhead, it remains a possibility that the form was introduced from Scandinavia with local smiths making their own variants. Alternatively some, at least, of the Coppergate specimens may be imports and the reference to two arrowheads recently found in Århus which are almost exactly identical to 3926 may be recalled (6.3.80).

This brief survey is intended to show that the ironwork from Coppergate, and elsewhere in eastern England, does provide some palpable evidence for interaction with Scandinavia. Determining its nature, however, poses further problems as there are numerous mechanisms which can lie behind archaeological evidence for the movement of artefact classes or artefact features across geographical and cultural boundaries ranging from peaceful acculturation and gift exchange to commercial trade and warfare. The options are probably relatively limited in the case of iron objects, however, because of their relatively low value. This is suggested not only by the widespread occurrence of iron ore, but also by the discovery of relatively large quantities of objects and scrap on occupation sites compared to material in other metals. Trade in iron objects in 9th-11th centuries over any distance was, therefore, probably slight except in the case of those with unusually high quality metallographic structures and decorative features which means primarily weapons, but also, perhaps, horse trappings. At Coppergate, moreover, there is actually evidence for the manufacture in the 10th century of the dress fittings I have referred to as indicators of interaction with Scandinavia (5.6). It is hard to escape the conclusion, therefore, that in some instances smiths in York, and elsewhere in eastern England, were influenced by Scnadinavian ideas and indeed may themselves have been of Scandinavian origin or descent. This would parallel the situation in coin minting, the one metalworking craft at York for which, in the form of moneyer's names, there is documantary evidence (Dolley 1986, table 1) for a preponderance of men with Scandinavian names in the early 10th century.

It is also clear, however, from the discussion in this Chapter that Scandinavian warriors and settlers would have found a vital and dynamic smithing industry in England with its own traditions into which those of the aliens soon merged. From the 8th century onwards and particularly in the 9th and 10th the evidence is emerging for an industry characterised by innovation and diversification in terms of classes of object manufactured and variability of forms for both practical and non-practical functions.

In the field of tools this is most strikingly apparent with respect to knives. There is evidence for formal diversification of the tanged knife with the emergence of two distinct sub-classes one based on the angle-back blade and the other on possession of a tang twice the length of the blade (3.30.5; 6.3.30.7) Both may represent specialisation for purely practical purposes, but especially in the former case other meanings may be involved (see 7.7 for discussion of this point). The metallographic data also suggests diversification and innovation in approaches to the problems of combining iron and steel, a particular feature of the late 9th and 10th centuries being the widespread use of the sandwich-weld. Decorative additions to knives, from simple grooves to elaborate inlay and pattern-welding are also a feature of the period. In addition to changes among the tanged knives, new knife forms appear, including the pivoting knife (3.31) and folding knife (3.32). Other tools are less easy to discuss because there are few examples from Britain, but note may, perhaps, be made of the introduction of the 'T-shaped' axe as a specialised tool for woodworking (Wilson 1976a, 255-7).

Among structural ironwork and fittings one of the most striking developments of the 8th-9th centuries are the greater use of locks and the development of new forms of lock and key including, perhaps, the lock with sliding bolt and tumbler of the form represented at Coppergate (3.63.1; 6.3.63.1) and forms of lock with springs implied by keys 3654 and 3661 (3.64.2; 3.64.3). The barrel and box padlocks with T-shaped key holes (6.3.64.3; 6.3.64.4) also appear to be innovations of the period. Perhaps the other striking development in iron chest and casket fittings of the 8th-10th centuries is the appearance of examples decorated with spirally-twisted elements, relief work, including animal heads, and non-ferrous plating.

In dress fittings and riding equipment the spur and stirrup are probably innovations to Britain of the 8th and 9th centuries respectively and by the late 9th century the tri-partite bit was in use. Horse equipment and bridle fittings also become more diverse with many examples of relief work and plating. These developments are accompanied by diversification of iron dress fittings and the production of new classes of object in iron previously made exclusively in other metals.

Although weapons are not a major subject of this study, innovations are apparent in this area from the 8th century onwards. The leaf-shaped arrowhead may be an innovation of the 9th century (6.3.80) and other developments appear to occur thereafter with specialised forms for both armour piercing and for hunting emerging over the 10th-11th centuries.

CHAPTER 7

THE ECONOMIC and SOCIAL CONTEXT

7.1 Introduction

In Chapter 6 it was suggested that the ironwork from 16-22 Coppergate and other sites showed that the smiths' practice in the 9th and 10th centuries was characterised by innovation and diversification. In this chapter these developments will be set in their wider economic and social context, with particular reference to the emergence and growth of towns.

7.2 Economic context: theory

Economics may be defined as the study of the production, distribution and exchange of man's physical resources. It is a subject which illustrates in particularly acute form the problems, which all the social sciences have, of making a distinction between empirically testable hypotheses about human behaviour and purely ideological points of view.

Theories of economic behaviour may perhaps be divided into two broad groups (Robinson 1964). Classical theory, of which Marxist economics is the best known contemporary development, is based on the concept of value (ibid., 29). This was defined in a number of ways by Adam Smith and others, but Marx took value to reside in human labour power, the manipulation of which accounts for prices and wages. It would not be appropriate to discuss Marx's ideas in detail here, but suffice it to say that his conception of value can neither be defined nor measured in any meaningful way and may be substantially dismissed as dogma (ibid., 38). This dogma has, however, been enormously influential, especially when combined with Marx's materialist conception of society in which the economic basis is taken to determine all other aspects of its structure. Using this base - superstructure model, Marx was particularly concerned to define the nature of the state and reveal its essentially oppressive nature. Since the 9th- 11th centuries is a period in which the first state societies emerge in northern Europe, Marxist and neo-Marxist theories have had an important influence on the study of its economic and social history.

Neo-classical theory substituted one metaphysical concept for another and defined utility as the basis for economic behaviour. The underlying assumption of the theory is that participants in economic activity seek to optimise the utility they can derive from the scarce resources of the community. It is predicted that in an ideal world, essentially one without monopolies to distort prices, these resources will be allocated optimally and the welfare of each individual will be maximised. Neoclassical economics regards the state as a form of monopoly and hence as undesirable, but not as the inherently immoral instrument of oppression of Marxist theory.

Since the last war, at least until recently, the prevailing economic orthodoxy has been based on the work of Keynes. His main aim was to make capitalism effective and this involved him in detailed analysis of the implications of human behaviour on society's gross level of output, income, investment, employment and prices. One of Keynes' major achievements, however, was to introduce time into economic theory (Robinson 1964, 73) and allow a role to the variable nature of human expectations in an explanation of the essentially cyclical nature of economic activity. It is in this area that Keynesian economic theory has greatest relevance for economic history.

The principal concern of the theories I have outlined is, or was, to analyse the working of the economic systems contemporary with their proponents; economic history of ancient economies has been treated as a rather peripheral issue. The subject has, moreover, in the absence of statistics, allowed the metaphysical or ideological component of economic theory to assume a prominent role. The distinction between approaches based on Keynesian modifications of neo-classical theory, often referred to as 'formalist', and those based on Marxist theories lies essentially in the position adopted on the psychology of the participants in economic activity.

The formalist view is that economic motivation has always been subject to much the same considerations as it is today. Its economic history is principally focussed on the growth in the productivity of labour and capital. The fundamental engines of growth are seen as specialisation and technological improvement which gradually lead from economies based, like those of the ancient empires of the Near East, on centralised organisation of production and exchange, to those based on a market economy. This may be defined as an economic system in which large numbers of buyers and sellers have free access to trade, and exchange takes place at rates or prices determined by free bargaining which in turn determines the allocation of resources in production. The process is seen as essentially beneficial to all mankind, especially if the state's role is minimised.

Marxist economics also stresses the importance of the division of labour and technological improvement, but for its ideological purposes requires the existence of a primary stage of economic development characterised by a free association of peasants and artisans in which exchange is based on prices related directly to labour value and untainted by the profit motive. As methods of production change, however, changes are demanded in the social relations of production. Society's resources, initially land and then capital, or wealth not specifically tied to land, fall into the hands of a distinct social class creating a feudal and then a capitalist economic system. There is obviously a naive and idealised view of human origins in Marxist theory, but the idea of a non-exploitative economy also forms a powerful strand in the so-called 'substantivist' view of ancient or, more accurately, non-market economies when, it is suggested, motivation was very different from today. Anthropological evidence, such as that presented by Sahlins (1974), is used to show that non-economic values 'embedded' in society, which override self-interest and the desire to optimise utility, are the primary determinant of economic behaviour and organisation (Hodges 1982a, 13-4).

Three distinctive forms of trade in non-market economies have been identified by Polanyi (1963; 1976). 'Reciprocity' refers to the passing of gifts, often objects without practical function, between communities for social purposes, in particular for keeping the peace. 'Redistribution' refers to the way that community leaders will aggregate to themselves surplus production from their people or gifts from outsiders and give them to their followers according to community custom. 'Exchange' refers to buying and selling between communities in a variety of institutional environments.

Of particular relevance for the study of late Anglo-Saxon England is Bohannan and Dalton's (1962, 7-9) identification of societies with 'peripheral markets' where transactions were not the dominant source of material livelihood, although they might be used for the acquisition of a specific amount of cash income or for the acquisition of special items. Access to the market was not open to all comers and there was no competitive mechanism by which supply and demand determined prices and the allocation of resources in production. Although a class of middle men might emerge in these economies, their activities were largely subject to their rulers' requirements, hence trade is described as 'administered'. Trade was not generated by surplus, as proposed by formalist economic theory, but often arose because of a ruler's desire for 'prestige goods'; that is for objects which need not necessarily have been intrinsically valuable but conferred status on their owners. Subsistence goods, even if they were in short supply, might be exchanged for prestige goods. Administered trade might, in due course, lead to permanent settlements where foreign trade was organised in what Polanyi (1963) refers to as 'ports of trade'. They offered security to both the host and foreign trader, and in them diplomatic and administrative methods were employed in contacts between government and representatives of the trading parties, specifically to minimise competitive behaviour.

From the peripheral market system a market economy might subsequently develop and the profit motive would become the new motivating factor (Bohannan and Dalton 1962, 9-10). As much for its social and moral significance the substantivists, like the Marxists, regard this development as a much more fundamental change in human affairs than the formalists and one whose consequences are not entirely beneficial as they lead to socially divisive exploitation of many members of the community.

If moral issues are laid to one side it is, I suggest, clear that while there is an important distinction between pre-market and market economies, there is no evidence for a 'golden age' when the intra-social competitive urge was in some way muted and justice and harmony prevailed. I accept that the profit motive was not clearly defined in pre-market systems, but suggest that what Sahlins (1974) and others have described in the South Seas and elsewhere is a situation, somewhat similar to that in Stalinist socialist societies today where the profit motive is artificially suppressed and competition is based on the acquisition of status and power by non-economic means. A market economy allows new ways by which status and power can be measured but also, and here I agree with the formalist emphasis, creates new opportunities for participants in the economy many of whom may have been excluded under previous arrangements. The market economy may lead to exploitation, but does not necessarily introduce social divisions which did not exist previously.

7.3 Economic context : new approaches to the early medieval town

In discussing economic data relating to the early medieval town archaeologists have, until recently, confined themselves to fairly generalised descriptions of topographic developments, means of subsistence and the artefacts associated with trades and crafts. This approach can, for example, be found in accounts of the economy of Anglo-Scandinavian York by Radley (1971) and MacGregor (1978). It has been left to economic historians, working largely from written sources, to produce systematic accounts of the development of British and European urbanism. The formalist paradigm has been dominant with particular emphasis placed on two aspects of specialisation: long distance trade and technological improvement.

A concern with the patterns and intensity of long distance trade stems from the work of Pirenne (1925) who began the serious study of the economics of northern Europe's medieval towns. He assigned particular importance to international trade with the Mediterranean world in his account of the decline of towns after the end of the Roman empire and their re-emergence in 9th century. In his view the 7th-8th century Islamic invasions had caused the merchant class to disappear in western Europe and he identified a revival of towns in the 9th century as a result of the congregation of the local traders seeking protection around fortified sites known as portus. This led to the influx of artisans into them to take advantage of market opportunities. Institutional developments followed to make towns legally distinct from the countryside and create an atmosphere conducive to trade.

The debate on the subject since Pirenne has, until recently, been conducted very much on his terms (Hodges 1982a, 7). One criticism of Pirenne's work has, however, been that he overstated the significance of purely economic as opposed to legal and institutional factors in the growth of towns. Economic historians such as Postan (1975, 239) have argued that a crucial factor in the process was the acquisition of privileges which exempted the inhabitants from feudal obligations. Documentary sources to illustrate this for the pre-Norman period are very sparse (Reynolds 1977, 34-6), but I believe it is reasonable to propose that the emergence of a dynamic social class of urban artisans and merchants was a vital factor in the history of the late Anglo-Saxon town.

In recent years approaches to the development of early towns have supplemented documentary sources with the evidence of anthropological analogy and the growing body of archaeological data. These new classes of evidence have, in particular, informed the work of scholars seeking to adapt the systems theory approach to the study of the post-Roman period in western Europe. In their analysis of developments before and during the establishment of the market economy and state society a substantivist, if not strictly Marxist, paradigm is accepted (Hodges 1982a, 14). The importance of competition for power and status has, correctly I believe, assumed particular prominence, although other aspects of the new approaches are less satisfactory.

Since it is an easily visible feature of economic activity in archaeological assemblages, long distance trade continues to receive particular emphasis from the systems theorists. In The Prehistory of Denmark Jensen (1982, 254-274) outlines a development of the 7th-9th century economy of that country which clearly has parallels in other northern European countries, including England. He characterises Denmark as a 'prestige goods economy' whose most distinctive feature was an administered intercommunal trade in high quality imported objects. Largely the products of the Roman Empire and its successors, they were used to demonstrate their owner's status and political power. In order that they should maintain this role they had to be kept scarce and one strategy for doing this was to use them as grave goods. That locally produced objects might also assume prestige status is indicated by the inclusion of some remarkably elaborate iron objects, notably cauldron chains and hearth furniture, in burials of the period, including those at Vendel (Stolpe and Arne 1927) for which there are as yet few parallels on occupation sites. Jensen goes on to suggest that this exchange system of prestige goods was supported by an intracommunal trade based on redistribution in which tribute, usually agricultural products, was transferred upwards from the peasantry to leaders. In Sweden and Norway, however, the success of ruling dynasties in this period also appears to have rested in large part on control of trade in iron (Hyenstrand 1981, 43-4) which may account for the prominent use of iron objects in burial furnishing.

These exchange patterns are thought to have accompanied the development of an increasingly hierarchical society in western Europe. In a study of the period Hodges (1982b) identified the 'ranked society' as a characteristic form of organisation whose leaders began to rule over relatively stable territories and conducted administered trade through versions of the 'port of trade' termed 'gateway communities' or 'emporia' (Hodges 1982a, 23-5). They were usually located on coastal sites or adjacent to national borders so as to be well-placed for the trade in prestigious imported goods (ibid., 53). By the 8th century royal initiative in foundation was often expressed by the deliberately planned streets and buildings which have been identified archaeologically at such sites as Hamwic, Hedeby and Dorestad (ibid., 60-1). These sites should, however, not necessarily be classified as towns comparable to late 9th-10th century York. Hamwic, for example, does not seem to have been fully integrated with the economy of the surrounding area, judging by the absence of its sceatta coinage on local rural sites (Brisbane 1988, 106), and within the settlement no property boundaries have been found which suggests to Hodges that Hamwic was similar to a palace site in consisting of a single unit under royal control (1988, 5).

During the 9th century it is proposed that competition between the elites of ranked societies intensified; the Viking raids being regarded as one symptom. This competition led to changes in the organisation and intensity of agricultural production, recognisable archaeologically at sites such as Vorbasse in Denmark (Randsborg 1980, 61-7), and in the scale and organisation of production in the emporia as the leadership required more commodities to trade for imported prestige goods. In this context it follows that craft and industry would receive particular attention from the royal authorities as a basis for the generation of wealth (Hodges 1982a, 160-3), although details are relatively sparse for the way this was organised in practice. Eventually a more efficient form of economic articulation was required and the market economy was born. Hodges adopts a substantivist position in regarding this as a radical change in the economic and social system and also supports Pirenne's original argument in claiming that: "The ninth century probably experienced the greatest socio-economic changes of the medieval period." (1982a, 160-3).

The leaders of the competing elites able to organise these developments became established as leaders of a new form of socio-political entity, the state. The concept of a state has been extensively discussed by archaeologists and anthropologists and no further discussion is warranted here except to note Randsborg's analysis of northern European developments (1980, 8-10). He distinguishes between 'primary states', the ancient Empires culminating in that of Rome, and 'secondary states' which developed in the 9th-

10th century on the periphery of the former Roman Empire. A secondary state is a well-defined territory with a complex social hierarchy ruled over by a king able to impose a dynastic system of inheritance of power, and to command a monopoly of force administered through a relatively complex administration. In order to maintain this structure the social elite had an interest in promoting efficient systems of exchange and raising revenue. In the resulting market economy, therefore, access to the market by people at all levels in the community became freer and competition between them boosted the productivity of labour and taxable wealth. In order to facilitate the working of the system a mass circulation coinage was introduced. Although the town, as a recognisable centre of craft production and trade, as well as governmental and religious institutions, is not necessarily a component of state society, states heavily dependent on external trade soon acquired towns as a distinctive institution in their economic and social organisation.

Good examples of 10th century secondary states are Wessex, ruled by Alfred and his descendants, and Denmark, ruled by the Jelling dynasty. It is not clear if the area ruled by Scandinavian kings from York in the late 9th and early 10th century qualifies, but since its boundaries and rulers changed frequently its political status should probably be seen as uncertain until the hegemony of the Wessex dynasty was first asserted in the late 920s.

The impact of the new archaeological and anthropological data and their analysis with the tools of systems theory have undoubtedly changed perceptions of the post-Roman economy and emergence of towns. It remains the case, however, that the evidence for many of the devlopments outlined above is sparse. It is unclear if the notion of radically increased pace of change in the 9th century can be sustained in view of, for example, the evidence for the origins and development in the 8th century of the diversification and innovation which characterise the 9th-10th century blacksmiths' practice. The transition from one dominant mode of economic organisation to another, in this case a pre-market to market system, is likely to have been gradual with aspects of the earlier surviving in certain types of transactions or geographical areas. There must also be doubts about the ability of kings to control economic and social developments and set the rules for economic and social competition in the manner proposed, for example, by Hodges for whom royal intervention appears to rank alongside environmental perturbation as an external agent of systemic change.

A rounded picture of the economic history of the period clearly requires consideration of the evidence that survives for all levels of society, although this is scarce for ranks below the political and religious elites. Virtually the only evidence for urban artisans, for example, is their products and their working areas few remains of which have, however, been found. It is clear, therefore, that the identification of iron smithing and other craft workshops at 16-22 Coppergate is of considerable importance for testing theories abouth the pattern of economic development in the latter part of the first millennium.

7.4 Economic context : the York ironworking evidence

To understand how the data from 16-22 Coppergate relates to the problems outlined in the previous section, it is necessary to review them in the context of the conclusions presented in Chapter 6.

The evidence from England before the 8th century suggests production of a relatively restricted range of iron objects which were usually formally simple and of uneven quality, although weapons might on occasions be sophisticated products. This is consistent with a smithing craft practised in large part by itinerant craftsmen who produced tools and fittings for local consumption using local raw materials. The incentive for experimentation was probably low and assimilation of new techniques slow since communications were poor and the population scattered. At certain centres, however, presumably controlled by high ranking individuals, more specialist smiths, including those capable of producing high quality weapons, may have been established on a permanent or semi-permanent basis. Helgö is probably a good example of such a site in Sweden, but nothing exactly contemporary is known from Britain. By the 8th century the evidence of the artefacts and smithies from Hamwic suggests, however, that a revival of international trade had allowed the creation of a new type of centre of craft excellence where communities of specialist smiths might settle on a permanent basis to produce a wide range of products, including blades and edged tools of considerable sophistication. It is these characteristics of permanence and specialisation which, I suggest, give the Anglo-Saxon proto-urban and urban settlements their particular character.

In settlements such as Hamwic, and subsequently York, smiths would have benefited from the communication of ideas amongst themselves, an improved supply of raw material and, at the same time, a market of unprecedented size and sophistication, largely local, but open to influences from a wide geographical area. It is no surprise, therefore, that a wave of diversification and innovation began. When the Hamwic material has been fully studied more details of how this happened will doubtless emerge. It is clear, however, that many of the changes which appear to be taking place there came to a fuller flowering by the later 9th century in towns like York where, judging by the advent of a mass-produced coinage (Dolley 1978, 26), a market economy was probably fully established around the year 900. In contrast, perhaps, to Hamwic, the evidence from 16-22 Coppergate is for the engine of growth in this economy to be locally based trades and crafts rather than international trade. The amount of imported pottery is relatively very small (Mainman forthcoming), as is the number of other clearly imported items from areas other than the northern half of eastern England.

The evidence from 16-22 Coppergate is for smithing on or around the site from the mid 9th century until the last quarter of the 10th century. This continuity of association with a particular part of the town suggests sedentary rather than itinerant craftsmen, as does the co-occurrence of smithing waste and tools (5.3; Hodder 1982b, 59). In the early 10th century (c.930) the craft survived the replanning of the area and adapted itself to the property boundaries laid out on the site, boundaries whose presence and form are, in addition to the coinage, another important indicator of the settlement's new urban status. In Period 4B the evidence for iron smithing is perhaps particularly strong in Tenements B and C, but was probably also undertaken in A and D (5.6).

A question which should be examined, however, is whether smithing took place continuously or in intermittent episodes with, perhaps, gaps of several years or more in between during which smiths removed to other centres. This is difficult to resolve archaeologically because the original pattern of discard has been substantially disturbed, but arguing for an intermittent scenario is the fact that the average number of iron objects and quantity of smithing slag discarded on the site during Periods 3, 4A and 4B is low (5.2). However, there is no stratigraphic evidence for interruptions in the deposition of ironworking material and I am inclined to suggest that smithing was continuous and intensive on or near the 16-22 Coppergate site, especially during Period 4B. The apparently small quantity of objects discarded per annum I take to reflect very rigorous curation practices; the small quantity of slag may indicate that some was removed from the site for disposal elsewhere. It is, nonetheless, likely that the smiths had periods of activity of greater and lesser intensity. By analogy with the comparatively well documented later medieval period, the local economy is likely to have experienced substantial cyclical fluctuations with alternating periods of hardship and prosperity governed by the fortunes of local agriculture (Postan 1975, 256-7) and the dislocations of war and plague.

Although smithing was strongly associated with the four Coppergate tenements, it is not so apparent that the site was in any sense in an exclusive smiths' quarter of the 9th-10th century town. It is clear from documentary sources, if not necessarily from archaeology, that in many later medieval towns the practitioners of the various crafts and trades grouped together in relatively distinct areas. This has not as yet, however, been shown to be a feature of the settlements at Hamwic (Brisbane 1988, 104), Ipswich (Wade 1978; 1988, 97) or Hedeby (Schietzel 1981, 70), but is to be found in, for example, 11th-12th century Winchester, judging by the Winton Domesday (Biddle 1976, 427-8, 439). Until there has been further excavation in York the extent of grouping of trades and crafts in the Anglo-Scandinavian town can not be known; all that can be said at present is that the four Coppergate tenements were not used exclusively for iron smithing or even metalworking as evidence for many other craft activities was abundant.

In about 975 a reorganisation of the Coppergate site, if not the centre of the Anglo-Scandinavian city itself, is suggested by the replacement of the post and wattle buildings by sunken-floored structures with plank walls (1.2). Although ironworking debris continued to occur in Period 5B and 5C contexts, the change in building type appears to be accompanied by an end to metalworking on the site and the related debris is probably residual from Period 4B or secondary refuse from elsewhere in the town (5.6). Other crafts may have been practised in the sunken-floored buildings, but it is possible that metalworking, a dangerous, noisy and otherwise anti-social activity (as suggested by Aelfric's Colloquy, see 1.11) had been removed to locations peripheral to the more densely settled areas. The existence of smithies on the urban fringe appears to be a feature of Winchester in the 11th-12th century, although it is suggested that concentrations near the gates may be related to the smiths' desire to take advantage of the trade in shoeing horses (Biddle 1976, 434).

The other feature of the organisation of the late Anglo-Saxon smithing industry, which is important for characterising the settlements where it took place is the extent of specialisation. By this I mean both the extent to which craftsmen specialised in the working of iron as opposed to other metals or other materials, and the extent to which they concentrated on a particular aspect of iron smithing. A characteristic of the organisation of crafts and industries in later medieval towns was the division of their practitioners into gilds, each of which jealously guarded its rights to operate within a small sector of the urban economy.

