IRONWORK IN MEDIEVAL BRITAIN
AN ARCHAEOLOGICAL STUDY

IAN H GOODALL

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An archaeological study

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FOREWORD

This monograph is the publication of the late Ian Goodall's doctoral thesis on medieval ironwork in Britain which was submitted to the Department of Archaeology, University College, Cardiff, in 1980. Thirty years on, it remains the definitive survey of iron tools and other fittings in use during the period *c*1066 to 1540 AD. Exceptional in a north-western European context for its range and coverage of artefacts from both rural and urban excavations, much of the material described here was recovered during 'rescue' projects in the 1960s and 1970s funded by the State through the Ministry of Public Works and Buildings and their successors. It immediately established Ian as one of Britain's leading authorities on all things ferrous and later medieval.

Only a month before Ian's unexpected death in 2006, I met with him to discuss a report he had been preparing on the metalwork finds from Clarendon Palace in Wiltshire. As he worked his way through fragments of medieval arrowheads and knives, modern bicycle bells and lawn-mower blades, I asked why he had never published his thesis. Ian explained to me then that, after leaving Cardiff, his career with Royal Commission on the Historical Monuments of England and latterly English Heritage had been as an architectural historian rather than any strictly academic or archaeological enterprise and, although he had continued to compile reports on assemblages all the while, he had just never had the time to sit down and update his original work. By the time we had time to think more seriously about how his thesis might be brought to a wider audience, Ian had gone.

Certainly there is neither academic nor professional reason why his thesis should not now be published, indeed it is a work ideally suited to wider dissemination because it is relevant, useful, and difficult to access. The text contains almost everything necessary to identify, date and understand medieval iron objects. In scope and detail there is still no published parallel and, as such, it will be essential for almost any archaeologist working in later medieval archaeology, particularly in the fields of excavation, finds study, museums and research.

That said, a thesis serves a very different purpose to a published text and, although this monograph is faithful to the original as far as is possible, some changes have been necessary. In the first place the whole typescript was re-typed, and I am grateful for a small grant from the Society for Medieval Archaeology who paid for this task. Thereafter, English Heritage sponsored the editing, re-setting and final publication and, without their intervention, this project could not have been completed. The task of preparing the monograph for publication has been undertaken by Alejandra Gutiérrez. The main challenge has been to update as many of the bibliographical references as possible because, of course, most references in the original thesis refer to then unpublished reports which have since appeared as articles and monographs. The dating of the Winchester finds has also been updated here in those few cases where the published reports (Goodall 1990) offer a different date to that thought correct at the time of writing the thesis in 1980. A list of Ian Goodall's major publications on metalwork is also provided arranged by date. This new bibliography should be of tremendous value to all those researching medieval metalwork and in search of further bibliography and parallels.

Finally, there have also been changes to the format. Ian's original thesis comprised three volumes: text, catalogue and figures, which were arranged into chapters according to object type, covering all types of iron artefacts and tools except weapons, armour, arrowheads and spurs. For this publication, the three original volumes have been re-combined by theme, rather than keeping the catalogue as an appendix at the end of the text. This will allow the reader to check illustrated examples and read descriptions more comfortably within each chapter and theme rather than constantly shuffling pages. Some re-drawing of the finds has also been undertaken where the quality of the originals has faded. I would like to thank Norfolk Museums and Archaeology Service for their permission to use the drawing for D1 (Figure 5.1). I am grateful too to John Clark, formerly of the Museum of London, for adding the preface.

Christopher Gerrard
October 2010

PREFACE

Ian Goodall and the study of medieval ironwork

The name of Ian Goodall is surely known to anyone who has consulted archaeological reports on medieval sites in Britain published in the last 30 years or so. It will be even more familiar – even if they never met him or benefited from his advice – to those who have themselves faced the task of contributing the small finds section to such a report. For it is impracticable, or at least unwise, to write a report on excavated medieval iron artefacts without referring to at least one and probably several of the many such reports Ian himself wrote between 1970 and his early and unexpected death in 2006. I see, for example, that I and the other contributors to a volume on medieval horse equipment from London, published in 1995, listed in our joint bibliography some seventeen of his articles; the introduction to the second edition added another. Moreover, it may be revealed, Ian was the referee asked by English Heritage to assess the merits of that publication at typescript stage. His extensive and detailed comments were of immense value to the authors.