Geddes (1983, 17) has suggested that: " Whereas in the 11th century a smith could have made swords, horseshoes and ploughshares, by the 15th he was only allowed to make part of a single article." In the 15th century York evidently had ten iron working gilds and London had fourteen.

Documentary sources do not relate whether an embryonic craft gild system existed in late Anglo-Saxon towns, although there are some suggestions of a division of the metalworking crafts in the period (1.11). The expertise and time required to make a pattern- welded sword (Anstee and Biek 1961, 83-4), however, suggests that Geddes has oversimplified the 11th century smith's role. Men such as Biorthelm who advertises himself as the maker of the Sittingbourne sax, and Wulfric, referred to as a smith in the will of the Aetheling Aethelstan (Whitelock 1930, 57), may have been specialist smiths who solely concerned themselves with quality blades. The hoards of tools and other metalwork from Mästermyr (Arwidsson and Berg 1983), Smiss (Zachrisson 1962) and Tjele (Leth-Larsen 1984), and some of the burials from Scandinavia (Müller-Wille 1977a, 181-6), however, indicate that in rural areas in northern Europe smiths continued to be craftsmen working both a number of metals and other materials including wood. At the Danish fortress of Fyrkat also there is good evidence that iron and other metals were worked side by side (Roesdahl 1977, 196).

In the urban context of 16-22 Coppergate Periods 3 and 4A produced a mixed assemblage of debris of ironworking and non-ferrous metalworking, but since no smithies were found little can be said about the extent of specialisation at this time. In Period 4B, as I have shown in 5.6, there is some evidence for a greater concentration on ironwork in Tenements B and C and non-ferrous metal working in Tenement D, but it is likely that all metals were worked side by side, probably by the same men. A close relationship between the ferrous and non-ferrous metalworking is clearly implied by the production of tinned iron objects, particularly dress fittings (5.6). Any specialisation here was more likely to have been on the basis of the class or classes of object manufactured rather than the metal a man would work. The data is unable to take us further than this at present, but at least it is consistent with that from Flaxengate, Lincoln where there is evidence in the late 10th-mid 11th centuries for a craftsman making dress hooks in both copper alloy and iron (Perring 1981, 41).

Although trade and exchange mechanisms form an important part of the discussion of early medieval economic history, the study of late Anglo-Saxon and Anglo-Scandinavian ironwork has only a restricted contribution to make. Trade and exchange networks would have existed at both ends of the smithing industry; at one end there was the trade in raw material and at the other the trade in finished products. Because of the problems of analysis the source of the metal used in York cannot be firmly established, although it is likely to have been relatively local, except, perhaps, in the case of some scrap items which could theoretically have been discarded in York after coming from anywhere in northern Europe or beyond.

Smelting slag has been found at Coppergate and it is likely that a small amount of smelting took place on or near the site in Period 4B (5.6). It is unlikely, however, that smelting was carried out regularly within the city in view of the cost of transporting the ore and the dangerous nature of the process. As a rule, therefore, iron was probably smelted near to the mining areas and brought to York in the form of simple bars and strips. In view of the importance of iron as a raw material for a wide range of tools and for weapons, control of the iron trade was probably a matter of particular concern for the royal authorities and the coin dies found at Coppergate (3.9), probably brought in as scrap from a mint (5.7.1), may be a small piece of evidence for this.

The nature of the trade in iron artefacts is also hard to determine although market and non-market forms of exchange probably existed side by side. Presumably the point of sale for objects manufactured at 16-22 Coppergate was usually the street frontage or designated market places, but itinerant pedlars no doubt existed even if the smiths themselves remained in York. It is also possible that smiths received special commissions, especially from prosperous or high ranking individuals, for artefacts such as pattern-welded knives or swords. The geographical area within which the 16-22 Coppergate smiths traded is unknown. There are a few very distinctive artefacts, including some of the dress fittings, which should be recognisable as York products if found elsewhere, but I know of none. Distribution of what were, for the most part, relatively low-value items is, however, unlikely to be have been anything but local.

In conclusion I suggest that the archaeological evidence from Coppergate in the late 9th and 10th centuries is consistent with the emergence of a smithing industry based on small workshops, where other metals were also worked, which produced a range of products, but possibly specialised in certain lines, notably tin-plated dress fittings. These developments occurred against a background of the opportunities presented to the urban craftsman by the change from a primarily administered economy to a market economy in which prices were, to a greater extent than before, arrived at as a result of the balance of supply and demand.

The role of the state in 10th century York's economy remains hard to define, but by analogy with the later medieval period, its ability to control the market was probably uneven and it is likely that two other aspects of economic life were of greater importance to the smith as an urban artisan. One is competition, which was probably especially strong in times of general economic growth when new market opportunities presented themselves. Opposing the competitive urge, however, especially in times of stagnation or decline, there would have been restrictive barriers erected to keep out new entrants into the industry and keep prices up. Because of the technical skill required to work in iron and metal generally, this strategy was probably more successful than it would have been in most other crafts. Both competition and restriction would have had an effect on prices and on the quality and diversity of the smiths' products. The one increasing them and the other, perhaps, causing retrenchment. Although archaeological material cannot at present be used to plot the conflicting fortunes of the smithing industry in any detailed sense, I suggest that the evidence of diversification and innovation in iron artefacts of the period from Coppergate and elsewhere indicates a response to the overall trend of rising prosperity of late Anglo-Saxon England, although regular troughs in the economic cycle probably meant frequent hard times.

7.5 Social context: introduction

Although the trend towards diversification and innovation in 9th-11th century ironwork can be related to an environment of economic growth, economic factors alone cannot, however, explain the patterns of artefact variability which developed in the period. The examination of this problem must involve setting the artefacts in the social context in which they were produced.

The implications of structuralist and post-structuralist theory for archaeological interpretation (2.4) suggest that by using the idea of society as constituted by forms of communication, including material culture, which embody the categorisation principles of the human mind, it is possible to develop a powerful tool for examining the relationship of artefact variability to social behaviour and organisation. Although it is doubtful whether a detailed understanding of the symbolically coded messages incorporated in ancient artefacts can be gained, especially given their likely ambiguous and polysemic nature, and although the criteria for verification remain a matter for debate, I believe that given sufficient contextual and associational information, structuralist and related paradigms can be the basis for penetrating interpretations of the meaning of artefact classification. I also believe that all aspects of variability in material culture, in no matter how apparently humble a form, should be seen as components of ideological representation and, as part of the environment of social relations, will play an active role in cultural reproduction. Since the beliefs informing ideological representation are rarely held in common by members of a society, artefacts as material expression of ideology may also be manipulated in the struggle to legitimate competing social interests and become manifestations of a Nietzschean "will to power".

In the remainder of this chapter I will discuss, using three examples, how aspects of the 9th - 11th century smiths' practice betray levels of meaning which go beyond reference to practical function and have structured the process of diversification and innovation identified in previous chapters. The arguments I will use are based on the view that the context in which metal workers of the period operated was that of a socially distinct group to which access was restricted by the nature of the technological expertise required. Within the group there might be distinctions, for example, between craftsmen producing everyday items and those specialising in the production of high quality blades, but a more important distinction was between metal workers as a whole and the rest of their community. In the case of blacksmiths this distinction may have been dignified by the mythological associations of smithing and blade making which is apparent in contemporary literature (1.11). As a result of the separateness imposed by both technological and cognitive barriers, smiths would, I suggest, have perceived the world in a different way from the rest of their community and the resulting stress at the interface would have inspired their search for ideological legitimation in the intra-societal power struggles of the day (well illustrated by the exchanges in Aelfric's Colloquy, see 1.11). In spite of their separateness, however, it was crucial to the smiths' strategy to appreciate the requirements of customers and patrons in the spheres of social communication and struggle in which they employed material culture to assert their status. The iron artefact production process was therefore based on a mutual dependence, as well as tension, between producer and consumer.

Post-structuralist theory, as outlined in 2.4, implies that the pursuit of group social power, at whatever level of organisation, requires a two part strategy. One part involves self-definition which is usually based to some degree on a common economic interest, but also requires a shared ideology and mode of expression which will involve material symbols as well as forms of social action. The second part of the strategy involves the encroachment on as many contexts of social interaction, or communication, as possible, but with particular attention to those areas where values are changing most rapidly and differentiation of forms of interaction consequently increasing since it is here that opportunities for seizing social power are greatest. Craftsmen will seek to make their products relevant to interaction in these areas and thus increase the demand for them. Miller (1985, 190) observed this sort of phenomenon in his study of contemporary Indian potters who continually strive to improve the status of pottery and create the need for new forms.

In the course of the intra-social power struggle the extent to which, in any context, one group is able to impose its will on other competing groups and 'naturalise', in Barthes' term (1973, 129), its forms of control and mode of expression has a powerful influence on the extent to which related artefacts are differentiated. While increasing social conflict may lead to greater differentiation of material culture, the greater the control of a dominant group, the less differentiation there is likely to be. From an archaeological point of view, therefore, identification of artefact variability is of some importance for understanding social behaviour.

While this variability can be analysed in detail and related to practical function it is, however, more difficult to relate to other, more abstract aspects of social function. The evidence from occupation sites for the role of objects in social strategies is usually difficult to interpret since the status of the inhabitants of a site may not be apparent; even if it can be established it may not be clear how that status related to material culture items discarded there (2.4). The inhabitants of the Coppergate tenements in 10th and 11th centuries were presumably urban artisans and this may have implications for the significance of certain objects. The discard of material peculiar to other social groups is, however, also possible either during manufacture on site or as a result of redeposition.

The advantage of burial evidence is that it allows the direct relation of artefacts to people whose status can, with varying degrees of reliability be determined. Although the picture of social organisation presented by the burials may serve to naturalise a particular ideological point of view (2.4; Pader 1982), it is often possible to get some idea of the area of social relations in which an artefact operated. Unfortunately there are few furnished burials from Britain datable to the 9th-11th century except for those thought to be of pagan Vikings which largely occur on the periphery of the British Isles (Bjørn and Shetelig 1940; Shetelig 1945; Wilson 1976b, 397; Graham-Campbell 1980b). A number of probable 8th-10th century graves containing iron-bound coffins, probably re-used chests, have, however, been found in England (Table 7.5). As, perhaps, the only legitimate form of furnishing in Christian cemeteries they may perhaps have been an important vehicle for indicating status differences previously indicated by a variety of other artefacts. In contrast to Britain, burials in Scandinavia continue, until at least the mid 10th century, to exhibit a wide range of furnishings often including iron or partly iron objects. In view of the historical evidence for close contact in the form of both conquest and migration between Scandinavia and Britain in the 9th-10th centuries, I have admitted burial data from across the North Sea, especially from the area of the emerging Danish state, as relevant to the following analysis.

Non-archaeological evidence which, in a manner comparable to burials, shows artefacts in direct relation to people and social situations can be found in contemporary documents and illustrations. For iron artefacts of the 9th-11th centuries, however, useful examples are scarce. I have, moreover, not attempted to be comprehensive in the use of this material, but have selected a number of examples which appear particularly relevant. It is clear, however, that the literary sources, like the burials, also give an idealised picture of social relations, principally that espoused by the literate classes in the aristocracy and church. As Deetz (1977, 21-5) has implied (2.4), there is no sense in which documentary history has any privileged position as a means to understanding the past. Both written and illustrated sources also pose problems of relating artefacts referred to (2.5) or depicted to archaeological material even in the case of manuscripts, such as B.L. Harley 603, which appear to be reliable portrayals of the contemporary scene (Carver 1986, 129).

Leaving aside any imperfections in the sources and my interpretation of them, what I hope above all to have achieved in the remainder of this chapter is the development of a useful method for analysing the meaning of archaeological classifications.

7.6 Social context: dress fittings and riding equipment

A striking feature of the formal variability of the Anglo-Scandinavian ironwork from 16-22 Coppergate and other sites of the period is the occurrence of decoration in the form of relief and incised surface treatment and non-ferrous plating (4.4, 4.5, 6.4.2, 6.4.3). I suggest that three aspects are of particular significance: 1) classes of iron object previously undecorated begin to acquire decoration; 2) classes of decorated object not previously known to occur in iron appear; 3) decorated objects are found in assemblages from occupation sites, indicating that they were in use in a wider range of social contexts than had been the case prior to the 9th century when decoration of ironwork was largely confined to weaponry. It may also be noted, in addition, that there is some evidence in the 9th-10th centuries for the spread of pattern-welding as decorative feature on blades other than those of weapons (6.4.3 - 6.4.5).

Although decoration is found on iron objects in a number of different classes, they can be unified under a few broad headings notably dress fittings and riding equipment, with which I will be principally concerned in this section, box and chest fittings (discussed in 7.8) and weapons. Furthermore, as I have shown in 4.4 and 4.5, the occurrence of decorative motifs is not necessarily confined by the boundaries between classes or between the broader groups and this suggests that there were links between the social meanings of these objects in their contexts of manufacture and use. On a practical level, for example, it is well known that keys and knives were often carried around on the waist and so may be understood, to some extent, as forms of dress fitting but it is also likely that more abstract cognitive connections existed between the contexts of all the decorated ironwork as will become apparent in subsequent discussion.

In virtually all human societies dress is one of the principal media of communication of rank, status and other social values; late Anglo-Saxon and Anglo-Scandinavian society was clearly no exception (Dodwell 1982, 174). Loyn (1984, 50) stresses the importance of dress in marking distinctions in social rank between nobles and other freemen and between the free and the unfree members of society. Archaeological evidence for dress in 9th-11th century England is, however, sparse. There are no data comparable to that from, for example, the earlier Anglo-Saxon period when furnished burials not only produce evidence for garments and dress fittings, but also allow a range of inferences to be made on related social variables. Textile does not survive well on occupation sites and, in the virtual absence of furnished burials, British evidence is largely confined to unassociated dress fittings. Contemporary literature and illustrations provide information on garments with varying degrees of reliability, but little on the fittings and their context. Owen-Crocker (1986, 140, 162), for example, found few examples of late Anglo-Saxon representations of buckles although they are common site finds.

Although I have assumed that many of objects from 16-22 Coppergate classified as dress fittings and riding equipment could have been used in either context, the comparative material from Scandinavian burials suggests that the iron buckles, buckle-plates and other fittings may in fact have been primarily used on bridles or spur and stirrup straps, the durability of the metal giving it an advantage over non-ferrous metals. There are very few late Anglo-Saxon or Viking Age graves from Britain with riding equipment, but reference may be made to the well known 9th-10th examples from Scandinavia which are found especially in the Jutland peninsula and southern Sweden (Brøndsted 1936; Müller-Wille 1977b; Randsborg 1980, 127-9), but also in central Sweden including Birka (Gräslund 1981, 39-43). These graves indicate very strikingly the iconic association of the horse with upper class males often accompanied also by their weapons. Since a similar association of horses and riding equipment with the upper classes in England is indicated by references in Anglo-Saxon wills (Whitelock 1930) and in contemporary illustrations such as the Bayeux Tapestry, the value system these Scandinavian burials and their contents represent can not have been too different on each side of the North Sea. It is not clear how exclusive a preserve of the upper classes riding was, but it is perhaps significant that at 16-22 Coppergate very few horse bones were found (O'Connor 1989, 186), although it is necessary to be cautious about using this evidence to assert the urban artisan's lack of access to these animals.

Given this background, some of the forces affecting formal variability may now be discussed. In both culture history theory and systems theory changes in artefact form are related to interaction between social groups. It is not possible, however, to regard the increasing variability in dress fittings and riding equipment found at 16-22 Coppergate as simply the result of influence from outside York or outside England, although there is some artefactual evidence for close contact with Scandinavia (6.5). New areas of social stress in the 9th-11th centuries may, however, have affected the production of material culture in respect of its role in social communication, especially in the towns with their growing populations of people with heterogeneous origins. The iron artefacts, such as dress fittings, which appear to have been particular focusses for variability were especially visible when in use and so well placed to perform a communication function. The information exchange theory (2.3) which relates artefact variability to social interaction in this way does not, however, fully explain the specific circumstances in which certain artefacts were chosen to assume a specific communication role. In the generalised propositions about information flow no account is taken of the context of the artefact production process or of the way symbolic meaning is related to formal variability.

As I have suggested in 7.5, the areas in which diversification and innovation in the smiths' practice took place indicates their perception of social priorities. The appearance of decorated iron dress fittings and riding equipment in the 9th century therefore seems to imply that the need for social communication was increasing in the contexts of rank and status divisions where these objects operated and that smiths, whether consciously or unconsciously, were responding to this need and manipulating it for their own ends. One reason why dress fittings and, more specifically, items of riding equipment were used may, however, lie in their role as part of ideological representations regarding the issue of social rank in society.

While there seems no doubt that the horse was associated with the ruling class in both England and Scandinavia, the relationship was, perhaps, becoming more intense in the 10th century because of new methods of fighting in the emerging state societies, although there is little evidence for cavalry forces in the Viking period (Roesdahl 1982, 139). In the Scandinavian rider graves iron bridles and riding equipment such as bits, spurs, stirrups and related straps and buckles, are usually found accompanying the horse itself. In many instances the objects are highly decorated with non-ferrous inlay. Comparable decoration is hardly known from this country and indeed hardly known in Scandinavia outside burials; in short, these horse trappings were 'prestige goods', possibly made principally for burial. Other aspects of the form of these objects, however, render them similar to less elaborately decorated objects from occupation sites in York and eastern England where, I suggest, they had also been employed as symbols of social status; in other words, the symbolic significance of comparable riding equipment and other horse furniture was much the same on both sides of the North Sea. Furthermore, the appearance of these objects on a site such as 16-22 Coppergate may imply their use by sections of the community other than the nobility, although, as I have noted, the site produced few horse bones to indicate the inhabitants' use of these animals.

In conclusion, it is possible to understand the material components of the activity of horse riding as suitable vehicles for what Barthes (1973, 109-59) has defined as 'myth' (2.4) which turns meaning derived from 'historical', or practical, function into meaning appropriate to a particular social group. This meaning will, moreover, be, Barthes stresses (ibid., 124), defined by its intention rather than its literal sense. It is not necessary for an object to resemble another exactly for it to have a common meaning as long as it is able to trigger the same response. Myth, Barthes continues, has an imperative character (ibid., 124-5); an object with mythological significance will try to grab attention by making an immediate impression and to do this some formal impoverishment or debasement is of positive value. It is not necessary, therefore, for a simple spur from York to resemble a highly decorative example closely for it to trigger a similar response in men's minds and place it in the same sphere of meaning. It might need only the form of the terminal, the grooves on the arms or the tinning which has some resemblance to silver, to make the connection; the simpler the reference the quicker the message is transmitted. I have already shown in 4.4 how the decorative motifs on the Coppergate ironwork are formally simple and suggested that this was due to the constraints of the material and tools, but, if Barthes is correct, then it is clear that the principle of economy of effort was guided by non-practical forces also.

The social process by which an object originally peculiar to members of a particular social group or rank spreads beyond them is often referred to as emulation. People of, for example, a lower rank who wish to associate themselves with their social superiors adopt, amongst other things, material culture items which symbolise their superior rank (Miller 1985, 185). In the context of the emergent late Anglo-Saxon towns it may be suggested that the urban artisans were seeking to assert themselves as equals of the landowning aristocracy using objects, such as riding equipment, which expressed the latter's power. Because it involves an expanded production of the emulated object the process of emulation will also involve simplification of form of the original to the minimum required for the symbolic significance to be apparent. Reproduction may also be in cheaper materials and this may explain the emergence of new classes of decorative ironwork which are copying non-ferrous models.

7.7 Social context: knives

Some of the ideas expressed in the previous section may be examined again in a study of knives, one of the more numerous classes of object from 16-22 Coppergate and other sites of the 9th-11th century. As I have shown in 3.30, knives may be differentiated in respect of form, including surface treatment, dimensions and proportions, and metallographic structure. There is also good evidence that the extent of variability in all respects was increasing in the 8th-10th centuries (6.30) with the emergence of knives with the angle-back form and those with tangs over twice the length of the blades being among the more striking developments. In addition to diversification of tanged knives, there was the introduction of new forms of knife such as the pivoting and folding knives (3.31; 3.32). It is also likely that knife handles began to exhibit increasing variability in the period but, since the evidence is still sparse, I will confine my remarks to the the smiths' work.

To some extent increasing variation, especially perhaps in size or proportion, was related to practical function (3.30.9). Innovations in metallographic structure may also have had a practical purpose in that the sandwich weld technique allowed a blade to be used for longer before becoming useless (3.30.8). It is evident, however, that many features of knives are less easily explained. As in the case of dress fittings and other decorated objects, the occurrence of these features may be seen in the context of an expanding economy but may also, I suggest, be related to the symbolic communication of social information on more abstract levels.

As in the case of dress fittings and riding equipment, the contextual and associational data on the use of knives is exiguous and difficult to interpret. The 16-22 Coppergate material was probably largely discarded after use in domestic or craft activity on the site itself, although some of the larger specimens may have served as weapons or hunting knives (3.30.9). Other knives of the period from Britain also come largely from occupation sites and so their context of use is equally difficult to determine in detail. Knives had been common grave finds in Anglo-Saxon graves before c.750 (Härke forthcoming), but become very rare in burials after that date, although a few examples may usefully be cited (Table 7.1).

Other aspects of the graves or the nature of the cemetery from which they come suggest that in the late Anglo-Saxon England knives were confined to burials of individuals with a distinct status, either as persons of high rank or as Vikings warriors. In Scotland and the Isle of Man the burials with knives are probably of Viking settlers, but again other aspects of the burials suggest some, at least, were of high rank. With such a small sample it is difficult to relate knives of a particular form to other social variables which burial might suggest. There is no consistent pattern in terms of knife size, for example, although many of the knives cited are above the average length of Coppergate knives. It may be noted, however, that six of the English examples have back form A and they all either definitely or probably accompany male burials. The occurrence of a knife with back form A from Peel Castle is with a female but clearly one of high rank. The occurrence of non-ferrous bindings on the Peel knife handle links it to the knife in Grave 203 at Repton and to graves of other

Table 7.1 Examples of late 8th-10th century burials with knives from Britain

Note: Sex has been determined either by study of bones or nature of associated grave goods

Site and Reference	Sex	Blade form	Other remarks
England			
Basingstoke, West Ham (Shetelig 1945, fig.13)	m	C1?	Weapons in grave
Carlisle Cathedral Grave 251 sf261	?m	A2	In scabbard, tang largely missing; L.75mm.
Harling, Norfolk (Rogerson forthcoming)	?m		Grave also contained two pivoting knives and a spur hence ?male
Find no.6		C1	L.173; blade:L.77mm
Find no.7		A2	L.117; blade:L.69mm
Little Paxton (Addyman 1969, 64, fig.3)	m	A2	L.120; blade:L.69mm
Repton Grave 203, sf1248	f		Burial in churchyard C3 S-shaped cutting edge, handle with non-ferrous bindings L.180mm
Grave 366	m		Coffined burial by mound to west of church
sf3744		C1	Tang missing, L.75mm
sf3782		Ci	Incomplete L.61, blade L.35mm
Grave 511, sf8671	m	Ci	Grave in churchyard, with sword and folding knife
Ripon, Ailcy Hill sf369	m	A1c	Groove on one face, tip of blade and tang missing. L.150, blade:L.105mm
Sonning (Evison 1969)	m	A2	L.166mm. Grave also contained sword and arrowheads
Thwing Grave Grave:J9, F.22; sf85.277	?	A2	L.122, tang incomplete.
York, St. Mary Bishophill Junior (Hall 1976, fig.11; Wenham and Hall 1987, 80)	m	C1	L.102mm

Table 7.1 continued

Site and Reference	Sex	Blade form	Other remarks
Scotland			
Aikerness, Orkney (Robertson 1968-9)	f	I	No details in publication
Barra (Brøgger 1930, fig. 148	f?	I	Knife form unclear, but not A
Colonsay: Grave 2 (Brøgger 1930, fig.133	m	I	Boat burial, knife form unclear
Oronsay (Anderson 1906-7)	m	I	Boat burial
Pierowall, Orkney: Grave 12 (Brøgger 1930, fig.78)	f	I	
Reay, Caithness (Shetelig 1945, fig.2)	m	I	
Uigg (Welander et al. 1987)	f	C or D	
Isle of Man			
Ballateare (Bersu and Wilson 1966, 61, pl.15b)	m	Ci	Boat burial. L.188; blade: L.105mm
Cronk Moar (Bersu and Wilson 1966, pl.17)	m	Ci	Boat burial L.203; blade: L.96mm
Knoc-y-Doonee (Kermode 1930a; 1930b)	m		Boat burial
1		?	L.c.127mm Bone handle
2		?	L.c.184mm Bone handle
Peel Castle (Graham-Campbell forthcoming)			
Grave 1:	f		
1		A1	L.215mm; Handle with non-ferrous bindings
2		Ci	S-shaped cutting edge
Grave 5	?	?	Very corroded, horn handle

high ranking individuals in Scandinavia in, for example, the Birka and Ladby cemeteries (Arbman 1940, Taf.177-9; Thorvildsen 1957, 93-4, fig.80). The form of the knives from the Scottish or Manx burials is hard to determine from the publications, but they do not appear to be back form A (except at Peel Castle) which would be consistent with the scarcity of the form in Scandinavia (6.3.30.2) if the burials are of Vikings.

In Scandinavia, where furnished burials of the Viking period are common, the knife is the most frequently occurring grave good in many areas (Müller-Wille 1987, 58). A brief review of the Danish and southern Swedish evidence, however, failed to indicate aspects of formal variability which could be consistently related to burials of particular status, although analysis is difficult because of poor survival of skeletons in the area. At Birka, however, there was evidence for a simple correlation between size and sex; smaller knives were much more common in burials thought to be female on the basis of other grave goods and the larger knives, or saxes, were found in burials thought to be male. This is comparable to the pattern in early Anglo-Saxon England where larger knives and saxes were exclusively buried with males (Härke forthcoming).

The significance of the knife in burials is difficult to assess but some concept of it as a personal possession and symbol of identity seems to be implied. One context in which the knife assumed this role was probably its use in eating. Knives are shown in contemporary illustrations, especially those of Christ's Last Supper, in connexion with meals and the pointed tip of 9th - 11th century knives indicates that, as in the later and post-medieval periods until the invention of the fork, knives were used not only to cut food but also to convey it to the mouth. In all societies eating is surrounded by numerous taboos relating both to what is fit and unfit as food and to protection of the mouth as an orifice through which disease, but more importantly perhaps, evil spirits and other polluting influences may pass (Douglas 1966, 33-4). It is not surprising therefore that knives acquired symbolic meanings based on their practical function, but of an essentially non-practical nature such as to make them enduring symbols in the idealised organisation of the world signified by burials.

Both British and Scandinavian burials indicate that knives were worn at the waist as items of personal equipment in manner also common today in parts of Scandinavia (Kostveit 1985) and elsewhere in the world. Elaborate leather scabbards from York (Tweddle 1986, 237-42) and other sites appear to confirm this, although Owen-Crocker (1986, 164) found no examples of contemporary illustrations showing the wearing of knives after c.800. There is, however, a probable 9th or 10th century sculpture from St.Mary Bishophill Junior church in York which shows two male figures, possibly huntsmen, one of whom has a large, scabbarded knife at his waist (Royal Commission on Historical Monuments 1972, xli, pl.26).

There is also some evidence for the use of knives in Anglo-Saxon England as symbols of identification in ceremonies relating to the transfer of land (Loyn 1984, 38). This practice continued into the 12th century when, Clanchy (1979, 24- 5) notes, knives were symbols of conveyance and were used to prove the authenticity of documents. He refers to a charter still preserved at Durham which has a knife attached to it and suggests that other charters of the period which have empty parchment strips hanging from them were probably authenticated by knives rather than seals. It is unfortunately not known what formal features, if any, a knife might require to assume these symbolic roles.

Contemporary illustrations are also difficult to interpret; the knives shown in, for example, B.L. Harley 603 (fo66v; Carver 1986, fig.12) and in the Bayeux Tapestry appear to bear little relation to archaeological material. One exception, however, may be the depiction of two lords feasting depicted in a mid 11th century manuscript from Winchester (B.L. MS Cotton

Tiberius C VI, fo5v); two substantial knives are shown, both of which appear to have back form A2c and one also appears to have decoration on the blade which might be interpreted as some form of inlay. Finally, evidence of the use of large knives for hunting is provided by an illustration from The Marvels of the East (B.L. MS Cotton, Tiberius B V fo6v; Temple 1976, fig.275) where a huntsman is shown gutting a stag.

Although the prospects for using contextual and associational information to understand the less practical aspects of variability in knives appear limited, it can, I suggest, be concluded they were used to convey symbolic messages about social status and identity, and, on occasions, property rights. In the present state of knowledge it is, however, not possible to add that knives also asserted regional identity, although the angle-back knife may be a primarily English form and, it may be noted, in vernacular practice in Norway today the pattern of notches in the back vary according to area (Kostveit 1985, 104). There is no evidence either that aspects of knife form reflect foreign influence. It cannot be shown, for example, that any development in knife form took place in Scandinavia before it occurred in England in spite of suggestions such as those of Addyman (1973, 91-2) who describes a knife from St.Neots as "...related to the series with Viking associations..." Nonetheless, increasing variability can, as in the case of dress fittings and riding equipment, probably be related to increasing social interaction in the 9th-11th centuries which led to an increasing need for non-verbal communication. Knives which, at least in some cases, were highly visible, would have been suitable vehicles for such information. Visibility alone cannot, however, explain why knives were used for social communication or the significance of specific formal features.

In spite of the problems I have outlined, I suggest that one way of understanding at least some aspects of knife variability is to consider the evidence for the use of knives alongside that for large single-edged weapons or saxes. The problem of distinguishing between knives and saxes has already been referred to in 2.2, 2.4, 2.5 and 3.30.9. In 2.5 it was given as an example of the general problem of classifying objects which are similar in some aspects of form, but vary in others, notably size, in such a way as to suggest that there was some functional distinction between them, although there might be no obvious grounds for making distinct classes. I suggested that in these cases there was probably an element of 'fuzziness' in contemporary classification. On such occasions, however, this very fuzziness may be useful to the archaeologist in allowing use of associational and contextual data relating to one group of objects to understand another. In the case of knives and saxes I concluded that while the distinction between single-edged blades as tools and as weapons must rest primarily on size, there was no convincing argument for a particular dimension or set of dimensions as a criterion for division. To facilitate discussion, however, I suggested in 3.30.9 that 250mm was a suitable length for a monothetic classification of single-edged blades into knives and saxes. This has the effect of excluding as saxes all the Coppergate knives and the vast majority of knives from other occupation contexts of the 9th-11th centuries, but classes as saxes the majority of objects customarily referred to by this name, all of which were probably weapons.

Although they are sometimes difficult to date, except on formal grounds, the development of saxes (as defined above) clearly runs parallel to that of knives. British saxes of 6th-8th century date usually have a blade back form corresponding to knife back form C1 (back straight and horizontal before curving down to the tip) with cutting edges which are straight or straight before curving upwards at the tip. Saxes of the 9th - 10th centuries usually have an angle-back blade. Cutting edges are usually straight but may curve upwards towards the blade tip; they are, however, never worn away to the elongated S-shape to be seen on many smaller knives which, I have suggested (3.30.3), is the result of heavy use in domestic or craft contexts. Surface decoration before the 9th century appears to be largely confined to grooves along the back of the blade face although the late 7th-early 8th century sax from Northolt (Evison 1961) was inlaid. Patterns of inlay, often very elaborate, and pattern-welding become well known on saxes of the later 9th and 10th centuries (Tables 6.3, 6.5).

One aspect of saxes by which they may be distinguished from smaller knives, however, both in the earlier and late Anglo-Saxon periods, is the type of context in which they were often found. Where this can be determined, it is frequently associated with behaviour of a religious nature, usually the burial of adult males, and also, perhaps, ritual deposition in rivers as is suggested, for example, by the sax from the Thames at Battersea (Wilson 1964a, 144-6) and others from the Witham (A.White 1980). This would seem to indicate an important role for the sax in the ideology of the aristocracy whose members had the power to determine the conduct of ritual or religion.

Although there are problems of translation (2.5), there may be references to saxes in the wills of aristocratic Anglo-Saxon males (Whitelock 1930, 23, 29). More convincing associational information is, however, provided by the saxes, apparently angle-backed, which appear at the waist of figures on the stone cross shafts of the late 8th century at Repton (Biddle and Kjølbye-Biddle 1985, 269-71) and the 10th century at Middleton (North Yorkshire). They clearly place the sax as a part of the equipment of males of high rank who enjoyed the privilege of being allowed to bear arms freely (Loyn 1984, 31). The sax, therefore, functioned in the context both of actual combat and in the ritualised behaviour related to it; in either case the user's identity and status was under stress. His weapon may therefore be seen as a vehicle for self-definition and self-assertion, and assumes a role as a symbol in the legitimation strategy of both the warrior and his social class.

The production of formally elaborate sax blades in late Anglo-Saxon times may, at one level, be related to the competitive economic environment of the period which led to product differentiation in other areas of the smiths' practice. The sax may, however, be an example of an object not usually traded in the market economy and there is some evidence that saxes were especially made to order for upper class patrons. The Sittingbourne sax, for example, bears the names of both the owner, Sigeberht, and the maker, Biorthelm. Formal elaboration presumably bears some relation to developments in the patron's strategy of ideological legitimation and by the mid-9th century the sax may have become an object with a considerable accretion of meanings beyond the purely practical. It may even be that in the last century or so of its currency its non-practical significance was beginning to overtake the practical. Although some saxes appear damaged (Evison 1964, 34), it seems unlikely that elaborately decorated examples were ever heavily used in warfare. They probably saw more service in purely ceremonial contexts, especially at a time when increased use of body armour (Owen-Crocker 1986, 162) would, perhaps, have reduced the effectiveness of a slashing weapon and greater emphasis was placed on piercing weapons such as swords and arrows.

The role of the sax in the environment of social relations of the 9th-10th centuries can, in conclusion, be related to two interlinked social issues in contemporary life: rank and personal identity. Aspects of the formal differentation of saxes may be regarded as references to them in the context of the ideology of the ruling class. The sax of the 9th-10th century is, in short, another of Barthes' mythological objects (7.6) whose meaning, while derived from historical or practical function, naturalises the power of a particular social group. It is in this mythological dimension of the saxes' significance that, I believe, an indication may be found of the meaning of some of the knives from occupation sites with which they share certain formal attributes.

One of the most distinctive attributes of both saxes and knives in the 9th-10th centuries is the angle-back (blade back form A1/2). I have shown above (3.30.5) that the 16-22 Coppergate knives with back forms A1/2 form something of a formally distinct group. The group also appear distinct metallographically (3.30.8) with a marked association with the butt-welded technique, a pattern which finds some support in comparable material (6.3.30.6). Two of the Coppergate specimens were also pattern-welded and I also showed that pattern-welding occurs exclusively on knives with the angle-back form (6.3.30.6). Finally, there is a greater correlation between the occurrence of grooves along the tops of the blades and notches cut into the back, and knives of back form A1 and A2 than between these features and knives of any other back form (3.30.6). Examples of inlay also occur exclusively on angle-back knives (although there is inlay on pivoting knives from Winchester and York; 6.3.31). In conclusion, there are a collection of attributes which tend to separate out knives with angle-backs from the rest. The development of this distinct sub-class suggests a need to emphasise, or at least refer to, a distinct series of social priorities different from those symbolised by the rest of the knives of the period. These priorities were, I propose, determined by the social group who used, and could afford, the saxes which the knives resemble.

In the light of this discussion it is easy to see how knives with angle-backs entered the same sphere of meaning and became part of the same mythology as the saxes in symbolising adherence to aristocratic values both in living contexts and also, perhaps, in burials. The 'imperative character' of myth (Barthes 1973, 124-5; 7.6) means that an exact resemblance between objects is not necessary for the communication of the same symbolic message. A small knife did not therefore have to resemble the Sittingbourne sax closely for it to trigger a similar response in men's minds and place it in the same sphere of meaning. It might need only the angle back or a simple groove along the back of the blade, for example, to make the required reference. These grooves whose significance appears at first sight so puzzling should, therefore I believe, be seen as simpler versions of the more elaborate ornamental incised and inlaid examples and another example of the economy of effort which underlies the smiths' work.

A powerful force in the production of knives was probably their use in emulation strategies in which people sought to acquire material symbols that would associate them with their social superiors. Although I have suggested that some of the larger knives from Coppergate, many of which have the angle-back, were, on the basis of size, hunting knives it is striking that 16-22 Coppergate produced virtually no evidence for the consumption of large game animals (O'Connor 1989, 187). Since hunting game was an activity restricted, to a large extent, to the aristocracy (Whitelock 1965, 91-2), it is possible that some townsmen were seeking to associate themselves with the status of the hunting classes rather in the manner of townsmen today who adopt the accoutrements of rural landowners.

One of the results of emulation behaviour, however, is that in order to retain exclusiveness the emulated class has either to restrict access to the items by which it defines its status, which can be done by burial for example, or it has to find new status items. A drive to do this may be one aspect of the decline of the sax in the 10th century, quite apart from its lack of military efficiency. Angle-back knives continue to be made in the 10th and 11th centuries, but as I have shown (6.3.30.2), they, along with grooves on the blades and pattern-welding, gradually become less common. Although many factors may intervene, these developments may be connected with a decline in the potency of the system of symbolic representation these objects described.

The angle-back knives are a good example of how specific formal variability can be understood in terms of a role in social strategies because of the existence of a bundle of correlated formal features which set the group somewhat apart. Some of those features, namely grooves on the blade face and notches in the blade back, do occur on blades of other forms in the 9th - 10th centuries and may again have the same metaphoric significance as they do on angle-backs; it is also possible that they indicate a breaking up of the symbolic homology of the angle-back knives as the form of the physical signs becomes devoid of meaningful content.

7.8 Social context : caskets, chests and their fittings

7.8.1 Introduction

There are very few caskets or chests of 9th-11th century date which survive in anything like a complete state. A few caskets have survived unburied in Cathedral treasuries and similar locations, but the rare examples of larger chests only come from archaeological contexts. Excavations in both Britain and Scandinavia have, however, produced evidence for many others usually in the form of iron and, occasionally, non-ferrous fittings. There are also large numbers of unassociated fittings from 16-22 Coppergate and other sites. Taking all the evidence together it is clear that there was a wide range of containers in use in the period ranging from small caskets to large chests. They were usually, if not exclusively, made of oak, although for caskets a variety of woods and, occasionally, other materials, including various metals and bone, were used. In terms of shape a simple oblong appears to be the commonest form, but convex and roof-shaped lids are known, as is the extension of the sides to form 'feet' and there is some evidence that caskets were carved or painted. Although the form and materials of caskets and chests were important aspects of formal variability, my principal area of interest is, however, to analyse how the blacksmiths' practice interacted with the production of caskets and chests. A number of Scandinavian examples with iron fittings are given in Table 7.2. with those from the Birka graves listed in Table 7.3. In Table 7.4 there is a list of cemeteries in England and Denmark where iron fittings, including hinges, corner brackets, hasps and locks, from chests used as coffins have been found. The only other English examples of 9th-11th century wooden containers with metal fittings that I know of are a small 11th century box wood casket with a roof-shaped lid and copper-alloy fittings (the lock is now missing) in the Victoria and Albert Museum (Talbot-Rice 1952, pl.38b), and a casket, probably of similar size, now only represented by iron corner brackets and a lock bolt, from Wicken Bonhunt (sf307 - 318, 321).

Table 7.2 Examples of 9th - 11th century caskets and chests with iron fittings from Scandinavia

Note: Sex refers to sex of burial

Site and reference	Sex	Description and size if known
Aske Frälsegård (Arne 1932, 81-3)		
Grave mound 1	f	? Convex lid, iron bands and lock
Grave mound 2	f	Stapled hasp with V-shaped notches in edge and other straps
Fyrkat: (Roesdahl 1977)		
Grave 4	f	Casket with decorative hinges, handle, stapled hasp; lock and key. Wood is oak and poplar
Grave 20	f	Casket with convex lid; decorative
Grave 22b	f	Chest as coffin with hinges, nails and hasp Casket with convex lid; decorative hinges, handle, stapled hasp; lock and key
Kaupang: (Blindheim et al. 1981, pl.39)	?	Straps, hinges, handle, stapled hasps, lock plate
Ketting (Brøndsted 1936, fig.45)	?	Lid covered with iron plate, handle fixed with Ag rosettes, Ae fittings fixed with Ag nails. 280 x 280 mm
Köping, Öland (Hagberg 1965, 163, fig.4; boat burial)	f?	Casket with iron nails and handle, bronze fittings and key
Langtora (Arbman 1936)	m	Casket with ring handles and plain straps.
Mästermyr (Arwidsson and Berg 1983)	na	Convex lid, feet; hinges, lock, lock plate 870 x 250 x 240mm
Oseberg Ship: (Grieg 1927-8)	f	
box 134		Iron tacks with tinned heads. L.350mm
casket 103		Iron and brass hinges and other plated fittings L.350mm
chest 149		Convex lid, plates with tinned nails, 3 hasps with animal heads. 1130 x 380 x 290mm
chest 156		Iron plates with nails with tin plated heads. 1040 x 360 x 410mm
chest 178		Nailed together 660 x 310 x 240mm

Table 7.2 continued

Site and reference	Sex	Description and size if known
Sønder Onsild: (Roesdahl 1976) Grave 8	f	Lock, lock plate, hasp, tinned nails; Wood is maple. L.250mm
Thumby-Bienebek (Müller-Wille 1976b, Tafn.36-7) Kammergrab 21	f	Convex lid, straps, nails, handle, hinges, staples, lock, key. 300 x 140 x 140mm
(Müller-Wille 1987, Abb.14) Kammergrab 51	f	Small cylindrical wooden box; ring handle, lock plates. Diameter c.300mm
Trelleborg: (Nørlund 1948, pl. 24, 10) Grave 99	f	Pinned hinge and ? other fittings
Tuna in Alsike Grave 8 (boat burial) (Arne 1934, 35 Taf. 7)	m	Lock and iron fittings

Table 7.3 Summary of caskets from the Birka Graves
(After Arbman 1943)

Fittings are iron unless stated

Grave	Sex	Description
24A	?	2 handles, key
67	?	2 handles fittings
212	?f	Handle, fittings, nails, key
513	f	Plain hinges, stapled hasp, lock bolt, nails; 225 x 135 x 90mm
539	f	Plain hinges, handle, lock bolt; 190 x 120 x 75mm
542	m	Cylindrical; ring handle, stapled hasp?
559	f	Handle, dome-headed nails, strap, key (bow and stem decorated with grooves)
573	m	Straps with bosses, dome-headed tacks; 570 x 360mm
585	f	Cylindrical; bronze plates and tacks, decorated lock plate, key?
590	f	Handle, 23 dome-headed tacks, key?
624	f?	Decorated straps and ring handle
639	f	1) Painted; plates, tacks, hinges, handle, hasps, lock plate (all copper alloy); 460 x 200 x 170mm 2) Bronze hinges and hasp; 200 x 70 x 90mm 3) ? stapled hasp and lock
708	m	Corner bracket, 2 keys
739	f	Iron sheathing, decorative tacks, corner fitting, lock, handle, 2 stapled hasps, key; 400 x 200mm
791	f	Vaulted lid, feet; straps, 3 hasps, handle, hinges
823	f	Nails, corner brackets, lock plate
838	f	Lock plate, lock, tacks, ring handle
845	f	Iron sheathing, decorative tacks, 2 stapled hasps
847	f	Lock plate, lock and fittings
850	m	Straps, decorative tacks, hinges
854	f	Vaulted lid? stapled hasps, straps, lock plate, bronze and iron key
963	f	Lock plate fittings
965	f	Decorated lock plate, ring handle, dome-headed tacks, key?
980	f	lock plate, hinges, staple
1081	f	Straps, key
1083	f	Handle, bronze fittings, bronze keys
1125	m	Plain hinges, ring handles, straps

Table 7.4 8th-11th century cemeteries from Britain and Denmark with burials in iron-bound chests

Site and Reference	No. of chest graves	Date	Status of site and remarks
Britain			
Dacre (Ottaway forthcoming)	5	8-9th	Monastic, chest graves concentrated near church, others disturbed, no skeletons survived
Garton Slack, (Mortimer 1905, pl.91, figs.715-7)	1	?8-9th	Date uncertain
Hereford, Castle Green grave S86 Shoesmith 1980, 36-8)	1	10th	Urban cemetery
Monkwearmouth (Cramp 1969, 33; pers.comm)	c.6	8-9th	Monastic, graves spatially clustered, hard to estimate numbers as much disturbance
Peel Castle Grave 5 (Graham-Campbell forthcoming)	1	10th	? Aristocratic
Repton	c.18	late 9th - 11th	Chest graves concentrated around burial mound west of church, none in churchyard cemetery
Ripon, Ailcy Hill (Hall and Whyman 1986)	c.12	8-9th	Unknown status but location and predominance of males suggests it is unusual. Coffin burials clustered at top of mound
Thwing	c.22	8-9th	? Aristocratic site
York Minster (Kjølbye-Biddle forthcoming)	5	9-10th	Cathedral cemetery
Denmark			
Forlev (Brøndsted 1936, fig.) 102-3)	1	?8-9th	Male burial
Fyrkat (Roesdahl 1977)	1	10th	Female burial
Lejre (Roesdahl 1982, 114-5)	1	9-10th	

Some indication has been made in the discussion in Chapter 6 that the chest and box fittings of the 9th-11th centuries exhibit considerable formal variability, much of which appears redundant with regard to purely practical function. The period also sees the increasing use, if not the invention, of new classes of fitting such as the stapled hasp and the barrel and box padlocks with T-shaped key holes. Although the evidence remains hard to evaluate, it appears that the extent of variability is much greater after c.800 than before, with the later 9th-10th century a time of considerable development. A feature of the data appears to be a correlation between small size and decorative treatment of fittings and this is confirmed by the occasional occurrence of small decorative non-ferrous fittings.

7.8.2 Contextual and associational data

The contextual and associational information on the role of chests in the environment of 9th-11th century social relations is, as in the case of dress fittings and knives, of a somewhat exiguous and heterogeneous nature. While the material from 16-22 Coppergate and other occupation sites appears to show that a range of chests of varying sizes and degrees of formal elaboration was in general use, an archaeological indication of their symbolic significance beyond their practical function derives primarily from burials. In

Britain small boxes and keys are frequent grave finds of the early Anglo-Saxon period; they appear to occur exclusively with female burials and often contain textile implements as well as other personal equipment (Fell 1984a, 40). From c.700 onwards small boxes and keys cease to occur in graves, but, as already noted, in 8th-10th century cemetery contexts there are a number of examples of large chests used as coffins (Table 7.4) which can be distinguished from simple nailed coffins by the presence of hinges, and, in many cases, hasps and locks.

As I have already suggested above (7.5), a coffin with its associated iron fittings was probably the only artefact, except perhaps for clothing which could legitimately be used to express status in Christian graves of the 9th-11th centuries so that these chest burials are of considerable interest from a social point of view. One indication of their distinct status is that the cemeteries in which they occur appear to be principally monastic, aristocratic or in some other way associated with the upper classes. Within the cemeteries the burials were, furthermore, often clustered together indicating a distinct social group. Further indication of high status is provided by two of the graves from Repton and one from York Minster which contained gold thread, presumably from garments.

In Viking Age Scandinavia numerous female graves, or graves presumed to be female, as well as a few graves presumed to be male, are known which contain small boxes or caskets and their occurrence often correlates with other grave furnishing denoting distinct status, probably high rank. Some examples have been given in Tables 7.3 and 7.4 which show that that the caskets often had decorative metal fittings. Keys were also common in graves and were usually of a small size suggesting a use with caskets rather than large chests or doors, although keys and caskets were rarely found together.

Turning from burials to contemporary documents, there are references which suggest a range of chests with different functions. In the will of Wynflaed (Whitelock 1930, 14), a high ranking lady of the 10th century, the two following passages appear:

"And she bequeaths to him two chests and in them a set of bed-clothing, all that belongs to one bed"

and

"And to Eadgifu two chests and in them her best bed-curtain and a linen covering and all the bed covering that goes with it ...and there are two large chests and a clothes chest, and a little spinning box and two old chests."

In a late Saxon estate memorandum usually referred to as the "Discriminating Reeve" there is reference to "chests", "coffers", "yeast-boxes" and a "resin-box" (Swanton 1975, 27). It is difficult to relate these references to surviving artefacts although they give the impression that formal variability was linked to a system of a cognitive classification with regard to chests in respect of contents and size. The wills are also striking in their association of women with chests and with certain types of property which would have been stored in them (Fell 1984a, 44-5). The absence of chests in male wills does not, as Fell (ibid.) points out, reflect an absence of male interest in bequests of small items of property, but it does, I suggest, emphasise a particular sphere of female concern.

Other documentary sources make the same association appearing thereby to stress that woman's role in late Anglo-Saxon or Viking society was as a person with a special responsibility for property in the domestic sphere. In the laws of Aethelbert (early 7th century) there is a reference in Chapter 73 to the "friwif locbore" which Fell (1984b, 161) has interpreted to mean "in charge of keys." Should such a woman be guilty of dishonesty a 30 shilling fine was payable. Fell (ibid.) also points out that Cnut's laws (early 11th century) make it clear that a woman was responsible for places to which she had the keys and would be counted as accessory to any theft of stolen goods locked in her "store room," "chest," or "box". The distinction between chest and box is suggested by Fell (ibid., 162) to be one of size: " ..the teag (box) being the place for small precious objects."