Most of Ian's published contributions to the subject were simply titled 'Iron objects', or a variation of that misleadingly simple designation; many ran to less than a dozen pages. But their small scale belies the wealth of knowledge and experience that lay behind the author's ability to identify and to diagnose the significance of sometimes heavily corroded and not immediately recognizable 'iron objects', and to set them in their historical context.

Ian Goodall was born in York in 1948, and in 1966 went to University College Cardiff to study archaeology. After graduation, he went on to begin the research that was to culminate in the award of a PhD for his thesis *Ironwork in Medieval Britain: an Archaeological Study*. However, Ian was still engaged on this work when in 1972 he returned to York to take up a post with the then Royal Commission on the Historical Monuments of England (later to be amalgamated with English Heritage). While contributing to major and productive research and publication projects on the buildings of York and of North Yorkshire for the Commission, he made time not only to travel extensively to study groups of medieval ironwork from excavations and in museum collections, but to begin the writing of the series of specialist reports on iron finds for which he remains so well known – the first to be published (I think) comprising the material from excavations carried out between 1970 and 1972 at Waltham Abbey, Essex.

I first met Ian when he came to London to look at ironwork in the medieval collections of the Guildhall Museum, later the Museum of London. We were agreed in our admiration of the work of John Ward Perkins, who had pioneered a new approach to the study of medieval artefacts in the *London Museum Medieval Catalogue*, published in 1940. We commiserated over the fact that the typologies and chronologies that Ward Perkins had proposed, useful though they were, were based upon so little in the way of well-dated material. Medieval ironwork in museum collections, although sometimes of high quality and individual interest, then comprised largely stray finds from building sites or from rivers, lacking any trustworthy external evidence for date or for context of use.

Major campaigns of excavation on large and productive medieval urban sites, such as those in Winchester, York and London, were to change that picture. But in the meantime there were many excavations of smaller sites, both urban and rural, which, although they individually might produce little medieval ironwork, could provide the dating and context information lacking in the old museum collections. Ian Goodall set himself the task of bringing that information together, of identifying and recording the similarities between find 1 from site A and find 2 from site B, and their relationship to find 3 from site C. Although his work on the iron artefacts from Martin Biddle's excavations in Winchester was a major contribution to the publication *Artefacts from Medieval Winchester: Object and Economy in Medieval Winchester* that appeared in 1990, the extraordinary range of artefacts from smaller sites was essential to the corpus of material that Ian assembled for his thesis. Although in many cases, alongside work on his thesis, he contributed a specialist report for the site publication, in other cases he incorporated in his thesis material from sites that remained unpublished, or published in not readily accessible form: the finds from Weoley Castle, Birmingham, perhaps, or the extraordinary 'hoard' of 13th-century sickles in Scarborough Museum from Ayton Castle, North Yorkshire.

By the time Ian submitted his thesis in September 1980 he had already built up an intensive knowledge of medieval iron finds from sites throughout Britain and an unparalleled expertise in their identification. In the Foreword to the thesis, Ian noted that 'Books, periodicals and unpublished objects have been examined to a terminal date of early 1980'. Some of the unpublished material was indeed to reach publication (in his Foreword Ian mentioned the Winchester material, publication then forthcoming), while he went on to study and publish other groups of iron finds himself, as his reputation spread and excavators recognized his expertise.

But his many individual publications, constrained as they were by the limits of a single site report and the specific requirements of 'relevance', allowed little scope for a discursive approach; finds must be interpreted in the context of the site, not in the wider context of similar objects from elsewhere. Larger publications of finds from multiple sites, such as the two volumes of the Winchester finds report, allowed more space for discussion – the presence of a large number of a particular type of artefact would warrant an introductory discussion, even the proposal of a typological and chronological classification, not feasible in the case of reports on individual sites where there might be only one or two examples. And there was always the need for reference to comparanda; sometimes a most valuable aspect of one of Ian's smaller reports is an extensive list of comparable material (with reference often to others of his own publications). Ian also contributed a short but valuable chapter on 'The medieval blacksmith and his products' to the CBA Research Report *Medieval Industry* in 1981, including within its brief compass illustrations of an extraordinary range of medieval iron objects, from blacksmith's tongs to currycombs – his own drawings, originally produced for his thesis.