I know of no contemporary illustrations showing chests except for a few representations of what are presumably small reliquary chests (e.g. in B.L. Arundel 155 fo133; Temple 1976, fig.213) which serve to emphasise the more general point about a relationship between small size and intensity of symbolic meaning in a religious context.

There are a number of references to locks and keys in Anglo-Saxon literature which indicate the role of these objects as vehicles for symbolic representation. The key has, of course, been a prominent and enduring symbol in the Christian world as the attribute of St. Peter, guardian of the gates of heaven and hell and this can be seen in numerous Anglo-Saxon manuscript illustrations (e.g. B.L. Stowe 944 fo7; Temple 1976, fig.248). In both cases the key has a symbolic role in marking a cognitive boundary of considerable metaphoric significance in contemporary life. The key's presence in this context presumably goes some way to explaining the formal elaboration of ecclesiastical keys of the medieval period and a 9th century silver example with an extremely elaborate openwork bow is the key of St.Servatius of Lorraine (Anon 1976, pl.9). Religious meaning may also have informed attitudes to keys in secular contexts and there are types of St. Peter's penny from York bearing a key (Almgren 1955, fig.58-9; Bendixsen 1982, fig.1) which may be seen as a religious symbol, but also as a declaration of the restored secular power of the church in 10th century York which had rapidly converted the pagan Vikings. The key, in other words, may form a component of the ideology of both spiritual and earthly power.

Keys also appear in literature. One of the riddles in the Exeter Book reads:

"My head is forged by the hammer, wounded with pointed tools, rubbed by the file. Often I gape at what is fixed opposite to me, when, girded with rings, I must needs thrust stoutly against the hard bolt; pierced from behind I must shove forward that which guards the joy of my lord's mind at midnight. At times I drag my nose, the guardian of the treasure, backwards, when my lord desires to take the stores of those whom at his will he commanded to be driven out of life by murderous power." (Gordon 1954, 308)

In addition to presenting the key as a symbol of power over property, one aspect of this riddle may be sexual innuendo and so it is a further indication of the relationship that existed between property rights and sexual roles.

The metaphoric suggestiveness of the key's form and the operation of locks appears to render these objects particularly suitable vehicles for symbolic representation in relation to sexual behaviour (Meaney 1981, 179). A particularly overt example, in this case probably concerning a padlock key, is to be found in another Exeter Book riddle, it begins:

"Swings from his thigh a thing most magical
Below the belt beneath the folds
of his clothes it hangs, a hole in its front end
stiff set but swivels about" (Alexander 1977, 99)

In conclusion, I suggest that caskets, chests and their fittings had a role in 9th-11th century society in symbolic communication relating to a number of areas of contemporary life including property rights, social rank and sexual roles. It is now possible to look a little further at how these functions related to artefact variability.

7.8.3 Interpretation

Clearly some aspects of the formal variability of caskets, chests and their fittings may have developed as a result of Scandinavian influence; one example being the stapled hasps with animal head terminals (3.52) from 16-22 Coppergate which do not occur elsewhere in Britain, but are well known at Birka and other Scandinavian sites (6.3.52). As in the case of dress fittings and knives, however, an examination of other forms of social interaction represents the best starting point for understanding the artefacts. Clearly the more decorative nature of smaller fittings and keys could be interpreted by claiming a relationship with their visibility when in use. As portable objects small boxes, padlocks and keys were presumably visible to a wider audience than the large household chests such as, for example, that containing Wynflaed's bed linen, which might stay in one place in the recesses of the home. Once again, however, merely to assert that objects functioned as channels of information exchange does not explain the details of formal variability of particular classes or allow an understanding of how they fulfilled their role in symbolic communication. These problems can only be approached by considering how they operated in the context of power-seeking strategies in society; in this case as they underlay concepts of property ownership, social rank and sexual roles.

One way of describing social power in relation to property is by its physical and spatial manifestations. In developing urban areas like Anglo-Scandinavian York or 11th century Winchester (Biddle 1976) property was divided spatially in a number of ways into units located one inside the other. The largest unit was the town itself; below that other units existed which divided the town up into parishes or wards, although their exact extent in the pre-Conquest town remains a matter of debate (Reynolds 1977, 94-5). At a lower level in the hierarchy were the individual tenements within which were the buildings and there were then intra-building divisions of which containers such as chests may be seen as examples. At the junction of each property unit there would be boundaries subject to legal provisions regarding access. Loyn (1984, 146) points out that laws to deal with theft, which can be defined as a form of illegal crossing of property boundaries, occupied the largest part of Anglo-Saxon law codes. Formal written versions of the codes derived from unwritten customary arrangements which still had considerable power in late Anglo-Saxon society. As I have suggested (2.4), following Levi-Strauss, the maintenance of boundaries relating to all aspects of social experience, including property ownership, in a non-literate society such as existed in 9th-11th century England, would have required a range of clear physical representations. It is not surprising, therefore, that artefacts which functioned on the boundaries between the property units were a focus for the development of formal variability since control over the ordering of property was a vital component in the acquisition of power in society. The significance of individual elements in variability is not usually apparent but the presence of protective animal heads may again be noted.

This increase in formal variability of related artefacts may be seen in the wider context of changing forms of ownership and administration of property in late Anglo-Saxon England. In the rapidly growing economies of the towns this probably caused particular social stress with new practices such as burgage tenure allowing payment of money rents and the freer alienation of land (Reynolds 1977, 93; Loyn 1984, 150-2). One indication of increasing concern for property rights in York was the imposition of tenement boundaries at 16-22 Coppergate and elsewhere in the early 10th century, a feature which distinguishes the late Anglo-Saxon towns from the proto-urban settlements such as Hamwic (7.3, 7.4). Immediately suggestive also of a society in which property was an issue is the relatively large number of keys and locks from proto-urban and urban sites of the 8th century onwards which appears to indicate a new-found concern to secure chests and houses against theft. The evidence of formal variability in chest fittings, however, suggests a particular concern to mark boundaries around the smallest elements in the property system. In the religious sphere this can perhaps be readily understood given the complex system of symbolic representation surrounding spiritual matters, but since iron objects are rarely part of reliquary caskets and the like, I will pass to a discussion of secular items.

One aspect of the general concern over property rights was its relationship to concern over sexual roles. Contemporary sources create the impression of a rigid distinction between the roles of men and women (Fell 1984a, 39-40). This distinction, however, masked a great imbalance in terms of social power, the advantage lying very much in favour of men to the extent that women were conceived of as, in a sense, part of a man's property. As in tribal societies observed by Levi-Strauss (1968, 83), strict rules of kinship and marriage probably created a society in which women were used as a form of social communication between male dominated families or clans. In this context aspects of material culture associated with women, including dress and the tools of activities peculiar to them would be manipulated as components of symbolic communication in men's strategies of legitimation. Since power based on property lay at the heart of relations between men and women items related to property may have assumed importance, especially at a time when the relationship between the sexes was changing (Fell 1984a, 39).

The ideas I have expressed in this section so far can be illustrated by the formal variability of all classes of fitting, but especially locks and keys which together form another example of the way the mythological significance of artefacts, in the Barthesian sense, derived originally from practical function.

In practical terms the overall level of security offered by the locks of the 9th-11th centuries appears to have been low. They were probably lacking both durability, due to the relatively poor iron used, and sufficient individuality and complexity to prevent easy picking. Improvements were, however, gradually made in the late Anglo-Saxon period leading to some gradations in the degree of security available. In the case of fixed locks, employing a tumbler (3.63.1; 3.64.1) rather than springs (3.63.2) there were, on occasions, quite complex ward patterns. In padlocks greater complexity was introduced by use of internal wires and the addition of strips to the leaf springs. One problem of increased elaboration, however, was that it probably involved a shorter life, both because intricate ward or spring patterns would be more susceptible to damage through misuse, and because the key once lost would be difficult to replace. Some confirmation of this point may lie in the more frequent occurrence of plating on keys with complex bits suggesting that they were not expected to be so heavily used as keys with simpler bits and no plating (4.5). In summary, it is suggested that the relationship between the cognitive and physical significance of locked property involved a considerable emphasis on the former as a way of maintaining security. As in other functional contexts, the balance gradually changed in subsequent centuries as technical efficiency caught up with social requirements. The emphasis on the cognitive significance of property boundaries, I suggest, structures aspects of formal variability in the artefacts with one prominent feature being the correlation of small size and diversity of form and decoration, and to large size with simplicity of form. The implication of the data is that boundaries to property of differing status, defined, presumably, either by contents or ownership, were marked in different ways.

The establishment of how the status of property differed may be revealed by the pattern of correlation between the complexity of keys and locks and formal variability. I suggested that keys with more complex bits were used in locks which did a better job because they were more individual, but that, other things being equal, did not last so long. It is possible, however, that these complex keys were treated with more care and not used so heavily because they opened locks in chests of a particular status or, more accurately, containing property of a particular status. On the basis of key size it is likely that these chests were relatively small, such as perhaps Wynflaed's "spinning box" or some of the Birka caskets, as opposed to the larger chests with simpler, larger locks which stood up to heavier use but contained property of rather different status. Confirmation would ideally need the clear association of the key with the casket but, except in a few Scandinavian burials, I know of no keys found with the locks for which they were intended. The burial evidence, however, suggests a correlation between small caskets and small keys and occasionally a correlation between decorative caskets and decorative keys. In Birka Grave 559 (Arbman 1943, Taf.270, 2; 1943, 180), for example, the casket was decorated with dome-headed nails and the hollow stem key is small and decorated with grooves and plating.

Based largely on the burial evidence, it may be suggested that one of the lines along which a distinction in property status ran was between property peculiar to women, such as jewellery and spinning tools, contained in small chests, and property either communally held by a household or property specifically held by men, such as the contents of the Mästermyr tool chest, which was contained in larger chests with plain fittings. Such distinctions could, however, have been cut across by distinctions based on other aspects of social status including rank. Female burials in chests and the association of Wynflaed with chests can be resolved by pointing out that the rank of these women might nullify sexual distinctions applying at other social levels. Where women, such as those whose wills survive, do appear to have had a measure of social power, it is, however, still manifested through traditional symbols such as chests. Wynflaed may have had control of rather more contexts of social interaction than poorer women, but was still constrained to express it by the diversity of her chests rather than by use of some artefact associated with the male realm.

Another example of the way chests might be manipulated as a symbol of social values is their use for the burial of certain individuals in the 8th-11th centuries (7.8.2; Table 7.4). Both the chests themselves and the ironwork may be considered, to some extent, as prestige goods buried to emphasise the ability of the owner, or owner's family, to deprive themselves of a valuable item. Clearly more data on the sex and age of chest burials may clarify the meaning of the custom, but it is likely that within the context of an increasingly hierarchical society, certain groups chose to assert their rank and status at the time of burial by direct association with an item symbolising property ownership. It is difficult to judge how the use of chests in burials affected the formal variability in the fittings, but it is possible that since use of chests as coffins was secondary to, and distinct from, their original function no close relationship existed. The symbolic significance of what were apparently often rather battered items, with fittings missing, was sufficient to make the necessary reference. In this context it may also be noted that in the three Danish examples the chests were insufficiently long for the burial (Fyrkat 1.30-5m long, Forlev 1.40m and Lejre 1.47m) and at Fyrkat and Lejre had their ends cut off and at Forlev the skeleton had been bent to fit (Roesdahl 1982, 114). The symbolic significance of employing a chest presumably outweighed the inconvenience of adaptation.

In conclusion, it may be suggested that the increasing formal variability of chests, caskets and their fittings in the 9th-11th centuries can be understood in the context of the growing importance of property rights as a social issue. Contextual and associational evidence indicates that this was closely bound up with issues of distinctions in social rank and status. Just as in the case of the dress fittings and knives, apparently simple formal features probably had considerable powers of reference whether in the relatively overt manner of the simplified animal heads on hasps and other fittings or the more abstract manner of the grooves, mouldings and other relief features.

7.9 Social and Economic Context : Conclusion

In examining the relationship between the patterning in late Anglo-Saxon and Viking Age ironwork and its economic context it is apparent that smiths were fully involved in the dynamic expansion and diversification of production which can also be observed in other crafts. These processes should, however, be seen against the background of change and conflict in social relations and concern about issues of social status, in particular rank, but also social roles. Variability in all three categories of object I have examined in detail can be interpreted as illustrations of the way that material culture played an active part in these developments both in the strategies of the smiths and those of their customers.

It is clear that the choice of the material means of expressing them was in no way arbitrary, but was motivated by the practical, or historical, function of the artefacts. There were moreover connections between the object classes I have discussed in terms both of their social role and pattern of formal variability. This is particularly apparent in respect of surface treatment. Firstly, in all three cases there is something of a hierarchy ranging from specimens which bear no or only a little surface treatment to others which are highly decorative. Secondly, in addition to non-ferrous plating or inlay, there are relief motifs which were used on objects across a wide spectrum of classes. I suggest that the context in which this comparability occurs is one of a homology of social values and priorities which the objects signify. Riding equipment, angle-back knives and saxes, and chests can all be seen as having a close interrelationship as a set of material symbols of social rank more powerful collectively than each individually. This interrelationship led to an ordered structure informing the smiths' practice which was manifested in elements of formal patterning common to a wide range of products.

CHAPTER 8

CONCLUSION

8.1 Introduction

In Chapter 1.1 I defined my principal objective as the reconstruction of the organisation and working methods of the Anglo-Scandinavian smithing industry by means of a detailed examination of the iron objects from 16-22 Coppergate.

In Chapter 3 the objects were described on the basis of their practical functions as craft tools, structural fittings, dress fittings, riding equipment, horse equipment and weapons. A prominent feature of the assemblage, however, were objects identified as bar iron, blanks and scrap (3.1) which, together with the large quantity of slag (1.6; 1.9), appeared to be good evidence for smithing on the site itself. This was confirmed in the study of the objects and slags in relation to their site context (Chapter 5) which showed that the Period 4B buildings (dated c.930 - 975) probably served as smithies and suggested that in Periods 3 and 4A (c.850 - 930) ironworking may have taken place in the immediate vicinity of 16-22 Coppergate. A number of possible site products were identified, notably needles and tin-plated dress fittings (5.6)

When the ironwork from Coppergate was compared to that from other sites of the 9th - 11th century in England and elsewhere in northern Europe (Chapter 6), it was evident that the York smiths' practice was not dissimilar, in terms of its range of products and their formal attributes, to that of other smiths of the period, especially in eastern England. At the same time there were indications of some localised formal idiosyncrasies peculiar to the city. The Coppergate material also confirms that the period was one of considerable diversification and innovation in the smithing of iron. The evidence was used in an attempt to throw light on social and economic developments (Chapter 7) in a period which other sources, both archaeological and historical, suggest was one of rapid growth in England's economy resulting in both the emergence of a market system centred on towns and increasing stratification and mobility in society.

In order to tackle the reconstruction of the smithing industry and examine the wider implications of the results I also noted in Chapter 1.1 that tools of both a practical and conceptual nature were required and that, moreover, developments in both fields had been rapid in recent years. I will conclude with a few recommendations for further work based on a brief assessment of the value of some of these developments.

8.2 Approaches to Excavation and Post-Excavation

There can be little doubt that the excavation of sites where artefacts were manufactured is of great importance because of the information they can provide firstly on their dating and provenance and, secondly, on a wide range of technological and economic problems. Since the beginning of the first millennium A.D. in Britain iron has been one of the most widely used materials; the archaeology of iron smithing sites must, therefore, be accounted of particular interest. As far as the post-Roman period is concerned, however, only a few sites have been recognised in Britain. Only two, both urban, have produced a substantial body of material; one of them is 16-22 Coppergate and the other is Six Dials, Hamwic (Youngs and Clark 1982, 184). The publication of the Hamwic material is of great importance, but excavation of further sites should also be given high priority to test the conclusions arrived at in the study of Coppergate. Urban sites, in particular, will be valuable because they usually produce substantial quantities of artefacts and residues, and because of deep stratification, allow the study of the industry in a diachronic manner not often possible elsewhere. It is nevertheless the case that the work of the non-urban Anglo-Saxon smith remains an important area for research.

16-22 Coppergate has shown that the way to dig ancient urban manufacturing sites is by large scale area excavation. Although the structures used for smithing may be more readily recognisable than those used for other crafts because of the relatively substantial nature of the hearths, they will still be hard to identify unless complete buildings can be revealed and related to spreads of slag and other smithing debris. It is likely that slag and scrap will be pervasive in urban areas and cannot always be taken to be indicative of the presence of a smith's workshop on a particular site. In the context of urban organisation a multi-property investigation will as at 16-22 Coppergate also be useful for assessing the degree of spatial concentration of the industry into a smithing quarter, although the evidence from this site is equivocal (7.4).

To get the maximum information from the excavation of an iron smithing site a continual review of the finds in the light of research objectives is necessary during fieldwork. It is unfortunate that, although large quantities of slag and other smithing debris were found during the excavation of 16-22 Coppergate, there was little recognition of the implications of the material until the post-excavation stage. It would, perhaps, be unduly cynical to suggest that the significance of the ironworking evidence was either obscured in the excavators' minds by the more immediately pleasing nature of non-ferrous metal, amber or jet finds, or given low priority because of enthusiasm for artefacts thought readily datable or sourceable. A reason should rather be sought in the pressure of work on a rescue project which tends to preclude much examination of artefacts after initial on-site recording. Nonetheless, failure to recognise the quality of the ironworking evidence on the site meant that, for example, systematic soil sieving to recover either hammer scale, one of the best indicators of smithing activity (1.9), or more of the small bars and strips (3.1) or possible products, such as needles, was not considered. I suspect, moreover, that the recovery and recording of iron slag, that most unfavoured component of urban deposits, was on occasions less than rigorous. All urban archaeology involves sampling, but this needs to be planned in accordance with a range of objectives which require continual review. At Coppergate emphasis was clearly placed on examination of structures but less regard was given to analysing the meaning of the site in respect of other categories of material culture.

The need for a fully integrated record of strata and related artefactual material as a basis for all forms of research in urban archaeology has been stressed, and computerisation will clearly be vital in facilitating this. I also suggest, however, that new forms of site recording may be required in excavation to deal with specific problems raised by manufacturing sites. I refer first to the three-dimensional plotting of artefact find spots. As I noted in Chapter 5.5, the interpretative value of the plots is greatest on undisturbed single period sites, but even on stratified sites with much secondary disturbance they can be of value in describing the patterning of artefact find spots, such as manufacturing debris, in relation to possible sources and identifying areas of activity especially refuse disposal. Secondly, I refer to the quantification of the volume of deposits as an important basis for establishing their meaning in terms of relative intensity of activity in different parts of a site or in different periods of occupation. One of the problems of demonstrating a significant non-random concentration of ironworking material around the Coppergate workshops was the difficulty of getting information on the volume of deposits of the various classes and in different periods and areas.

Moving from excavation to post-excavation, it became clear during my research that while iron objects present a distinct set of problems for archaeologist and conservator alike, their careful treatment after excavation is an essential prerequisite for study. The archaeologist should, in my view, aim to study an artefact in a condition as close as possible to that which it had on discard in antiquity. In the case of iron objects this presents a particular conservation problem as they are usually more corroded than objects made in other materials. Although they may have reached a reasonably stable condition in the ground, further corrosion will begin as soon as the object is excavated and this can, in most cases, only be retarded and not halted by conservation and proper storage conditions.

Failure to X-ray iron objects or to understand X-radiographs is, as I noted in 6.1, clearly at the root of many of the problems of relating the 16-22 Coppergate ironwork to comparative material. The value of X-radiography is now generally accepted in British archaeology as essential for correct identification of iron objects but, in view of their unstable nature, it should be done as soon as is practicable after excavation. This will provide a record of the object, including what may be fragile but important details liable to disappear in subsequent corrosion. The experience of studying the 16-22 Coppergate material also shows the importance of X-radiographing every object from a site and not merely those which appear 'interesting', however that term is defined. Out of several thousand objects thought on site to be nails, and initially not worth X-radiography, several hundred objects of other classes were found after X-radiography;

virtually every object in the catalogue with a small find number after 14500 falls into this category. X-raying iron objects is ultimately, however, only a recording device, and interpretation is clearly a skill which is greatly underdeveloped, as I have had occasion to discover when checking published material. Clear evidence for form as well as for details such as non-ferrous plating and metallographic structure is, for example, frequently ignored.

Conservation of more than a small percentage of ironwork from a site is usually impossible and so a well planned selective programme is vital, especially to examine the three dimensional features which can never be revealed by the two dimensionality of an X-radiograph. Paradoxically, perhaps, well-preserved ironwork, such as that from 16-22 Coppergate, warrants special attention in conservation as the original surfaces of the object may survive uncorroded and yield important detail of decoration and manufacture which do not survive on more corroded material. The Coppergate knives were, for example, all cleaned and details such as grooves and notches (3.30.6) were revealed which were not visible on X-radiograph.

While some metallographic features can be detected on X-radiograph, the Coppergate project has also demonstrated the value of physical examination on a relatively substantial scale. A virtue of the programme was that it was geared to answer technological problems within the context of archaeological research. The samples were chosen to relate metallographic data to chronological development and other artefact attributes. Metallography has added an extra dimension to classification and to the understanding of iron technology's cultural context since the patterning in metallographic structure is clearly determined by a range of cognitive factors in the same way as any aspect of external form.

It is probably invidious to claim that the 16-22 Coppergate ironwork has set a standard for others to follow in publication, but as I pointed out in 6.1, the standard of ironwork publication has been, to put it charitably, extremely variable rendering detailed comparative studies difficult. Whatever its other faults this thesis and the fascicule, AY 17/6, provide a detailed description of every object and a competent drawing of the vast majority, other than nails, based on a cleaned specimen or good X-radiograph. This should be seen as a fundamental requirement in publication, especially considering iron objects are by their nature likely to disintegrate over time and no longer be available for inspection in their excavated form.

8.3 Theory

The detailed study of archaeological material soon forces one to confront a number of basic theoretical and philosophical problems which essentially stem from the question of how reliable knowledge of human activity and behaviour in the past can be acquired. The essentially equivocal nature of much of the data means that it is rarely, if ever, possible to generate clear cut inferences and the student is left with provisional and contingent statements which appear to require a great deal of further research.

The archaeologist's knowledge of the past from its physical remains has always derived ultimately from the use of analogy (2.5) drawn from artefacts whose function may be determined as a result of some form of relevant record or observation. The use of analogy has, however, gradually become more sophisticated, especially in the last 30 years or so. At one time relatively direct projections were made from contemporary experience onto the past in all spheres of inference from object function to economic and social organisation. New sources of analogy, especially from ethnographic and anthropological observation have, however, meant that the range of potential meanings symbolised by ancient artefacts has widened considerably. Another source of information, the archaeological context, is also undergoing more sophisticated examination. Improved methods of excavation, recording and physical examination of deposits and structures are all contributing to an understanding of the processes leading to their formation and thus to the function of artefacts found in them.

The complexity of analysis which follows from accepting that ancient artefacts functioned in many overlapping contexts, which may have related to different aspects of their form, has meant that statistical techniques have become a necessary accompaniment to interpretation. They introduce an element of measurement of artefact variability and allow correlation between data sets. The extensive use of statistics has, of course, been strongly associated with systems theory approach (2.3), which has attempted to move archaeology towards the natural sciences and aimed to produce generalised and objective rules of human behaviour. A statistical element is also, however, important in the alternative approaches offered by structuralism and its derivations, although they return archaeology to the human sciences in which, as I noted at the beginning of 7.2, a subjective, even dogmatic, component is unavoidable in interpretation.

Culture in structuralist and post-structuralist theory is, as I have noted in 2.4, defined as a system of communication. This implies that all products of human culture are analogous to language and may be understood as a system of differences in which the relationship of meaning to representation is essentially arbitrary. Although it should not be assumed that this is an entirely appropriate paradigm for the study of material culture, since an element of their form is motivated towards practical function, structuralism and its derivatives do provide a powerful means of interpreting formal variability, especially in areas where function in a strictly practical sense is not evident.

The crucial component of post-structuralist theory is the stress placed on the ideological underpinning of culture which derives from the articulation of the shared interests of social groups and forms the basis for strategies of acquiring social power. The necessary implications of the theory may, on the one hand, be that the individual's scope for autonomous action is severely limited but, on the other, that aside from the results of idiosyncratic neurological phenomena, virtually all aspects of the formal variability of artefacts are potentially susceptible to analysis in terms of meaningful patterning. For archaeologists this means that attention to detailed recording is imperative as there can be no escape from the significant.

Another important aspect of post-structuralist theory is that it ties ideological constructions to historical context. This has the effect of reducing the potential for cross-cultural generalisations about human behaviour, although it does not exclude them and in Chapter 7, for example, much of the argument is based on an assumption that man's 'will to power' is a universal phenomenon. An appreciation of the importance of historical context for structuring man's cognitive responses to his environment also implies an explicit acceptance of the role of ideology in the way modern day archaeologists interpret the past. The systems theorists' ideal of removing the subjective from archaeological inference must be abandoned and while we are left with the aim of attempting to match our own ways of knowing the past with that of the ancient peoples who lived in it, we have, at the same time, to accept that this can never be attained. This is not to deny, however, that we can make sense of the past by the study of patterning in its remains and the intelligent use of analogical and contextual information.

Developments in approaches to the meaning of ancient artefacts are important for interpretation, but they are also important for data gathering. Limits on what it is believed possible to know will in turn place limits on what is investigated. There still exists a substantial gap, however, between academic research into theoretical matters and practical field work. It is, perhaps, unfortunate that most new theoretical approaches have been developed by the study of living societies in distant parts of the world rather than of ancient societies in Britain or Europe. This has, I suspect, contributed to a view prevalent in British field archaeology that the quality and form of data generation has no direct connection with epistemological problems.

This state of affairs hampers not only progress towards understanding the past, but also the development of new approaches to data gathering itself. In the attempt to use the study of 9th-11th century ironwork to examine the assumptions and implications of a range of theoretical approaches I have learnt to look in new ways at the objects themselves and to investigate formal attributes such as surface treatment and metallographic structure in a greater degree of detail than has been usual hitherto. The detailed examination of iron artefacts made possible by new techniques of conservation and physical examination is fundamental to successful exploitation of theoretical developments in classification and interpretation but they, in their turn, have led to a new awareness of previously unsuspected variability in the material.

APPENDIX 1

Summary of the numbers of iron objects from 16-22 Coppergate by class and period

(Numbers are computed on the basis of catalogue entries and do not imply complete objects)

(Note: US = unstratified and objects from the Watching Brief)

Description	Period 1-3	3	4A	4B	5A	5B	4-5	5CF	5CR	US	Total
Bar iron, blanks and scrap											
Bars	-	4	-	1	2	1	1	1	-	-	10
Strips*	8	85	25	145	52	79	2	3	38	1	438
Plates	1	41	11	78	18	47	5	-	8	-	209
Plated scrap	-	-	-	4	1	4	-	-	-	1	10
Total	9	130	36	228	73	131	8	4	46	2	667
* includes strip/ plates											
Metalworking Tools											
Anvil	-	-	-	1	-	-	-	-	-	-	1
Hammers	-	1	-	1	-	1	-	-	-	-	3
Punches	-	6	2	8	-	4	-	-	2	1	23
Chisel	-	-	-	-	-	1	-	-	-	-	1
File	-	1	-	-	-	2	-	-	-	-	3
Clippers	-	-	-	-	-	-	-	-	-	1	1
Mould	-	1	-	-	-	-	-	-	-	-	1
Coin dies	-	-	-	2	-	-	-	-	-	-	2
Total	0	9	2	12	0	8	0	0	2	2	35
Woodworking Tools											
Axes	-	-	-	2	1	1	-	-	-	-	4
Wedge	-	1	-	-	-	-	-	-	-	-	1
Socketed Chisel	-	1	-	-	-	-	-	-	-	-	1
Shave	-	-	-	-	1	-	-	-	-	-	1
Augers	-	-	1	5	1	2	-	-	-	-	9
Gouges	-	-	-	1	1	-	-	-	-	-	2
Total	0	2	1	8	4	3	0	0	0	0	18
Textile Tools											
Wool comb	-	-	-	-	-	2	-	-	-	-	2
Comb teeth	1	20	7	40	16	75	2	3	21	-	185
Needles	-	14	7	65	20	29	1	-	12	3	151
Needle shanks	-	7	3	34	5	14	-	-	7	-	70
Part-made needles	-	2	-	4	-	1	-	-	1	-	8
Shears	-	1	1	5	1	4	-	-	-	1	13
Tweezers	1	-	1	1	-	1	-	-	-	-	4
Total	2	44	19	149	42	126	3	3	41	4	433

Period	1-3	3	4A	4B	5A	5B	4-5	5CF	5CR	US	Total
Leatherworking Tools											
Awls	-	-	2	9	2	4	-	-	1	-	18
Creasers	-	-	-	-	1	3	-	-	-	-	4
Total	-	-	2	9	3	7	-	-	1	-	22
Other Awls and Punches											
Awls	-	6	4	4	1	3	-	-	2		20
Tanged punch	-	-	1	7	-	7	2	-	-	-	17
Possible punch	-	-	-	1	-	-	-	-	-	-	1
Total	0	6	5	12	1	10	2	0	2	0	38
Agricultural Tools											
Spade iron	-	-	-	-	-	1	-	-	-	-	1
Sickle	-	-	-	-	-	1	-	-	-	-	1
Pitch fork	-	-	1	-	-	-	-	-	-	-	1
Bells	-	-	1	1	2	1	-	1	-	-	6
Total	0	0	2	1	2	3	0	1	0	0	9

Period	1-3	3	4A	4B	5A	5B	4-5	5CF	5CR	V	Total
Knives											
Tanged knives	1	40	7	70	14	63	4	2	8	9	218
Pivoting knives	-	-	-	1	-	3	-	-	-	-	4
Folding knives	-	1	-	1	-	1	-	-	-	-	3
With pierced ends	-	1	-	-	-	-	-	-	-	-	1
With serrations	-	-	-	1	-	-	-	-	-	-	1
Other blades	-	4	-	1	-	-	-	-	-	-	5
Total	1	46	7	74	14	67	4	2	8	9	232
Other Tools and Implements											
Forks	-	1	1	-	-	-	-	-	-	-	2
Fish hooks	-	-	2	1	1	1	-	-	2	-	7
Pan and vessels	-	1	-	2	2	1	-	-	-	-	6
Scale Pan	-	-	-	-	-	1	-	-	-	-	1
Perforated disc	-	-	-	1	-	-	-	-	-	-	1
Spoons	-	-	-	6	-	-	-	-	-	-	6
Styluses	-	-	-	2	-	-	-	-	-	-	2
Total	0	2	3	12	3	3	0	0	2	0	25
Nails and Tacks											
Nails	53	800	51	451	96	344	53	6	141	4	1999
D.H. Tacks	-	111	1	10	2	8	2	-	1	-	135
Plated nails	-	1	-	16	-	13	1	-	12	1	44
Total	53	912	52	477	98	365	56	6	154	5	2178

	Period 1-3	3	4A	4B	5A	5B	4-5	5CF	5CR	US	Total
Structural Ironwork and Fittings											
Clench Bolts	1	14	3	15	4	36	-	1	12	-	86
Staples	-	25	4	52	14	52	3	1	4	-	155
Pierced fitting	-	19	1	30	9	17	-	-	4	-	80
Unpierced fitting	-	2	1	7	1	8	-	-	1	1	21
Disc fittings	-	-	-	2	-	-	-	-	-	-	2
Spirally twisted.	-	3	1	3	2	2	-	-	1	-	12
Hinge straps	-	2	-	2	1	2	-	-	-	1	8
Hinge pivots	1	5	1	7	5	12	2	1	3	-	37
U-eyed hinge	-	-	1	9	3	4	-	-	1	1	19
Small looped h.	-	2	-	1	-	-	-	-	-	-	3
Pinned hinge	-	1	-	-	-	-	-	-	-	-	1
Handle hinge	-	-	-	-	1	1	-	-	1	-	3
Corner bracket	-	3	-	-	-	-	-	-	-	-	3
Hasps	-	-	-	4	-	1	1	-	-	-	6
Stapled hasps	-	-	-	1	-	2	-	1	-	-	4
Handle	-	2	-	2	1	3	-	-	1	-	9
Chain links	1	2	-	5	-	4	-	-	-	-	12
Rings	-	6	4	10	-	2	-	1	2	-	25
Ring and strap	-	1	-	-	-	1	-	-	-	-	2
Vessel suspension	1	2	-	1	-	1	1	-	-	-	6
Wall hooks	-	3	1	3	-	-	-	-	1	-	8
Other hooks	-	1	1	2	2	4	1	1	-	-	12
Lynch pins	-	-	-	-	-	1	-	-	1	-	2
Tube/ferrule	-	1	1	5	4	6	-	-	1	-	18
Tubular object	-	-	-	-	-	-	1	-	-	-	1
Total	4	94	19	161	47	159	9	6	33	3	535
Locks and Keys											
Sliding bolt	-	1	-	6	1	6	-	-	1	-	15
Bolt and spring	-	-	1	-	-	-	-	-	-	-	1
Padlocks	-	2	-	2	-	-	-	-	-	-	4
Keys	-	5	-	15	6	13	2	-	-	2	43
Slide keys	-	2	1	3	1	1	-	-	-	-	8
Padlock keys	-	2	-	3	-	6	-	-	1	-	12
Total	0	12	2	29	8	26	2	0	2	2	83
Objects for Heating and Lighting											
Candle holders	-	1	1	-	1	3	-	-	-	-	6
Strike-a-light	-	1	1	-	1	-	-	-	1	-	4
Total	0	2	2	0	2	3	0	0	1	0	10

	Period										
	1-3	3	4A	4B	5A	5B	4-5	5CF	5CR	US	Total
Dress fittings and riding equipment											
Buckles	-	14	3	22	9	9	1	-	3	-	61
Buckle-plates	-	2	5	20	5	3	1	-	1	1	38
Part-made b-plates	-	1	-	1	-	1	-	-	-	-	3
Strap-guides	-	-	1	5	1	1	-	-	1	-	9
P.-made strap-guide	-	1	1	1	-	1	-	-	-	-	4
Strap-ends	-	-	-	3	1	1	-	-	-	-	5
Riveted dress fits.	-	-	1	2	-	-	-	-	-	-	3
Clip	-	1	-	-	-	-	-	-	-	-	1
Pins	-	6	1	6	-	4	1	-	1	-	19
Armlet	-	-	-	2	1	-	-	-	-	-	3
Dress hook	-	-	-	2	-	1	-	-	-	-	3
Looped dress fitt.	-	-	-	1	1	1	-	-	-	-	3
Spurs	-	-	-	6	2	2	2	-	-	2	14
Total	0	25	12	71	20	24	5	-	6	3	166
Horse equipment											
Bits	-	4	1	6	-	1	-	-	-	-	12
Horseshoes	-	-	-	-	-	4	-	-	2	-	6
Horseshoe nails	-	2	1	5	-	12	1	-	27	-	48
Total	0	6	2	11	0	17	1	0	29	0	66
Weapons											
Arrowheads	-	7	-	9	1	7	-	-	-	2	26
Spearheads	-	-	-	-	-	2	-	-	-	1	3
Swords	-	-	3	3	-	3	1	-	-	-	10
Caltrop	-	1	-	-	-	-	-	-	-	-	1
Total	0	8	3	12	1	12	1	0	0	3	40
GRAND TOTAL	69	1298	169	1266	318	964	93	22	325	33	4557

APPENDIX 2

Iron objects from 16-22 Coppergate examined metallographically, listed by period. Summaries of results appear in the relevant sections in Chapter 3

(For full details of results see J.G. McDonnell forthcoming in AY17/6)

Period 3

1472	Bar
1479	Strip
1495	Strip
1496	Strip
1505	Strip
1513	Strip
1514	Strip
1518	Strip
2206	Punch
2257	Wedge
2464	Needle
2756	Knife (examined non-destructively)
2757	Knife
2765	Knife
2767	Knife
2771	Knife
2777	Knife
2778	Knife
2795	Knife
2798	Knife
2982	Blade with pierced ends
2985	Blade
3307	Hinge strap

Period 4A

1624	Strip
1634	Strip
1636	Strip
1637	Strip
2800	Knife
2801	Knife
3460	U-eyed hinge
3556	Wall hook
3575	Ferrule
3936	Sword

Period 4B

1682	Strip
1684	Strip
1686	Strip
1712	Strip
1745	Strip

Period 4B continued

1758	Strip
2200	Anvil
2213	Punch
2265	Auger
2488	Needle
2694	Shears
2805	Knife
2808	Knife
2810	Knife
2815	Knife
2820	Knife
2821	Knife
2824	Knife
2826	Knife
2828	Knife
2829	Knife
2831	Knife
2840	Knife
2841	Knife
2842	Knife
2851	Knife
2860	Knife
3197	Staple
3199	Staple
3396	Unpierced fitting
3915	Arrowhead

Period 5A

1906	Strip
1907	Strip
1930	Strip
2220	Punch
2255	Axe
2877	Knife
2882	Knife
3634	Key

Period 5B

2018	Strip
2034	Strip
2035	Strip
2237	Tanged punch
2247	File
2892	Knife
2899	Knife
2913	Knife
2914	Knife
2920	Knife
2926	Knife
2927	Knife
2929	Knife
2976	Pivoting knife
3932	Spearhead

Period 4-5

2951	Knife
2954	Knife

Period 5CR

2957	Knife
2958	Knife
2960	Knife
2963	Knife
2974	Knife

Unstratified

2608	Needle

APPENDIX 3

GAZETTEER OF SITES REFERRED TO IN CHAPTERS 1-8

For England, Wales and Scotland modern county names are given (some old counties given in brackets)

Site	Region
England and Wales	
Barham Down	Kent
Barton-on-Humber	North Humberside
Basingstoke	Hampshire
Battersea	London
Burrow Hill	Suffolk
Canterbury	Kent
Carlisle	Cumbria
Cheddar	Somerset
Chichester	West Sussex
Clifton-on-Trent	Derbyshire
Crayke	North Yorkshire
Dacre	Cumbria
Dover	Kent
Durham	Co.Durham
Eaton Socon	Cambridgeshire
Ely	Cambridgeshire
Fiskerton	Lincolnshire
Garton Slack	North Humberside
Gilling	North Yorkshire
Goltho	Lincolnshire
Graveney	Kent
Halton	Lancashire
Hamwic	Southampton, Hampshire
Harling	Norfolk
Harrold	Bedfordshire
Hereford	Hereford and Worcester
Hesket	Cumbria
Hurbuck	Co. Durham
Jarrow	Co. Durham
Keen Edge Ferry	Berkshire
Kempsford	Gloucestershire
Kentmere	Cumbria
Kirby Hill	North Yorkshire
Lechlade	Gloucestershire
Lincoln	Lincolnshire
Little Bealings	Cambridgeshire
Little Paxton	Cambridgeshire
Maiden Castle	Dorset
Malton	North Yorkshire
Maxey	Northamptonshire

England and Wales continued

Millbrook	Sussex
North Elmham	Norfolk
Northampton	Northamptonshire
Norwich	Norfolk
Nunburnholme	North Humberside
Pevensey	East Sussex
Polhill	Kent
Portchester Castle	Hampshire
Poundbury	Dorset
Ramsbury	Wiltshire
Reading	Berkshire
Repton	Derbyshire
Ribblehead	North Yorkshire
Ripon	North Yorkshire
St. Neots	Cambridgeshire
Santon Downham	Norfolk
Sevington	Wiltshire
Shakenoak Farm	Oxfordshire
Sittingbourne	Kent
Skerne	North Humberside
Sonning	Berkshire
Stratford	Essex
Sutton Courtney	Berkshire
Tamworth	Staffordshire
Thetford	Norfolk
Thwing	North Humberside
Waltham Abbey	Essex
Walton	Buckinghamshire
Wensley	North Yorkshire
Westley Waterless	Cambridgeshire
West Stow	Suffolk
Wharram Percy	North Humberside
Whitby	North Yorkshire
Wicken Bonhunt	Essex
Winchester	Hampshire
Windsor	Berkshire
Winnall	Hampshire
Yeavering	Northumberland
York	North Yorkshire

Scotland

Aikerness	Orkney
Ardskinish	Highland (Colonsay, Inner Hebrides)
Barra	Western Isles (Outer Hebrides)
Brough of Birsay	Orkney
Colonsay	Highland (Inner Hebrides)
Elgin	Grampian

Scotland continued

Jarlshof	Shetland
Mote of Mark	Dumfries and Galloway (Kirkcudbrightshire)
Oronsay	Highland (Inner Hebrides)
Reay	Highland (Caithness)
Torbeckhill	Dumfries and Galloway (Kirkcudbrightshire)
Uigg	Western Isles (Lewis)

Denmark

Aggersborg	Jutland
Arhus	Jutland
Forlev	Zealand
Fyrkat	Jutland
Ketting	Isle of Als
Ladby	Fyn
Lejre	Zealand
Sønder Onsild	Jutland
Tjele	Jutland
Trelleborg	Zealand

Ireland

Dublin	Co. Dublin
Lagore Crannog	Co. Meath
Lough Gur	Co. Limerick

Isle of Man (No regions)

Balladoole
Ballateare
Cronk Moar
Knoc-y-Doonee
Peel

Netherlands

Domburg	Zeeland
Dorestad	Zeeland

Norway

Bygland	Telemark
Elgsnes	Troms
Grønneberg	Vestfold
Kaupang	Vestfold
Morgedal	Telemark
Oppdalsfjella	Tröndelag

Norway continued

Oseberg	Vestfold
Romfjöghellen	Møre og Romsdal

Sweden

Aske Frälsegard	Östergötland
Birka	Uppland
Köping	Öland
Langtora	Uppland
Lund	Skåne
Mästermyr	Gotland
Nosaby	Skåne
Smiss	Gotland
Vendel	Uppland

West Germany

Bamberg	Bavaria
Bendorf	Schleswig-Holstein
Dunum	Lower Saxony
Hedeby	Schleswig-Holstein
Süderbrarup	Schleswig-Holstein
Thumby-Bienebek	Schleswig-Holstein

APPENDIX 4

Details of the attributes of knives from 16-22 Coppergate

The columns contain the following data:

1. NO = Catalogue number

2. PRD = Period

3. ST = Condition: c = unbroken i.e. complete length survives
   bc = blade unbroken but tang incomplete
   i = incomplete i.e. both blade and tang broken

4. BF = Back form see 3.30.2 for details

5. CE = Cutting edge form: a = convex
   b = concave
   c = slight S-shape
   d = pronounced S-shape
   e = straight
   f = straight before curving up at the tip

6. SFEAT = Blade surface features:
   A:Blade faces run vertically down before converging on cutting edge, both faces.

   B:As A, but one face

   C:Blade faces slope outwards slightly before converging on cutting edge, both faces.

   D:As C but one face.

   E:Blade faces concave before converging on cutting edge, both faces

   F:As E, but one face.

   G:Chamfered back edges, both.

   H:As G, one edge only.

   J:Blade back triangular in cross-section.

   K:Grooves cut into blade, both faces.

   L:As K, one face only.
   The pattern of grooves is given as in following example: 2-1 = two grooves on one face and one on the other.

M:Notches cut in blade back with number.

N:Relief work pattern cut into back

7. L = Length

8. LB = Length of blade

9. W = Width of blade

10. TB = Thickness of blade (0 = unmeasurable)

11. LBL1 = Ratio of length of blade to length from shoulder to point where back changes line (blades with back forms A, B, C)

12. LLB = Ratio of length of knife to length of blade

13. LBW = Ratio of length of blade to width of blade

(Note: in columns 11-3 0.00 = not applicable due to breakage)

14. Angle at which back changes line (blades with back form A only)

NO	PRD	ST	BF	CE	SFEAT	L	LB	W	T	LBL1	LLB	LBW	ANGLE
2756	3	c	A1	c	-	230	131	29	11	2.62	1.76	4.52	10
2757	3	i	A2	a	K1-1	89	51	16	4	0.00	1.74	3.18	25
2758	3	bc	A2	e	-	89	89	17	5	2.02	0.00	5.24	20
2759	3	c	A2	e?	K1-1	85	50	16	4	2.38	1.70	3.13	25
2760	3	c	A2	c	-	101	69	13	5	2.09	1.46	5.31	15
2761	3	bc	A2	f	G	104	67	17	5	1.86	1.55	3.94	22
2762	3	i	A2	a	-	81	53	11	0	0.00	1.53	4.82	22
2763	3	bc	A2	c	K1-1	83	83	16	5	1.63	0.00	5.19	18
2764	3	c	A2	a	K1-1	110	83	17	5	2.44	1.33	4.88	15
2765	3	c	A2	b	G	96	68	13	4	2.27	1.41	5.23	15
2766	3	i	A2	a	K1-1	58	58	16	4	0.00	0.00	3.62	20
2767	3	c	C1	e	-	110	79	11	5	1.68	1.39	7.18	0
2768	3	c	C1	c	-	87	60	10	4	1.25	1.45	6.60	0
2769	3	i	C1	e?	-	46	25	12	4	0.00	0.00	0.00	0
2770	3	c	C1	c	G	92	58	13	5	1.50	1.59	4.46	0
2771	3	bc	C1	c	T L1-0	100	100	16	0	1.25	0.00	6.25	0
2772	3	c	C1	f	K3-1	107	78	14	4	2.36	1.37	5.57	0
2773	3	c	C1	c	-	105	66	15	4	1.65	1.59	4.40	0
2774	3	bc	C1	i	-	70	51	8	4	2.83	1.37	6.38	0
2775	3	i	C2	f	-	67	53	12	4	0.00	0.00	4.42	0
2776	3	c	C2	a	G	102	69	12	4	2.30	1.48	5.75	0
2777	3	c	C2	c	G M1	84	62	11	4	1.72	1.35	5.64	0
2778	3	c	C3	c	F	126	51	13	4	1.76	2.47	3.92	0
2779	3	c	C3	c	-	152	46	12	6	2.09	3.30	3.83	0
2780	3	bc	C3	c	-	96	46	11	6	1.44	2.09	4.19	0
2781	3	i	I	i	-	69	36	9	3	0.00	0.00	0.00	0
2782	3	bc	D	f?	-	66	47	10	3	0.00	1.40	4.70	0
2783	3	c	D	c	-	103	61	16	5	0.00	1.69	3.81	0
2784	3	i	D	f	-	65	65	17	6	0.00	0.00	3.82	0
2785	3	i	D	i	-	50	18	9	4	0.00	0.00	0.00	0
2786	3	i	D	a	-	53	53	12	4	0.00	0.00	4.42	0
2787	3	i	I	i	-	39	39	11	4	0.00	0.00	0.00	0
2788	3	i	I	i	L2-0	64	61	9	3	0.00	0.00	0.00	0
2789	3	i	I	i	-	30	18	14	4	0.00	0.00	0.00	0
2790	3	i	I	i	-	69	31	16	5	0.00	0.00	0.00	0
2791	3	i	I	i	-	80	42	15	4	0.00	0.00	0.00	0
2792	3	i	I	i	-	34	29	11	5	0.00	0.00	0.00	0
2793	3	i	I	i	-	141	45	30	4	0.00	0.00	0.00	0
2794	3	i	I	i	-	35	35	10	0	0.00	0.00	0.00	0
2795	3	i	I	i	-	33	33	12	4	0.00	0.00	0.00	0
2796	3	i	I	i	-	44	14	12	4	0.00	0.00	0.00	0
2797	3-1	t	X	-	-	58	0	0	0	0.00	0.00	0.00	0

NO	PRD	ST	BF	CE	SFEAT	L	LB	W	T	LBL1	LLB	LBW	ANGLE
2798	4A	c	A1	c	-	108	63	22	3	1.66	1.71	2.86	35
2799	4A	c	A2	c	-	205	103	21	5	1.98	1.99	4.90	20
2800	4A	c	B	f	-	127	93	12	4	1.69	1.37	7.75	0
2801	4A	c	C3	c	E	148	90	16	5	1.48	1.64	5.63	0
2802	4A	i	C3	i	-	62	35	11	4	0.00	1.77	0.00	0
2803	4A	c	C3	c	J	117	74	11	5	1.51	1.58	6.72	0
2804	4A	c	D	a	E	135	54	15	4	0.00	2.50	3.60	0
2805	4B	c	A1	i	-	135	83	15	6	2.13	1.62	5.53	0
2806	4B	c	A2	b	-	142	88	27	4	2.15	1.61	3.26	30
2807	4B	c	A2	c	-	82	49	15	5	1.88	1.67	3.27	25
2808	4B	bc	A2	c	-	109	64	21	0	1.73	1.70	3.05	25
2809	4B	bc	A2c	a	M3K2-2	168	148	33	9	1.92	1.14	4.48	22
2810	4B	c	A3	c	-	138	97	19	3	1.87	1.42	5.10	4
2811	4B	c	B	f	C	224	191	26	6	1.67	1.17	7.35	0
2812	4B	c	C1	f	-	189	88	15	3	1.66	2.15	5.87	0
2813	4B	i	C1	f	A	82	82	16	4	0.00	0.00	5.13	0
2814	4B	i	C1	e?	-	89	89	12	4	0.00	0.00	7.42	0
2815	4B	bc	C1	f	-	81	52	12	4	2.17	1.56	4.33	0
2816	4B	i	C1	e	-	81	81	9	3	0.00	0.00	9.00	0
2817	4B	c	C1	c	-	100	63	10	3	2.03	1.59	6.30	0
2818	4B	c	C1	f	H M1	96	69	10	3	1.92	1.39	6.90	0
2819	4B	i	C1	e	-	93	77	12	0	0.00	1.21	6.42	0
2820	4B	bc	C1	a	B D J	82	71	15	5	2.84	1.15	4.73	0
2821	4B	bc	C1	i	-	93	93	18	2	1.72	0.00	5.17	0
2822	4B	c	C1	f	G M1	113	77	12	4	1.79	1.47	6.42	0
2823	4B	bc	C1	c	-	97	64	10	3	1.42	1.51	6.40	0
2824	4B	c	C1	a	-	114	77	16	3	1.45	1.48	4.81	0
2825	4B	i	C1	f	-	103	74	12	4	0.00	1.39	6.17	0
2826	4B	c	C1	c	-	200	125	18	4	1.47	1.60	6.94	0
2827	4B	c	C2	d	-	98	58	14	5	1.93	1.69	4.14	0
2828	4B	c	C2	c	-	99	63	16	5	1.58	1.57	3.94	0
2829	4B	c	C2	a	-	108	75	15	5	1.92	1.44	5.00	0
2830	4B	bc	C2	f	-	93	71	13	4	1.82	1.31	5.46	0
2831	4B	bc	C2	a	-	85	77	16	7	2.14	0.00	4.80	0
2832	4B	bc	C2	c	G	109	61	15	4	1.74	1.79	4.07	0
2833	4B	c	C3	c	B	157	73	13	5	1.46	2.17	5.61	0
2834	4B	c	C3	c	-	120	58	12	3	1.12	2.07	4.83	0
2835	4B	bc	C3	c?	B	99	82	15	3	1.37	1.21	5.47	0
2836	4B	bc	C3	c	A	107	62	14	4	1.35	1.73	4.43	0
2837	4B	c	C3	f	R	142	74	13	4	1.64	1.92	5.69	0
2838	4B	c	C3	c	A	155	65	18	6	1.97	2.38	3.61	0
2839	4B	c	C3	d	-	95	44	12	5	1.76	2.16	3.66	0
2840	4B	c	C3	e	C	87	55	10	5	1.20	1.58	5.50	0
2841	4B	i	C3	c	-	138	48	11	5	1.09	2.88	4.36	0
2842	4B	bc	C3	c	-	108	59	12	3	1.37	1.83	4.92	0
2843	4B	i	C1	c	J E	73	73	16	4	0.00	0.00	0.00	0
2844	4B	i	C1	a	A	68	68	14	3	0.00	0.00	0.00	0
2845	4B	i	C1	f	-	53	53	10	4	0.00	0.00	0.00	0
2846	4B	i	C1	a	-	76	76	12	4	0.00	0.00	0.00	0
2847	4B	i	D	e?	F	73	36	10	3	0.00	2.03	3.60	0
2848	4B	i	D	a	-	73	73	19	8	0.00	0.00	3.84	0
2849	4B	i	D	a	-	67	38	12	3	0.00	1.76	3.17	0
2850	4B	bc	D	a	-	69	69	17	4	0.00	0.00	4.06	0
2851	4B	bc	D	a	-	106	72	19	5	0.00	1.47	3.79	0
2852	4B	i	D	i	-	74	66	19	7	0.00	0.00	3.47	0
2853	4B	bc	D	c	-	90	74	18	5	0.00	0.00	4.11	0
2854	4B	c	D	a	A	94	63	13	3	0.00	1.49	4.85	0
2855	4B	c	D	f	A	113	77	12	3	0.00	1.47	6.42	0
2856	4B	bc	D	c	-	66	64	14	3	0.00	0.00	4.57	0
2857	4B	bc	D	c	-	134	61	15	4	0.00	2.19	4.06	0

NO	PRD	ST	BF	CE	SFEAT	L	LB	W	T	LBL1	LLB	LBW	ANGLE
2858	4B	c	D	a	-	81	52	11	5	0.00	1.56	4.72	0
2859	4B	bc	D	f	M1K2-1	87	87	10	4	0.00	0.00	8.70	0
2860	4B	bc	D	c	E	146	65	17	5	0.00	2.25	3.82	0
2861	4B	i	I	i	-	75	44	12	5	0.00	0.00	0.00	0
2862	4B	i	I	i	A	94	51	14	4	0.00	0.00	0.00	0
2863	4B	i	I	i	-	136	47	21	0	0.00	0.00	0.00	0
2864	4B	i	I	i	-	102	74	11	0	0.00	0.00	0.00	0
2865	4B	i	I	i	-	125	35	13	0	0.00	0.00	0.00	0
2866	4B	i	I	i	-	78	78	25	6	0.00	0.00	0.00	0
2867	4B	i	I	i	-	64	33	12	0	0.00	0.00	0.00	0
2868	4B	i	I	i	-	85	31	10	0	0.00	0.00	0.00	0
2869	4B	i	I	i	-	124	94	12	0	0.00	0.00	0.00	0
2870	4B	i	I	i	-	57	40	12	0	0.00	0.00	0.00	0
2871	4B	i	I	i	-	57	57	6	5	0.00	0.00	0.00	0
2872	4B	i	I	i	-	66	12	11	0	0.00	0.00	0.00	0
2873	4B	i	I	i	-	30	30	16	6	0.00	0.00	0.00	0
2874	4B	t	X	-	-	37	0	0	0	0.00	0.00	0.00	0
2875	5A	bc	C1	f	-	77	77	11	4	1.33	0.00	7.70	0
2876	5A	bc	C1	c	N	68	64	11	6	1.68	0.00	5.82	0
2877	5A	c	C1	c	-	160	62	12	3	1.44	2.58	5.17	0
2878	5A	i	C3	c	E	140	50	16	5	0.00	2.80	3.13	0
2879	5A	bc	C3	c	-	76	48	8	4	1.66	1.58	6.00	0
2880	5A	c	C3	c	E	147	55	13	4	2.04	2.67	4.23	0
2881	5A	c	C3	c	-	143	60	7	10	1.30	2.38	8.57	0
2882	5A	c	D	c	-	100	56	15	5	0.00	1.79	3.73	0
2883	5A	i	D	a?	A	63	53	17	5	0.00	0.00	3.12	0
2884	5A	i	I	i	-	58	58	11	4	0.00	0.00	0.00	0
2885	5A	i	I	i	-	46	25	14	5	0.00	0.00	0.00	0
2886	5A	t	X	-	-	48	0	0	0	0.00	0.00	0.00	0
2887	5A	t	X	-	-	67	0	0	0	0.00	0.00	0.00	0
2888	5B	i	A1	f	K1-1	59	54	11	3	0.00	0.00	5.36	10
2889	5B	bc	A1	f	-	95	49	14	5	1.32	1.94	3.50	20
2890	5B	bc	A2	a	M3	84	84	15	5	1.95	0.00	6.00	0
2891	5B	c	A2	f	-	83	51	14	5	2.22	1.62	3.64	20
2892	5B	i	A1	c	-	132	132	21	7	0.00	0.00	6.29	19
2893	5B	i	A2	e	-	75	47	13	4	0.00	1.60	3.62	0
2894	5B	bc	A2	a	-	70	65	14	3	2.24	0.00	4.64	13
2895	5B	bc	A2	a	-	105	78	20	4	2.05	1.34	3.90	18
2896	5B	i	Ai	i	-	110	93	20	0	0.00	0.00	4.65	10
2897	5B	bc	Ai	b	-	65	65	14	5	2.71	0.00	4.64	10
2898	5B	c	C1	c	-	171	75	13	3	1.17	2.28	5.77	0
2899	5B	i	C1	c	J	191	102	17	0	0.00	1.87	6.00	0
2900	5B	i	C1	e	-	85	45	11	3	0.00	1.89	4.09	0
2901	5B	bc	C1	f	-	70	70	11	4	1.40	0.00	6.36	0
2902	5B	c	C1	f	E	110	68	11	5	1.58	1.62	6.18	0
2903	5B	i	C1	i	-	68	52	13	5	0.00	0.00	4.00	0
2904	5B	i	C1	c	J K1-1	76	67	13	6	2.23	0.00	5.15	0
2905	5B	bc	C1	e?	-	129	55	12	4	1.67	2.35	4.59	0
2906	5B	i	C1	f	-	60	60	11	5	0.00	0.00	5.45	0
2907	5B	c	C1	f	B	177	83	14	0	1.77	2.13	5.93	0
2908	5B	c	C1	a	-	151	111	13	5	1.91	1.36	8.54	0
2909	5B	c	C1	c	-	150	74	17	4	2.11	2.03	5.10	0
2910	5B	c	C2	f	K2-1	82	54	12	3	2.00	1.52	4.50	0
2911	5B	c	C3	i	-	110	71	9	4	1.29	1.55	7.89	0
2912	5B	c	C3	a?	-	89	40	16	2	1.81	2.23	2.50	0
2913	5B	c	C3	d	J	118	84	12	5	1.45	1.40	7.00	0
2914	5B	i	C3	c	-	154	60	12	6	0.00	2.57	5.00	0
2915	5B	bc	C3	c?	-	75	51	10	4	1.11	1.47	5.10	0
2916	5B	c	C3	c	-	122	64	22	2	1.83	1.91	2.91	0
2917	5B	bc	C3	c	-	71	62	12	4	1.68	0.00	5.17	0
2918	5B	c	C3	i	-	102	65	13	4	1.59	1.57	5.00	0
2919	5B	i	Ci	c	-	75	40	11	4	0.00	0.00	0.00	0
2920	5B	i	Ci	b	-	87	87	19	9	0.00	0.00	0.00	0
2921	5B	i	Ci	a	-	79	79	15	4	0.00	0.00	0.00	0
2922	5B	i	Ci	c	-	135	63	19	0	0.00	0.00	0.00	0
2923	5B	i	Ci	b	-	40	40	18	6	0.00	0.00	0.00	0
2924	5B	bc	Ci	c	-	42	37	10	4	2.31	0.00	3.70	0
2925	5B	i	D	c	-	74	74	15	7	0.00	0.00	4.93	0

NO	PRD	ST	BF	CE	SFEAT	L	LB	W	T	LBL1	LLB	LBW	ANGLE
2926	5B	c	D	c	-	98	60	9	4	0.00	1.63	6.67	0
2927	5B	bc	D	c	A	93	51	12	3	0.00	1.82	4.25	0
2928	5B	i	D	d	-	83	83	15	8	0.00	0.00	5.53	0
2929	5B	c	D	c	-	102	66	11	5	0.00	1.55	6.00	0
2930	5B	bc	D	b	-	67	67	13	0	0.00	0.00	5.15	0
2931	5B	bc	D	f	-	119	75	14	5	0.00	1.59	5.38	0
2932	5B	i	D	c	AM2	86	86	17	4	0.00	0.00	5.06	0
2933	5B	c	D	c	J K1-1	128	49	12	9	0.00	2.61	4.08	0
2934	5B	bc	D	c	-	77	77	12	5	0.00	0.00	6.42	0
2935	5B	c	D	c	M2	113	72	12	6	0.00	1.57	6.00	0
2936	5B	c	D	a	-	86	57	16	6	0.00	1.51	3.56	0
2937	5B	c	D	c	-	111	77	11	4	0.00	1.44	7.00	0
2938	5B	c	D	c	-	134	39	9	5	0.00	3.44	4.33	0
2939	5B	c	E	i	-	183	150	18	4	0.00	1.22	8.37	0
2940	5B	i	I	i	-	34	43	16	6	0.00	0.00	0.00	0
2941	5B	i	I	i	G	68	32	10	3	0.00	0.00	0.00	0
2942	5B	i	I	i	-	92	92	17	5	0.00	0.00	0.00	0
2943	5B	i	I	i	E	74	59	16	5	0.00	0.00	0.00	0
2944	5B	i	I	i	-	73	73	11	4	0.00	0.00	0.00	0
2945	5B	i	I	i	-	88	9	12	3	0.00	0.00	0.00	0
2946	5B	i	I	i	-	43	43	11	4	0.00	0.00	0.00	0
2947	5B	i	I	i	-	92	77	14	0	0.00	0.00	0.00	0
2948	5B	t	X	-	-	56	0	0	0	0.00	0.00	0.00	0
2949	5B	t	X	-	-	56	0	0	0	0.00	0.00	0.00	0
2950	5B	t	X	-	-	50	0	0	0	0.00	0.00	0.00	0
2951	5B4	i	A2	c	-	133	133	30	6	0.00	0.00	4.43	19
2952	5B4	i	C1	f	G	77	77	12	4	0.00	0.00	6.42	0
2953	5B4	bc	C3	c	-	90	66	12	5	1.38	1.36	5.50	0
2954	5B4	i	D	b	-	135	48	12	4	0.00	2.81	4.00	0
2955	5CF	c	C3	c	-	120	66	14	6	2.06	1.82	4.71	0
2956	5CF	bc	C1	i	-	85	60	12	3	0.00	0.00	5.00	0
2957	5CR	i	A2	d	K1-1	116	77	14	3	0.00	1.51	5.50	15
2958	5CR	c	C1	c	J K1-1	92	56	9	4	2.00	1.64	6.22	0
2959	5CR	c	C1	f?	-	132	79	13	5	1.68	1.67	6.08	0
2960	5CR	c	C1	c	-	114	70	14	5	1.71	1.63	5.00	0
2961	5CR	i	C1	f?	-	90	58	13	4	0.00	0.00	0.00	0
2962	5CR	bc	D	c	K1-1	150	138	13	6	0.00	1.09	10.62	0
2963	5CR	c	D	c	-	160	66	16	4	0.00	2.42	4.13	0
2964	5CR	c	D	f	-	87	52	10	4	0.00	1.67	5.20	0
2966	U/S	c	A1	a	-	94	67	13	5	1.63	1.40	5.15	18
2967	U/S	bc	A1	a?	-	79	79	22	11	1.34	0.00	3.59	0
2968	U/S	c	C1	i	K3-1	93	70	13	4	1.56	1.33	5.38	0
2969	U/S	c	D	i	-	83	68	10	3	0.00	1.22	6.80	0
2970	U/S	c	D	c	J L1-0	103	65	13	5	0.00	1.59	5.00	0
2971	U/S	i	D	i	-	68	49	12	0	0.00	1.39	4.08	0
2972	WB	bc	A2	e	K1-1	118	82	19	6	1.78	1.44	4.32	22
2973	WB	bc	C1	c	U	96	66	10	4	1.38	1.45	6.60	0
2974	WB	c	C1	i	E	119	80	17	2	0.00	1.49	4.71	0

APPENDIX 5 Summary decription of iron objects from 16-22 Coppergate with surfaces exhibiting relief work and three dimensional moulding (excluding knives and arrowheads)

For a more detailed description of treatment see catalogue reference

No.	Object class	Summary of treatment
Period 3		
3303	Fitting	Moulded panels divided by relief strips and grooves
3317	Fitting	Relief strips in centre and at one end
3387	Fitting	Grooves across body
3388	Fitting	Grooves across body
3479	Looped-eye hinge	Chamfered edges and V-shaped grooves in sides
3609	Padlock tube	Applied strip
3610	Padlock	Applied strips, some spirally twisted
3613	Key	Grooves on stem at base of bow; grooves and expansion at tip of stem
3614	Key	Grooves on stem at base of bow and in centre of stem
3662	Barrel padlock key	Grooves around centre of stem and on edges of upper stem
3746	Buckle-plate	Central panel with rectangular notches
3785	Part-made strap-guide	Relief strip across head
3797	Clip	Grooves at ends of panel and around edges of head

Period 3 continued

No.	Object	Motifs
3803	Pin	Octahedral head with applied pellets
3842	Bit snaffle link	Dots on face of eyes; grooves at base of eyes and around centre of shank

Period 1-3

No.	Object	Motifs
3319	Fitting	Grooves on one face

Period 4A

No.	Object	Motifs
3322	Fitting	Animal head terminals
3389	Fitting	Six protrusions along centre
3777	Strap-guide	Lobe (originally two) on head
3786	Part-made strap-guide	Relief strip across head
3794	Riveted dress fitting	Six relief protrusions in line
3844	Bit snaffle link	Double grooves making chevrons

Period 4B

No.	Object	Motifs
2908	Spoon	Grooves in central panel and at base of bowl; linear grooves along stem
3000	Spoon	Linear grooves along stem; grooves at base of bowl; V-shaped grooves in edge of bowl face
3001	Spoon	Linear grooves along stem
3002	Spoon	Centre panel has chamfered shoulders
3323	Fitting	Animal head terminals
3324	Fitting	Chamfered edges; thin relief panels and grooves
3339	Fitting	Double groove along centre

Period 4B continued

No.	Object	Motifs
3392	Fitting	Two grooves V-shaped in cross-section along face
3396	Fitting	Two rows of punched dots
3408	Disc fitting	Concentric C-shaped punch marks
3409	Disc fitting	Punched dots
3474	U-eyed hinge	Strap edges chamfered; grooves across base of eye and above terminal
3480	Looped-eye hinge	Grooves at base of eye and on terminal
3617	Key	Grooves on bow and around stem
3621	Key	Moulding at base of bow; grooves on stem
3629	Key	Saltire crosses in rectangular panels formed by double grooves
3671	Box padlock key	Grooves at base of stem
3703	Buckle	Grooves on curved side of frame
3704	Buckle	Grooves on thicker side of frame and at base of tongue
3710	Buckle	Relief and recessed panels on frame
3753	Buckle-plate	V-shaped notches at inner end
3754	Buckle-plate	V-shaped cut at inner end
3759	Buckle-plate	Central relief panel with grooves and rectangular notches
3762	Buckle-plate	Inner end V-shaped with rounded corners; V-shaped notches in sides

Period 4B continued

No.	Object	Motifs
3765	Buckle-plate	Central relief panel with strips and notches
3778	Strap-guide	Relief strip with dots across head
3779	Strap-guide	Relief strip across head
3780	Strap-guide	Relief strip with grooves cut into it across head
3781	Strap-guide	Two lobes at head
3787	Part-made strap-guide	Relief strip across head
3789	Strap-end	Lobes and relief strips
3790	Strap-end	Punched dots on main panel; simplified animal head at tip with oblique grooves on relief strip; V-shaped notches at inner end
3791	Strap-end	Punched dots on main panel; relief strip at tip
3795	Riveted dress fitting	Relief panel in centre; groove along sides; V-shaped notches at one end; punched dots making 'flower' motif
3796	Riveted dress fitting	Central panel with grooves and rectangular notches
3805	Pin	Polyhedral head; relief strip around base of head
3807	Pin	Moulded head
3808	Pin	Grooves at top of shank
3810	Pin	Moulding near head; double criss-cross grooves on shank
3817	Armlet	Ring-and-dot on outer face
3826	Spur	Moulded goad; grooves and punched dots on arm; relief strip at top of terminal; relief V-shaped

Period 4B continued

No.	Object	Motifs
		panel at base of terminal
3827	Spur	Grooves at base of goad
3828	Spur terminal	Grooves making chevrons
3849	Bridle link	Domed protrusion in centre
3938	Pommel guard	Vertical grooves
3945	Bit?	Moulded end

Period 5A

3475	U-eyed hinge	Animal head terminals
3476	U-eyed Hinge	Polygonal moulding at tip of strap; grooves at eye
3769	Buckle-plate	V-shaped cut at inner end; scalloped sides
3792	Strap-end	Grooves across body; fine grooves at inner end
3832	Spur	Spherical moulding with criss-cross grooves on goad
	Strap-guide	Saltire cross on domed head
3834	Spur	Moulding with spheres and grooves on goad; lobes and grooves on arms

Period 5B

2739	Awl	Triangular notches in central panel
3365	Fitting	Grooves across centre
3366	Fitting	Edges chamfered
3367	Fitting	Grooves across central strip; domed protrusions on terminal
3403	Fitting	Three grooves with V-shaped cross-section along face

Period 5B continued

No.	Object	Motifs
3404	Fitting	Transverse grooves at intervals
3477	U-eyed hinge	Groove along sides of strap and along face of eye; triangular relief panel at base of eye
3496	Stapled hasp	Animal head terminal; two grooves with V-shaped cross-section along body
3641	Key	Notches on bow; moulding at head of stem
3653	Key	Grooves on bow
3673	Box padlock key	Stem has applied strips with grooves along their centre
3738	Buckle	Grooves on frame
3783	Strap-guide	Two lobes on head
3793	Strap-end	Relief chevrons and triangles at tip; relief strips across main panel
3811	Pin	Polyhedral head; grooves around base of head
3940	Sword pommel	Relief lozenges along base of faces
3941	Sword guard	Vertical grooves

Period 4-5

No.	Object	Motifs
3592	Tubular object	Applied relief strip at base of socket
3836	Spur	Grooves on arms
3943	Pommel	Simplified animal head moulding

Period 5CF

No.	Object	Motifs
3498	Stapled hasp	Short grooves cut into edges

Period 5CR

No.	Object	Motifs
3784	Strap-guide	V-shaped notches around domed head
3821	Dress hook	Groove runs close to the sides of one face

Unstratified

3478	Hinge	Animal head terminals
3838	Spur	Grooves on outer faces of arms; V-shaped grooves at base of goad

Unstratified (intrusive in Period 1)

3065	Nail	V-shaped notches around head

APPENDIX 6

Non-ferrous plating, inlay and other non-ferrous deposits on iron objects from 16-22 Coppergate

All analyses were undertaken at Ancient Monuments Laboratory following cleaning of the objects at Y.A.T. Conservation Laboratory

Non-ferrous plating

No.	Object class	Analysis results
Period 3		
3031	Nail	tin with a little lead
3303	Fitting	tin with a little lead
3316	Pierced plates	tin-lead alloy
3387	Fitting	tin with a little lead
3388	Fitting	tin
3479	Hinge fitting with looped eye	tin with some lead
3609	Padlock tube	copper, with a little zinc, tin and lead
3610	Padlock	copper, tin with a little lead
3613	Key	traces of tin and lead
3615	Key	tin
3627	Key	tin
3746	Buckle-plate	tin
3802	Ringed pin	tin with traces of copper and lead
Period 1-3		
3319	Fitting	tin with some lead

Period 4A

No.	Object class	Analysis results
3699	Buckle	tin
3747	Buckle-plate	tin with traces of lead, copper and zinc
3749	Buckle-plate	tin-lead alloy
3777	Strap-guide	tin
3794	Riveted dress fitting	tin
3844	Bit snaffle link	tin with a little lead

Period 4B

No.	Object class	Analysis results
2191	Strip	tin with a trace of lead
2192	Strip	tin
2193	Strip	tin
2194	Plate	tin with possible traces of lead and copper
2752	Bell	largely copper with a little zinc, tin and lead
2998	Spoon	tin with traces of lead and copper
2999	Spoon	tin with traces of copper and lead
3000	Spoon	tin with a little lead and trace of copper
3001	Spoon	tin with a little lead
3002	Spoon	about 45-55% tin; 45-55% lead
3003	Spoon	tin with a little lead
3032	Nail in wooden top	not available for analysis ?tin
3034	Nail	lead
3035	Nail	lead

Period 4B continued

No.	Object class	Analysis results
3036	Nail	tin with a little lead
3037	Nail	tin
3038	Nail	tin with a little lead
3039	Nail	tin with some lead
3040	Nail	tin-lead alloy
3041	Nail	tin-lead alloy
3042	Nail	
3322	Fitting	tin
3323	Fitting	tin
3324	Fitting	tin with a little lead
3326	Fitting	tin with a little lead
3327	Fitting	tin with a little lead and trace of copper
3334	Fitting	tin-lead alloy
3350	Fitting	tin with some lead and traces of copper and zinc
3352	Fitting	tin
3393	Fitting	tin
3394	Fitting	tin
3395	Four nails in stave-built vessel	tin
3396	Fitting	tin with traces of copper and lead
3408	Disc fitting	tin with a little lead
3409	Disc fitting	tin-lead alloy
3474	U-eyed hinge	tin
3480	Small hinge with looped eye	tin with traces of copper and lead

Period 4B continued

No.	Object class	Analysis results
3515	Chain links	tin with a little lead and trace of copper
3612	Padlock tube	tin with a little lead
3617	Key	tin with a trace of lead
3621	Key	tin with a trace of lead
3626	Key	copper with traces of lead and tin
3629	Key	tin
3631	Key	brass with a little lead and trace of tin
3702	Buckle and buckle-plate	tin; fitting on strap -end is brass
3703	Buckle and buckle-plate	tin
3704	Buckle	tin-lead alloy with a trace of copper
3718	Buckle	tin with some lead
3752	Buckle-plate	tin-lead alloy
3753	Buckle-plate	tin with a little copper, zinc and lead
3757	Buckle-plate	tin with a trace of lead
3762	Buckle-plate	tin
3764	Buckle-plate	tin with a trace of lead
3765	Buckle-plate	tin with some lead and a trace of copper
3766	Buckle-plate	tin
3789	Strap-end	tin with a trace of lead
3790	Strap-end	tin

Period 4B continued

No.	Object class	Analysis results
3791	Strap-end	tin
3795	Riveted dress fitting	coating: tin rivet heads: copper with a little lead, zinc and ?tin
3796	Riveted dress fitting	coating: tin rivet heads: copper, zinc, tin (gun metal)
3805	Pin	tin
3810	Pin	tin with a trace of lead
3817	Armlet	tin with a trace of copper and/or lead
3818	Armlet terminal	tin
3821	Dress hook	tin
3826	Spur	tin
3827	Spur	tin with a little lead
3830	Spur	bronze with a trace of lead
3849	Bit bridle attachment link	tin
3937	Sword pommel	copper, silver

Period 5A

2195	Plate	copper with traces of lead and zinc
2753	Bell	brass with a trace of lead
3354	Fitting	traces of tin, lead and copper
3363	Fitting	tin
3475	U-eyed hinge	tin
3483	Hinge fitting	tin with a little lead and traces of copper and zinc

Period 5A continued

No.	Object class	Analysis results
3633	Key	tin
3636	Key	tin
3637	Key	tin
3667	Padlock key bit	copper
3725	Buckle	tin with a little lead
3727	Buckle	tin with a little lead
3732	Buckle tongue	tin
3752	Buckle-plate	tin-lead alloy
3769	Buckle-plate	tin
3792	Strap-end	tin with a little lead
3819	Armlet	tin with a trace of lead
3832	Spur with buckle, 2 buckle-plates and strap-guide	tin, with traces of copper, lead and zinc

Period 5B

No.	Object class	Analysis results
2196	Strip	brass with a little lead
2197	Strip	tin, lead
2198	Strip	copper with a little lead and tin
2199	Plate	tin
3008	Scale pan	copper, zinc, lead and ?a little tin (a brazing wash)
3043	Nail	tin with some lead
3044	Nail	tin with a trace of lead
3045	Nail	tin
3046	Nail	tin with a little lead

Period 5B continued

No.	Object class	Analysis results
3047	Nail	tin
3048	Nail	tin with a little lead
3049	Nail	tin with a trace of lead
3050	Nail	lead
3051	Nail	lead
3052	Nail	lead
3053	Nail	lead
3054	Nail	tin with some lead
3055	Nail	tin with a little lead
3365	Fitting	tin with a little lead and trace of copper
3367	Fitting	tin
3400	Plate	tin with a little lead
3402	Fitting	tin with a trace of lead
3404	Fitting	tin with a little lead
3405	Fitting	tin
3477	U-eyed hinge	coating: tin with a trace of lead; rivet-heads: brass
3589	Tube	brass
3641	Key	tin with a ittle lead
3644	Key	tin
3645	Key	traces of lead detected
3672	Padlock key	tin-lead alloy
3738	Buckle	traces of lead and tin detected
3783	Strap-guide	tin with a little lead

Period 5B continued

No.	Object class	Analysis results
3793	Strap-end	tin
3811	Pin	tin
3814	Pin	tin, a little lead & traces of copper and zinc (a pewter hardened by the addition of a small amount of copper alloy)
3834	Spur	tin
3940	Sword pommel	tin
3941	Sword guard	traces of silver and copper

Period 4-5

3056	Nail	lead
3592	Tubular object	copper, tin
3772	Buckle-plate	tin

Period 5CF

3498	Stapled hasp	tin with a little lead

Period 5CR

3057	Nail	tin with a little lead
3058	Nail	tin with a little lead
3059	Nail	tin with traces of copper, zinc and lead
3060	Nail	lead
3061	Nail	tin with a little lead
3062	Nail	tin with a little lead
3063	Nail	lead and traces of tin
3064	Nail	tin
3485	Handle hinge fitting	tin
3784	Strap-guide	tin with a little lead

Unstratified

No.	Object class	Analysis results
2190	Strip	tin with some lead
3065	Nail	tin-lead alloy
3478	U-eyed hinge	tin
3653	Key	tin
3838	Spur	tin
3839	Spur	tin

Inlay and other non-ferrous deposits

Period 3

1565	Plate	flecks of tin with some lead and a trace of copper
2246	File	metal in teeth is copper with a little zinc and ?lead
3798	Pin head	tin-lead alloy
3799	Pin head	lead with a little copper
3800	Pin	tin-lead alloy
3801	Pin head	lead with a little tin

Period 4B

2219	Punch	flecks adhering are copper, zinc and lead
2805	Knife	lump on end of blade is tin
2809	Knife	inlay: brass with traces of lead. Flecks of coating: copper; lump at tip: copper, zinc, lead
2812	Knife	inlay on handle: pewter type alloy (tin-lead with a trace of copper)

Period 4-5

No.	Object class	Analysis results
3815	Pin head	leaded gunmetal (copper, zinc, lead & tin)

Tenement D

11 Strips and plates
1 Axe
1 Auger
3 Wool comb teeth
5 Needles
5 Awls
4 Knives
1 Spoon
1 Plated nail
1 Clench bolt
15 Nails
3 Staples
3 Fittings
1 Disc fitting
1 Hasp
1 Wall hook
1 Padlock bolt
2 Keys
2 Buckles
1 Buckle-plate
1 Spur
1 Sword pommel guard

Table A7.2a Number of contexts containing iron objects by Period and context class

Period	Total	Layers	Pits	Cuts	Floors
3	381	202	119	60	na
4A	65	49	8	8	na
4B	500	308	52	43	97
5A	135	110	14	11	na
5B	410	269	67	59	15
4-5	22	13	5	4	na
5CF	13	10	0	3	na
5CR	61	31	27	3	na
Total	1587	992	292	191	113

Table A7.2b Number of contexts containing iron objects as a percentage of the period context total

Period	Layers	Pits	Cuts	Floors
3	53	31	16	
4A	75	12.5	12.5	
4B	62	10	9	19
5A	81.5	10.5	8	
5B	65.5	16.5	14.5	3.5
4-5	59	23	18	
5CF	77	0	23	
5CR	51	44	5	
Total	62.5	18.5	12	7

Table A7.3a Number of contexts containing smithing slag by period and context class

Period	Total	Layers	Pits	Cuts	Floors
3	148	80	49	19	
4A	49	37	6	6	
4B	268	163	19	18	68
5A	88	66	12	10	
5B	161	104	28	25	4
4-5	5	3	1	1	
5CF	4	3	0	1	
5CR	25	20	4	1	
Total	748	476	119	81	72

Table A7.3b Number of contexts containing smithing slag as percentage of the period context total

Period	Layers	Pits	Cuts	Floors
3	54	33	13	
4A	76	12	12	
4B	61	7	7	25
5A	75	13.5	11.5	
5B	64.5	17.5	15.5	2.5
5CF	75	0	25	
5CR	80	16	4	
Total	63.5	16	11	9.5

Table A7.4a Number of contexts containing smelting slag by period and context class

Period	Total	Layers	Pits	Cuts	Floors
3	15	9	4	2	na
4A	10	8	0	2	na
4B	85	45	3	7	30
5A	41	34	7	0	na
5B	70	55	5	9	1
4-5	3	2	1	0	na
5CF	2	2	0	0	na
5CR	18	14	3	1	na
Total	244	169	23	21	31

Table A7.4b Number of contexts containing smelting slag as percentage of total contexts in the period

Period	Layers	Pits	Cuts	Floors
3	60	27	13	
4A	80	0	20	
4B	53	3.5	8	35.5
5A	83	17	0	
5B	78.5	7	13	1.5
5CR	78	16.5	4.5	
Total	69.5	9.5	8.5	12.5

Table A7.4 Summary of objects in context 29263 backfill of sunken building in Tenement D, Period 5B (Object classes listed in catalogue order)

4 Strips and plates
1 Wool comb
9 wool comb teeth
3 Needles
2 Tanged punches
8 Knives
4 Nails
1 Clench bolt
2 Staples
1 Fitting
1 Spirally-twisted fitting
1 U-eyed hinge
1 Hinge pivot
2 Lock bolts
1 Buckle
1 Arrowhead

APPENDIX 8

Details of knives from comparative assemblages at Hamwic, Thwing, Wicken Bonhunt, Goltho Manor, Repton and Thetford. (For discussion see 6.3.30.7.)

The columns contain the following data:

1. SITE

2. REF = Reference: Hamwic AH = Addyman and Hill 1969
   Other Hamwic refs. are Six Dials site except for .99 = St.Mary's Street
   Goltho Manor = Goodall 1987
   Thetford 84.00 = I.Goodall 1984
   Thetford 89.00 = Goodall and Ottaway forthcoming
   Repton, Thwing and Wicken Bonhunt are unpublished

3. DT = Date: LS = Late Anglo-Saxon
   MS = Middle Anglo-Saxon

4. ST = Condition: c = unbroken i.e. complete length survives
   c* = blade tip missing, but complete length can be estimated
   bc = blade unbroken but tang incomplete
   i = incomplete i.e. both blade and tang bro

5. BF = Back form see 3.30.2 for details

6. CE = Cutting edge form:
   a = convex
   b = concave
   c = slight S-shape
   d = pronounced S-shape
   e = straight
   f = straight before curving up at the tip

7. SFEAT = Blade surface features:

A:Blade faces run vertically down before converging on cutting edge

B:As A, but one face

C:Blade faces slope outwards slightly before converging on cutting edge

D:As C, but one face

E:Blade faces concave before converging on cutting edge

F:As E, but one face

G:Chamfered back edges

H:As G, one edge only

J:Blade back triangular in cross-section.

K:Grooves cut into blade

L:As K, one face only.
The pattern of grooves is given as in following : example: 2-1 = two grooves on one face and one on the other. Inl = inlay.

M:Notches cut in blade back with number.

N:Relief work pattern cut into back

8. L = Length

9. LB = Length of blade

10. WB = Width of blade

11. LL1 = Ratio of length of blade to length from shoulder to point where back changes line (blades with back forms A, B, C)

12. LLB = Ratio of length of knife to length of blade

13. LBW = Ratio of length of blade to width of blade

(Note: in columns 11-3 0.00 = not applicable due to breakage)

14. Angle at which back changes line (blades with back form A; 0 = not accurately measurable)

APPENDIX 7

Table A7.1 Summary of iron objects from Period 4B building floors (object classes listed in catalogue order)

Tenement B

12 strips and plates
1 Punch
2 Wool comb teeth
3 Needles
1 Part-made needle
1 Tanged punch
1 ?Tanged punch
3 Knives
4 Staples
18 Nails
1 Plated nail
1 Clench bolt
2 Fittings
1 Key
1 Buckle-plate
1 Pin

Tenement C

24 Strips and plates
1 Coin die
1 Auger
3 Wool comb teeth
19 Needles
1 Part-made needle
4 Leatherworker's awls
7 Knives
1 Perforated disc
27 Nails
6 Staples
1 Ring
3 Fittings
2 U-eyed hinges
1 Hinge pivot
1 Ferrule
2 Tubes
2 Buckles
2 Buckle tongues
4 Buckle-plates
1 Strap-end
1 Strap-guide
1 Riveted dress fitting
1 Spur
1 Horseshoe nail

SITE	REF	DT	ST	BF	CE	SFEAT	L	LB	WB	LL1	LLB	LBW	A
Goltho Manor	35	LS	bc	C1	c	-	137	61	15	1.20	2.2	4.07	0
Goltho Manor	36	LS	i	C3	i	-	79	47	12	0.00	.00	0.00	0
Goltho Manor	38	LS	bc	C1	a	-	63	58	10	1.61	.00	5.80	0
Goltho Manor	39	LS	bc	A1?	a	-	83	55	18	1.31	.00	3.06	17
Goltho Manor	40	LS	bc	A1?	c	-	101	66	12	1.61	.00	5.50	10
Goltho Manor	41	LS	c	D	c	-	112	70	13	0.00	1.6	5.38	0
Goltho Manor	42	LS	c	C1	e	-	110	74	13	1.51	1.5	5.69	0
Goltho Manor	43	LS	c	A1c	c?	-	112	91	14	1.40	1.2	6.50	0
Goltho Manor	44	LS	c	A1?	i	-	103	52	12	2.60	2.0	4.33	5
Goltho Manor	45	LS	bc	C1	a	-	75	69	16	1.97	.00	4.31	0
Goltho Manor	46	LS	c*	C1	i	-	125	83	16	1.84	1.5	5.18	0
Goltho Manor	52	LS	c	C3	c	-	150	58	16	1.57	2.6	3.63	0
Goltho Manor	53	LS	c	C3?	c?	-	129	77	16	0.00	1.7	4.81	0
Goltho Manor	54	LS	i	C3?	b?	-	120	33	12	0.00	.00	0.00	0
Goltho Manor	55	LS	i	D?	i	-	134	52	17	0.00	.00	0.00	0
Goltho Manor	56	LS	bc	C3	i	-	90	52	16	0.00	1.7	3.25	0
Goltho Manor	57	LS	c	C3	f	-	89	59	12	1.74	1.5	4.92	0
Goltho Manor	58	LS	c*	C1	a	-	130	73	15	1.40	1.8	4.87	0
Goltho Manor	59	LS	i	C3	i	-	74	47	12	0.00	.00	0.00	0
Goltho Manor	60	LS	i	C1	b	-	105	67	11	0.00	.00	0.00	0
Hamwic 169	1011	MS	c	D	f	-	130	87	19	0.00	1.5	4.58	0
Hamwic 169	1051	MS	bc	C1	c	-	128	87	12	1.71	.00	7.25	0
Hamwic 169	113	MS	c	C1	c?	-	105	70	12	1.56	1.5	5.83	0
Hamwic 169	193	MS	c	C1	c	-	111	73	9	1.70	1.5	8.11	0
Hamwic 169	241	MS	bc	A1c	a	-	100	94	12	1.88	.00	7.83	10
Hamwic 169	263	MS	c	A1	c	-	117	80	11	2.00	1.5	7.27	10
Hamwic 169	266	MS	c*	A2	a	K1-1inl	128	85	15	2.24	1.5	5.67	17
Hamwic 169	2681	MS	c	C1?	f	-	151	97	17	1.62	1.6	5.71	0
Hamwic 169	310	MS	bc	A1	a	-	105	85	15	1.63	.00	5.67	10
Hamwic 169	311	MS	c	C2	c	-	86	59	11	2.36	1.5	5.36	0
Hamwic 169	312	MS	bc	A2	a	K1-?	80	57	13	1.46	.00	4.38	20
Hamwic 169	3318	MS	c*	C1	f	-	134	86	15	2.15	1.6	5.73	0
Hamwic 169	3337	MS	bc	C1	a	-	89	88	13	1.87	.00	6.77	0
Hamwic 169	421	MS	c	A2	e?	K1-?	133	81	14	1.88	1.6	5.79	19
Hamwic 169	558	MS	c	A2	a	-	147	116	17	1.97	1.3	6.82	17
Hamwic 169	606	MS	bc	A2	f	-	90	65	13	2.24	.00	5.00	16
Hamwic 169	610	MS	c	C1	c	-	116	73	9	1.49	1.6	8.11	0
Hamwic 169	883	MS	bc	A1	a	-	138	115	15	1.62	.00	7.67	11
Hamwic 169	912	MS	c*	A2	a	-	134	94	16	2.00	1.4	5.88	15
Hamwic 169	927	MS	c	C1	f	-	95	57	9	1.68	1.7	6.33	0
Hamwic 169	98	MS	c	C3?	i	-	68	31	10	0.00	2.2	3.10	0
Hamwic 177	294	MS	bc	A2	a	-	102	96	17	2.13	.00	5.65	15
Hamwic 177	53	MS	c	A2	e	-	101	76	12	1.77	1.3	6.33	20
Hamwic 177	86	MS	c	A1	c	-	85	52	11	1.49	1.6	4.73	23
Hamwic 184	179	MS	c	D	e	-	123	83	12	0.00	1.5	6.92	0
Hamwic 184	80	MS	c	C1	c?	-	110	76	6	1.49	1.4	12.66	0
Hamwic 24	1094	MS	c	A3	f	-	122	80	12	1.51	1.5	6.66	9
Hamwic 24	1181	MS	c	C2	c	-	127	87	16	1.58	1.5	5.44	0
Hamwic 24	1255	MS	c	C1	c	-	133	86	14	1.62	1.6	6.14	0
Hamwic 24	1889	MS	c	C2	e	K2-2inl	79	48	14	1.78	1.6	3.43	30
Hamwic 24	201	MS	bc*	A2	a	-	86	62	18	2.00	.00	3.44	22

SITE	REF	DT	ST	BF	CE	SFEAT	L	LB	WB	LL1	LLB	LBW	A
Hamwic 24	2016	MS	c	A2	f	-	138	91	22	2.28	1.5	4.14	26
Hamwic 24	286	MS	c	A2	a	-	145	102	15	1.96	1.4	6.80	17
Hamwic 24	2865	MS	bc	C1	f	-	68	40	9	1.33	.00	4.44	0
Hamwic 24	334	MS	c	C1	f	K1-?	115	75	14	1.63	1.5	5.36	0
Hamwic 31	9	MS	c	A2	a	-	176	117	17	2.21	1.5	6.88	
Hamwic 31	1084	MS	i	Ai	a	K1-?	64	64	10	0.00	.00	0.00	0
Hamwic 31	1147	MS	c	C1	a	-	90	57	12	1.90	1.6	4.75	0
Hamwic 31	1197	MS	c*	C1	f	K1-?	162	129	10	1.79	1.3	12.90	0
Hamwic 31	1246	MS	bc	A2	f	-	138	128	18	1.78	.00	7.11	13
Hamwic 31	1274	MS	bc	Ci	a	-	79	73	11	1.46	.00	6.63	0
Hamwic 31	1376	MS	c	Ci	e	-	91	60	11	1.25	1.5	5.45	0
Hamwic 31	1464	MS	bc	C1	f	-	95	83	12	1.69	.00	6.92	0
Hamwic 31	1558	MS	c	A1	f	-	111	75	16	2.50	1.5	4.69	10
Hamwic 31	1559	MS	bc	A1	f	-	159	131	18	1.98	.00	7.28	8
Hamwic 31	1709	MS	c	C1	a	-	72	45	8	1.73	1.6	5.63	0
Hamwic 31	1725	MS	c	Ai	f	-	91	56	15	1.87	1.6	3.73	30
Hamwic 31	1840	MS	bc	C1	f	-	100	61	0	1.79	.00	0.00	0
Hamwic 31	1945	MS	bc	C2	e	-	93	72	14	1.41	.00	5.14	0
Hamwic 31	1975	MS	c	B1	f	-	153	117	17	1.60	1.3	6.88	0
Hamwic 31	2009	MS	c	A2	g	-	122	77	15	1.79	1.6	5.13	20
Hamwic 31	2352	MS	bc	C1	f	-	93	80	13	1.90	.00	6.15	0
Hamwic 31	2407	MS	c	A1	a	-	108	70	13	2.00	1.5	5.38	15
Hamwic 31	2471	MS	bc	A2	f	K1-?	107	92	15	1.84	.00	6.13	13
Hamwic 31	2502	MS	c	C1	c	-	112	69	12	2.30	1.6	5.75	0
Hamwic 31	2516	MS	c	C2	c	-	98	67	10	1.68	1.5	6.70	0
Hamwic 31	2802	MS	bc	A2	a	-	69	55	18	1.96	.00	3.06	28
Hamwic 31	287	MS	c	C1?	a	-	146	117	13	2.17	1.2	9.00	0
Hamwic 31	340	MS	c	C2	e	-	109	70	10	2.00	1.6	7.00	0
Hamwic 31	407	MS	c	C2	e	-	103	55	9	1.62	1.9	6.11	0
Hamwic 31	458	MS	c	A2	a	-	144	118	22	1.87	1.2	5.36	25
Hamwic 31	654	MS	c	C2	a	-	100	67	10	1.97	1.5	6.70	0
Hamwic 31	663	MS	c	E	a	-	94	61	11	0.00	1.5	5.55	0
Hamwic 31	986	MS	bc*	Ci	e	K1-?	88	88	13	1.57	.00	6.77	0
Hamwic 99	132	MS	c	C1	e	-	115	73	10	1.43	1.6	7.30	0
Hamwic 99	30a	MS	c	A2	a	M1	143	106	18	2.47	1.4	5.89	12
Hamwic 99	30b	MS	c	A1	f	-	132	92	13	2.14	1.4	7.08	8
Hamwic 99	92	MS	c	A1	c	-	141	97	15	1.54	1.4	6.47	7
Hamwic AH	24.10	MS	i	Ai	f	-	120	120	21	0.00	.00	0.00	20
Hamwic AH	24.11	MS	bc*	A3	i	G?	108	81	18	1.31	.00	4.50	8
Repton	1614	LS	c	C3	c	-	73	62	13	1.24	1.2	4.77	0
Repton	1840	LS	c	D?	a	-	101	47	13	0.00	2.1	3.62	0
Repton	1843	LS	i	C1	c	M9	96	70	15	0.00	.00	0.00	0
Repton	2762	LS	c	A2	c	-	128	86	23	0.00	1.5	3.74	0
Repton	3106	LS	c	C2	f	-	68	40	9	0.00	1.7	4.44	0
Repton	3258	LS	i	A1c	f	K1-?	91	62	20	0.00	.00	0.00	10
Repton	3260	LS	i	C1	c	-	95	68	18	0.00	.00	0.00	0
Repton	3300	LS	c	A2	a	-	78	51	12	1.76	1.5	4.25	20
Repton	3312	LS	bc	A2	b	-	143	116	18	1.66	1.2	6.44	20
Repton	3329	LS	bc	C1?	c	-	89	55	11	1.47	1.6	5.00	0
Repton	3336	LS	c	A2	i	-	116	76	20	1.52	1.5	3.80	35
Repton	3340	LS	bc	A2	i	-	85	85	20	1.44	.00	4.25	35

SITE	REF	DT	ST	BF	CE	SFEAT	L	LB	WB	LL1	LLB	LBW	A
Repton	3626	LS	c	A2	e	-	96	58	21	2.07	1.7	2.76	39
Repton	3744	LS	bc	C1	e	-	75	72	12	1.67	.00	6.00	0
Repton	3756	LS	i	C?	i	-	69	17	10	0.00	.00	0.00	0
Repton	3782	LS	i	C?	e	-	61	35	10	0.00	.00	0.00	0
Repton	4124	LS	i	C	i	-	56	51	17	0.00	.00	0.00	0
Repton	5036	LS	c*	C1?	e	-	60	52	9	1.68	.00	5.78	0
Repton	5105	LS	i	A2	e	-	91	75	25	0.00	.00	0.00	0
Repton	5174	LS	c*	A2	e	-	78	57	21	2.48	1.4	2.71	29
Repton	5321	LS	c	A2	b	K1-?	71	48	17	1.85	1.5	2.82	39
Repton	5738	LS	bc	A2	c	-	70	53	19	1.66	1.3	2.79	43
Repton	5791	LS	c*	A2	f	-	105	95	18	2.32	1.1	5.28	21
Thetford	84.100	LS	c*	C3	c	-	156	55	12	1.25	2.8	4.58	0
Thetford	84.101	LS	c	C1	c	-	172	70	10	1.21	2.5	7.00	0
Thetford	84.101	LS	bc	C3	c	-	84	61	15	1.22	.00	4.07	0
Thetford	84.102	LS	bc*	C3	c	-	94	52	10	1.53	1.8	5.20	0
Thetford	84.103	LS	c	B1	f	-	146	111	14	1.54	1.3	7.93	0
Thetford	84.50	LS	i	A2	e	-	118	70	20	0.00	.00	0.00	20
Thetford	84.51	LS	bc	A2	i	-	88	66	12	1.38	1.3	5.50	26
Thetford	84.52	LS	bc	A2c	a	-	112	102	18	3.40	.00	5.67	10
Thetford	84.53	LS	bc	A2	c	-	96	68	22	1.62	1.4	3.09	40
Thetford	84.54	LS	c	C2	i	-	74	36	7	1.38	2.1	5.14	0
Thetford	84.55	LS	c	A2	a	-	117	74	16	1.68	1.6	4.63	21
Thetford	84.56	LS	c	A1	f	-	110	72	14	1.89	1.5	5.14	15
Thetford	84.57	LS	bc	A1	c	-	90	50	10	1.43	1.8	5.00	25
Thetford	84.58	LS	bc	A1	d	-	136	100	14	1.64	1.4	5.56	16
Thetford	84.58b	LS	bc	C1	c	-	104	63	12	1.58	.00	5.25	0
Thetford	84.58c	LS	bc	C3	c	-	85	68	15	1.31	.00	4.53	0
Thetford	84.59	LS	bc	C2	d	-	98	72	14	1.71	1.4	5.14	0
Thetford	84.60	LS	bc*	C1	e	-	144	104	16	1.86	1.4	6.50	0
Thetford	84.61	LS	bc	C1	g	-	162	100	16	2.00	1.6	6.25	0
Thetford	84.62	LS	c	Ai	c	-	101	68	14	1.48	1.5	4.86	25
Thetford	84.63	LS	bc	C3	c	-	72	36	8	0.00	.00	4.50	0
Thetford	84.64	LS	bc	C3	c	-	66	52	10	1.73	1.3	5.20	0
Thetford	84.65	LS	bc	C1	g	-	78	68	16	0.00	.00	4.25	0
Thetford	84.66	LS	c	C1	a	-	95	66	12	1.57	1.4	5.50	0
Thetford	84.67	LS	c	A1	d	-	132	80	16	1.60	1.6	5.00	0
Thetford	84.68	LS	c	A2	f	-	133	94	18	1.96	1.4	5.22	10
Thetford	84.69	LS	bc	C2	a	-	135	124	18	1.68	1.1	6.89	0
Thetford	84.70	LS	i	C1	a	-	280	212	30	0.00	.00	0.00	0
Thetford	84.71	LS	c	C1	c	-	74	38	8	1.52	1.9	4.75	0
Thetford	84.72	LS	bc	A2	i	-	70	50	10	2.00	1.4	5.00	10
Thetford	84.73	LS	bc	C1	f	-	74	62	12	2.06	.00	5.17	0
Thetford	84.74	LS	bc	C1	a	-	88	72	11	1.89	1.2	6.54	0
Thetford	84.75	LS	bc	C1	c	-	100	82	12	1.64	1.2	6.83	0
Thetford	84.76	LS	c*	C1	f	-	118	83	12	1.22	1.4	6.92	0
Thetford	84.77	LS	i	C1	i	-	144	94	16	0.00	.00	0.00	0
Thetford	84.78	LS	bc	A1	f	-	150	133	19	1.51	.00	7.00	0
Thetford	84.78f	LS	bc	C1	a	-	51	49	11	2.04	.00	4.45	0
Thetford	84.78c	LS	bc	C1	c	-	73	63	10	1.47	.00	6.30	0
Thetford	84.78b	LS	c	C1	f	-	99	70	13	1.56	1.4	5.38	0
Thetford	84.79	LS	c	C1	f?	-	104	53	14	2.20	2.0	3.79	0

SITE	REF	DT	ST	BF	CE	SFEAT	L	LB	WB	LL1	LLB	LBW	A
Thetford	84.80	LS	i	C1	c	-	55	42	7	0.00	.00	0.00	0
Thetford	84.81	LS	i	A1	i	-	67	53	9	0.00	.00	0.00	5
Thetford	84.82	LS	c	A1	a	-	108	74	16	2.18	1.5	4.63	20
Thetford	84.83	LS	c	A1	f	-	156	67	18	1.91	2.3	3.72	10
Thetford	84.84	LS	bc	C1	f	-	200	134	12	1.68	1.5	11.17	0
Thetford	84.85	LS	c	D	c	-	164	63	13	0.00	2.6	4.85	0
Thetford	84.86	LS	c	C1	d	-	140	52	10	1.18	2.7	5.20	0
Thetford	84.87	LS	c	C1	d	-	140	60	12	1.76	2.3	5.00	0
Thetford	84.88	LS	c*	C1	c	-	166	70	11	1.30	2.4	6.36	0
Thetford	84.89	LS	c	C1	d	-	128	76	10	2.11	1.7	7.60	0
Thetford	84.90	LS	bc	C1	c	-	157	93	12	1.19	1.7	7.75	0
Thetford	84.91	LS	i	C3	c?	-	138	46	14	0.00	.00	0.00	0
Thetford	84.92	LS	c	C1	c	-	139	48	10	1.78	2.9	4.80	0
Thetford	84.93	LS	c*	C3	c	-	123	57	14	0.00	2.2	4.07	0
Thetford	84.94	LS	bc	C3	a	-	76	52	16	1.30	.00	3.25	0
Thetford	84.94a	LS	c	C3	a	-	93	57	11	1.43	1.6	5.18	0
Thetford	84.95	LS	c	D	a	-	169	68	18	0.00	2.5	3.78	0
Thetford	84.96	LS	c*	C3	c?	-	142	45	10	1.18	3.2	4.50	0
Thetford	84.97	LS	bc	C1	c	-	104	52	11	1.30	2.0	4.73	0
Thetford	84.99	LS	c*	D	d	-	168	68	16	0.00	2.4	4.25	0
Thetford	89.13	LS	ç*	B	c	-	100	76	13	1.41	1.3	5.85	0
Thetford	89.212	LS	c	C1	c	-	145	63	12	1.50	2.3	5.25	0
Thetford	89.302	LS	c	C1	a	-	87	61	9	1.53	1.4	6.78	0
Thetford	89.382	LS	c	C1	c	-	130	68	11	1.48	1.9	6.18	0
Thetford	89.415	LS	c	C3	c	-	80	65	13	1.51	1.2	5.00	0
Thetford	89.887	LS	c	D	c	-	172	67	15	0.00	2.6	4.47	0
Thetford	89.895	LS	c	C3	c?	-	70	47	11	1.74	1.5	4.27	0
Thwing	73.26	MS	bc	C1	e	-	129	96	12	1.20	1.3	8.00	0
Thwing	76.21	MS	i	C1	i	-	65	53	10	0.00	.00	0.00	0
Thwing	76.9	MS	i	Ci	-	-	99	49	16	0.00	.00	0.00	0
Thwing	79.135	MS	i	A1	c	-	109	77	17	0.00	.00	0.00	0
Thwing	81.137	MS	c	C1	i	-	130	90	10	1.22	1.4	9.00	0
Thwing	81.24	MS	bc	C1	e	-	63	52	9	1.30	.00	5.78	0
Thwing	81.4	MS	i	C1	f	-	83	75	11	0.00	.00	0.00	0
Thwing	81.60	MS	i	C1	i	-	63	40	15	0.00	.00	0.00	0
Thwing	81.69	MS	bc	Ai	i	-	114	97	16	1.62	.00	6.06	24
Thwing	82.11	MS	bc	A2	i	-	71	56	15	2.15	.00	3.73	0
Thwing	82.14	MS	c	A1	c?	-	105	69	13	1.86	1.5	5.31	0
Thwing	82.15	MS	bc	A2	f	-	0	108	20	2.30	.00	5.40	0
Thwing	82.24	MS	bc	A2	i	-	82	82	18	2.34	.00	4.56	13
Thwing	82.40	MS	bc	C1	c	-	105	75	13	1.39	1.4	5.77	0
Thwing	82.95	MS	i	A2	a	-	74	74	18	0.00	.00	0.00	20
Thwing	83.163	MS	i	A1	c	K1-1	147	107	18	0.00	.00	0.00	0
Thwing	83.250	MS	bc	C1	i	-	91	83	14	1.66	.00	5.93	0
Thwing	83.261	MS	c	A2	f	K2-2	99	77	16	2.26	1.3	4.81	16
Thwing	83.43	MS	bc	A2	c	-	121	117	19	2.44	.00	6.16	15
Thwing	83.44	MS	bc	A2	d	K2-2	105	99	20	1.74	.00	4.95	18
Thwing	83.82	MS	bc	A1	c	K1-1	160	138	21	1.92	.00	6.57	14
Thwing	85n808	MS	bc	A1	c	-	123	81	16	0.00	1.5	5.06	0
Thwing	85.24	MS	i	C3?	b	-	93	24	12	0.00	.00	0.00	0
Thwing	85.277	MS	i	A2	a	-	122	110	20	2.08	.00	0.00	11

SITE	REF	DT	ST	BF	CE	SFEAT	L	LB	WB	LL1	LLB	LBW	A
Thwing	85.281	MS	i	A2	c	-	85	61	15	0.00	.00	0.00	23
Thwing	85.346	MS	c	A2	b	-	96	51	12	1.50	1.9	4.25	0
Thwing	85.47	MS	i	C3	c	-	98	50	11	0.00	.00	0.00	0
Thwing	87.118	MS	c	A2	c	K1-1	154	100	19	1.82	1.5	5.26	0
Thwing	87.61	MS	bc	C1	f	-	90	74	13	1.64	.00	5.70	0
Thwing	87.76	MS	c	C2	c	-	97	61	16	2.03	1.6	3.81	0
Thwing	87.79	MS	bc	E?	b	-	47	47	9	0.00	.00	5.22	0
Wicken Bonhunt	231	MS	i	C2	e	-	40	32	8	2.46	1.2	4.00	0
Wicken Bonhunt	235	MS	c	D	c	-	145	98	14	0.00	1.5	7.00	0
Wicken Bonhunt	28	MS	c	C1	a	M1-1	110	69	9	2.09	1.6	7.67	0
Wicken Bonhunt	283	LS	bc	F	a	E	79	79	19	1.93	.00	4.16	0
Wicken Bonhunt	286	LS	c	A2	f	K inl	135	84	29	1.75	1.6	2.90	43
Wicken Bonhunt	29	MS	i	C1	i	-	71	47	11	0.00	.00	0.00	0
Wicken Bonhunt	30	MS	c	C2	e	-	83	54	9	1.74	1.5	6.00	0
Wicken Bonhunt	31	MS	bc	C	e	-	50	50	9	1.79	.00	5.56	0
Wicken Bonhunt	32a	MS	i	Ci	i	-	60	0	0	0.00	.00	0.00	0
Wicken Bonhunt	32b	MS	i	D	i	L1-0	52	52	15	0.00	.00	0.00	0
Wicken Bonhunt	324	MS	c	D	i	M1-1	105	69	10	0.00	1.5	6.90	0
Wicken Bonhunt	33	MS	c	C1	c	L1-0	103	70	11	1.56	1.5	6.36	0
Wicken Bonhunt	34	MS	c	C1	e	-	143	98	10	1.72	1.5	9.80	0
Wicken Bonhunt	345	MS	i	C?	b	K1-1	98	58	12	0.00	1.7	4.83	0
Wicken Bonhunt	346	MS	c	C3	c	-	94	63	11	1.62	1.5	5.73	0
Wicken Bonhunt	348	MS	c	C2	e	K1-1	81	63	10	1.35	1.3	6.30	0
Wicken Bonhunt	368	MS	i	A1	a	-	144	97	15	1.70	1.5	6.47	0
Wicken Bonhunt	398	MS	c	C3	c	-	126	84	13	1.45	1.5	6.46	0
Wicken Bonhunt	449	MS	c	A2	?	-	114	74	23	2.11	1.5	3.22	0

APPENDIX 9

Examples of objects exhibiting relief work from middle Anglo-Saxon and late Anglo-Saxon (or equivalent period) contexts other than 16-22 Coppergate (not including knives, or weapons).

Site and Reference	Object	Motifs
<u>Britain</u>		
Middle Anglo-Saxon		
Hamwic: Six Dials SOU15.008	Strap-end	grooves across centre
SOU31.150	Strap-end	grooves on surface
SOU31.1335	Small fitting	grooves on surface
SOU169.1683	Small fitting	grooves on surface & scalloped edges
SOU169.1855	Small fitting	grooves on surface
SOU169.2184	Spur	grooves at base of goad
Thwing	Small fitting	grooves at base of terminal
Late Anglo-Saxon / Anglo-Scandinavian		
Balladoole (Bersu and Wilson 1966, fig.19)	Stirrup	boss at head
Cheddar (Goodall 1979a, fig.91, 56	Buckle-plate	notches in sides
Goltho Manor: (Goodall 1987, fig.156, 25	Harbick	grooves on central panel
fig.158, 94	Small fitting	grooves on body, dots on terminals

fig.160, 160	Bridle attachment link	central moulding and grooves on eyes
fig.160, 161	Bridle attachment link	dots on surface
fig.160, 165)	Ring and distributor straps	notches in straps
Lincoln, Flaxengate:		
Fe74, 1127	Small fitting	grooves on surface
Fe74, 1188	Small fitting	triangular notches
Fe75, 2552	Strap-guide	bi-lobate head
Fe75, 2593	Key	grooves on bow
Fe76, 107	Small fitting	small bosses
Fe76, 112	Small fitting	moulding at one end, ?animal head
London:		
Canning Town (Wheeler 1927, fig.19)	Spur	moulded goad
St. Mildred's Church (Rhodes 1975, fig.12, 142)	Spur	grooves on arms
Northampton, St.Peter's Street: (Goodall 1979b		
fig.116, 9	Key	grooves on bow
fig.119, 82	Small fitting	grooves and expansions
fig.120, 102	Buckle frame	dots and grooves
fig.121, 120	Spur	dots on arm
fig.121, 121)	Buckle	dots

Norwich (Jope 1952, fig.14, 3)	Spur	grooves and moulded goad
Site and Reference	Object	Motif
Thetford:		
(I.Goodall 1984:		
fig. 130, 160	Small fitting	animal head moulding
fig. 130, 162	Small fitting and Hasp	Fitting:triangular notches in termianal and relief strips on body. Hasp:grooves on body
fig. 132, 186	Key	grooves on bow
fig. 137, 235	Buckle	grooves
fig. 138, 249	Bit cheek piece	grooves
fig. 138, 250	Bit cheek piece	grooves
fig. 138, 258	Bridle attachment link	expansions between eyes
fig. 138, 260	Bridle attachment link	grooves
fig. 138, 261)	Bridle attachment link	grooves
(Ellis 1984,		
fig. 140, 266	Spur	grooves on goad
fig. 140, 267	Spur	grooves on arms and moulded goad
fig. 140, 269	Spur	criss-cross grooves on arms
fig. 141, 271	Spur	bosses on arms and moulded goad
fig. 141, 272	Spur	moulded goad
fig. 141, 273	Spur	grooves and bosses on arms and neck

Thetford continued:

fig. 141, 276)	Spur	relief strip above terminal
(Ottaway and Goodall forthcoming		
sf189	Bit cheek piece	grooves
sf259A)	Bit cheek piece	grooves
Thetford, Red Castle: (Knocker 1967, fig.13, 5)	Key	grooves on stem
Winchester (Waterman 1959, 8.2)	Bit	expansions between eyes
York: 6-8 Pavement (MacGregor 1982, fig. 46, 414	Strip	animal head
fig. 46, 415	Strip	small expansions
All Saints Pavement (Tweddle 1986, fig.101, 1233	Ringed pin	grooves and saltire on shank
Various sites (Waterman 1959, fig.8, 1	Bit	grooves and protrusions
fig.8, 4	Stirrup	bosses on arms
fig.8, 5	Spur	bosses on arms
fig.8, 6	Spur	bosses on arms, relief strip on terminals
fig.8, 7	Spur	bosses and relief strip at neck
fig.8, 10)	Fork	moulding at top of socket

Site and Reference	Object	Motifs
Denmark		
Viking Age		
Århus (Andersen et al., 220, BCS, EYA	2 Awls	moulding between arms
213, EKP	Spur	moulded goad
Fyrkat (Roesdahl 1977, fig.174	Small hinge strap	grooves
fig.175	Small hinge strap	moulding between terminals and body
fig.195	Small hinge strap	grooves and moulding in centre
fig.198)	Hasp	moulding between terminal and body
Ladby (Thorvildsen 1957, fig.42)	Bit	mouldings on cheek piece
Trelleborg (Nørlund 1948 pl.22.3	Barrel padlock key	grooves at head and base
pl.25.13)	Small hinge strap	grooves
Germany		
Viking Age		
Hedeby: (Jankuhn 1943, Abb.64a)	Key	grooves on bow
(Müller-Wille 1973, Abb.5, 4)	Shears	relief panel on stems
Abb.6, 2)	Spur	grooves on terminal

Thumby-Bienebek: (Müller-Wille 1976b, Taf.29, 2)	Buckle	grooves
Norway		
Viking Age		
Kaupang (Blindheim et al. 1981, pl.35	Bit	mouldings and grooves on links and bridle straps
Oseberg (Grieg 1927-8, fig.118	Shears	notches in edge of bow mouldings at bow and stem junction
fig.65)	3 Stapled hasps on chest	animal head terminals
Sweden		
Viking Age		
Aska Frälsegård Arne 1932, Abb.31	Bit	grooves on ring cheek piece
Abb.42b)	Stapled hasp	notches on edge of one face
Birka (Arbman 1940, Taf.22	3 Buckles	grooves
Taf.22	Bit ring cheek piece	grooves
Taf.22	Bridle strap	small dots
Taf.22	3 Bridle rings	grooves
Taf.26, 2	Buckle	grooves
Taf.38, 4a	Spur	grooves
Taf.38, 1a-c	Spur	grooves
Taf.38, 3	Spur	moulded goad

Birka continued:

Taf.45, 4	Ringed pin	grooves on ring
Taf.57, 1	Bow brooch	raised panel with relief animal head
Taf.57, 5	Bow brooch	raised panel with relief animal head

Birka continued:

Taf.174, 1	Shears	mouldings on stem
Taf.174, 2a	Shears	grooves on stem and mouldings at top and base of stems
Taf.269	Key	moulding on stem above bit
Taf.270, 2	Key	grooves on bow and stem
Taf.273, 3	Barrel padlock key	grooves
Taf.272, 3b;	Stapled hasp	animal head terminal
Arbman 1943, 206-7	Casket fittings	rows of dots

Lund:
P.K. Bank
(Mårtensson 1976,

fig.355	Key	grooves on bow
fig.358	Barrel padlock key	moulding between bit and stem
fig.358	Barrel padlock key	moulding at top and base of stem
fig.367	Small hinge strap	notches in edges
Thule site (Blomquist and Mårtensson 1963, fig.108	Key	grooves on bow and stem

Lund continued:

fig.127	Key	grooves on stem

APPENDIX 10

Examples of objects plated with non-ferrous metal from middle or late Anglo-Saxon (or equivalent period) contexts other than 16-22 Coppergate.

(* = if known from analysis or surmised from visual inspection)

Site and Reference	Object	* Principal Metal
Britain		
Middle Anglo-Saxon		
Dacre: (Ottaway forthcoming, sf321)	2 Nails in hinge strap	
Hamwic:		
SOU15.8	Strap-end	
SOU24.215	Lock?	
Six Dials		
SOU31.150	Strap-end	
SOU31.459	Dome-headed nail	
SOU31.674	Small pierced fitting	
SOU31.1335	Small pierced fitting	
SOU31.1522	Small fitting	
SOU169.460	Dome-headed nail	
SOU169.1148	Small fitting	
SOU169.1298	Buckle?	
SOU169.1400	Small fitting	
SOU169.1445	Ring	
SOU169.1643	Key	
SOU169.1683	Small fitting	
SOU169.1855	Small fitting	
SOU169.2021	Small fitting	
SOU169.2070	Plate	

Hamwic continued:

SOU169.2173	Plate	
SOU169.2184	Spur	
SOU169.2187	Plate	
SOU169.2641	Nail	
SOU169.2652	Buckle	
SOU169.2807	Object	
SOU169.2809	Key	
North Elmham: (Goodall 1980b, fig.267, 95)	Small fitting	
Thwing 76.30	Fitting	
83.47	Ring	
83.277	Fitting	
85.21	Fitting	
Wicken Bonhunt: sf218	Key	Cu
sf393	Small fitting	Sn
Late Anglo-Saxon		
Cheddar: (Goodall 1979a, fig. 91, 56	Spur terminal and buckle-plate	
fig. 91, 19	Buckle-plate	
fig. 91, 58	Strap-end?	
Goltho Manor: (Goodall 1987, fig.156, 25	Harbick	
fig.158, 93	Small hinge fitting	
fig.158, 94	Small fitting	
fig.160, 160	Bridle attachment link	
fig.160, 161)	Bridle attachment link	

Lincoln, Flaxengate:		
Fe74.362	Padlock case	
Fe74.801	Small fitting	
Fe74.1127	Small fitting	
Fe74.1188	Small fitting	
Fe75.1524	Buckle & Buckle-plate	
Fe75.2545	Spur terminal & buckle	
Fe75.2552	Strap-guide	
Fe75.2594	Box padlock	
Fe75.2615	Small fitting	
Fe76.107	Small fitting?	
Fe76.112	Small fitting	
Fe76.380	Small fitting	
(White 1980)	Barrel padlock	Cu
London: St.Mildred's Church (Rhodes 1975, fig.19, 142)	Spur	Sn
Canning Town (Wheeler 1927, 42, no.1)	Bit	Cu
42, no.2)	Bit	Sn?
Northampton: St.Peter's Street (Goodall 1979b, fig. 116, 2	Box padlock	Cu
fig. 116, 3	Barrel padlock	Cu
fig. 116, 9	Key	
fig. 119, 82	Small fitting	
fig. 120, 120	Spur	
fig. 120, 121)	Buckle, Strap-end and Strap-guide	
Norwich (Jope 1952 fig.14, 3)	Spur	Sn

Repton sf3812	Bell	Cu
sf5257	Strap-guide	
Ribblehead (King 1978)	Bell	Cu
Thetford: (I.Goodall, 1984, fig.130, 162	Hasp & fitting	
fig.132, 188	Key	
fig.132, 189	Key	
fig.134, 207	Chain fitting?	
fig.137, 235	Buckle	
fig.138, 249	Bit cheek-piece	
fig.138, 260	Bridle attachment link	
fig.138, 261	Bridle attachemnt link	
fig.139, 264	Bridle boss	
(Ellis 1984, fig.140, 266	Spur	
fig.140, 267	Spur	
fig.140, 269	Spur	
fig.140, 273)	Spur	
(Goodall and Ottaway forthcoming, sf189	Bit cheek-piece	
sf259)	Bit cheek-piece	
Winchester: Castle Yard CY297 (Seaby and Woodfield 1980, 119)	Stirrup	
Cathedral Green (Biddle and Kjølbye-Biddle forthcoming, Grave 74)	Lock and coffin straps	Sn

York:		
Hungate (Richardson 1959, fig. 18, 4)	Box padlock and chain	Cu
Skeldergate (MacGregor 1978, fig. 27, 2)	Box padlock	Cu
6-8 Pavement (MacGregor 1982, fig. 46, 414	Small fitting	Sn
fig. 46, 415)	Small fitting	Cu
All Saints, Pavement (Tweddle 1986, fig.101, 1233)	Ringed pin	Sn
Various: (Waterman 1959, fig.5, 10	Fork (moulding)	Cu
fig.8, 4)	Stirrup	Cu

<u>Denmark</u>

Viking Age

Århus: (Andersen et al., EVX	Buckle	
Fyrkat: (Roesdahl 1977, fig.174	Small hinge fitting	Sn
fig.175	Small hinge fitting	Sn
fig.195	Small hinge fitting	Sn
fig.196	Small hinge fitting	Sn
fig.198)	Hasp	Sn
Ladby: (Thorvildsen 1957, fig.60	Whip shaft?	Au, Ag
fig.50)	Nails in bridle	Sn
Sønder Onsild (Roesdahl 1976, 32)	Casket nails	Sn

<u>Norway</u>

Viking Age

Oseberg Ship: (Grieg 1927-8, 37, fig.17	Nails and tacks in sledge	Sn
fig.65	Nails in chest 149	Sn
fig.66	Nails in chest 156	Sn
fig.131	Hasp	Cu
fig.132)	Nails and hinge straps in box	Sn

<u>Sweden</u>

Viking Age

Birka: (Arbman, 1940, Taf.22	3 Buckles	Sn
Taf.22	Bridle rings	Sn
Taf.22	Other bridle fittings	Sn
Taf.24	Buckle and buckle-plate	Sn
Taf.26, 2	Buckle	Sn
Taf.45, 4	Ringed pin	Sn
Taf.57	4 Bow brooches	Sn?
Taf.151, 4	Spoon	Au
Taf.210, 2b, 3b, 5	3 groups of Dome-headed tacks from bucket fittings	Sn
Taf.276)	Nails in bucket	Sn
(Arbman 1943, Abb.656-7	Clasp	Sn
Abb.163)	Casket fittings	Sn
Lund: P.K.Bank (Mårtensson 1976, fig.359	Barrel padlock	Cu
fig.361)	Barrel padlock	Cu

Thule site (Blomquist and Mårtensson 1963, fig. 116	Barrel padlock	Cu
fig. 117	Barrel padlock	Cu
fig. 118)	Barrel padlock	Cu
Mästermyr: (Arwidsson and Berg 1983, pl.17, 26-8	3 Bells	Cu
pl.19, 10)	Box padlock	Cu

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