It was always Ian's hope – a hope shared by anyone who was privileged to see and make use of a copy of his thesis – that it would one day be published. Sadly, this was not to be in his lifetime. Yet here it is at last.

Ian's original Foreword set out the scope of his work, limiting 'the medieval period' to *c*1066 to 1540, and excluding weaponry and spurs from his coverage. The contents list defines the overall approach: objects are dealt with under clear functional headings such as 'woodworking tools'. Introductory paragraphs set the particular tool, household object or fitting in its historical context. Ian often defines, with drawings, the terminology he uses for parts of an object – useful for any report writer wishing to describe an unfamiliar artefact, and uncertain perhaps of the difference between the 'butt' and the 'poll' of an axe. For many objects he establishes a typological classification based upon form, to which he then applies a chronology drawn from stratified examples. This was of course the time-honoured approach that had been adopted by John Ward Perkins in the *London Museum Medieval Catalogue*, though Ward Perkins lacked the strong foundation of stratified examples that Ian was able to call on to support his conclusions about dating. And indeed in some cases – keys, for example, and shears – one can make a direct comparison between the typologies established by the two authors; Ian sometimes provides a useful list of correlations between the two. No doubt if he himself were preparing this volume for the press he would have refined his typologies on the basis of more recent finds, perhaps refined his dating – but others may now do that.

Terminologies and typologies make this volume a resource for any finds specialist needing to describe iron artefacts; there is, in spite of the existence of some thesauri, still a great lack of agreed standards. But it is the catalogue and illustrations that define this work as essentially a corpus: a brief catalogue entry for each item, including a date or date range derived from its archaeological context, and in nearly every case an outline drawing. An archaeological corpus of this type is an old idea, but time and time again such bodies of material prove their usefulness. The search for parallels for a particular object, whether it is a site find or in a museum collection, can be a tedious one, often dependent upon happenstance even if the researcher has access to a library containing all the county and local journals and monographs in which so many relevant finds reports have appeared – note the extent and range of the Bibliography of the present work. With this volume as a tool, the finds specialist will find comparative examples to hand – even that 'unidentified object' may suddenly yield its identity as a result of a search through the pages of Ian's drawings.

Much has changed in medieval archaeology since Ian submitted his thesis in September 1980. Major finds have been made and published; research into such relevant subjects as metallurgy has advanced. Yet there is nothing else that brings together such a wealth of everyday ironwork from such a range of medieval sites, from towns, villages, castles, manors and farmsteads.
It is a tool ready to be used.

John Clark
Curator Emeritus, Museum of London
April 2010

SUMMARY

This monograph is a survey of iron tools and other fittings in use during the medieval period, defined here as *c*1066 to 1540 AD. It is designed to help identify, date and understand medieval iron objects from archaeological excavation. The major categories of finds covered are tools from metalworking, woodworking, stoneworking, plastering, textile manufacture, tanning and leatherworking and agriculture. There are also sections on knives, shears and scissors, building ironwork, locks and keys, household ironwork, buckles and dress accessories and horse equipment. Weapons, armour, arrowheads and spurs are excluded. Both text and drawings derive from a doctoral thesis completed in 1980.

RÉSUMÉ

Le présent livre est une étude d'objets et ustensiles en fer en usage durant la période du haut Moyen Age (*c*1066 to 1540 apr JC). Il a pour objectif d'aider l'indentification, la dation et la compréhension des objets en fer trouvés lors de fouilles archéologiques. Les principales catégories d'objets couvert sont les outils utilisés pour travailler le métal, le bois, la pierre, le travail du plâtre, la production de textile, le tannage et le travail du cuir en général ainsi que des outils utilisés pour les travaux agricoles. Il y a aussi des parties dédiées aux couteaux, cisailles et ciseaux, des objets utilisés dans le domaine du bâtiment, des serrures ainsi que des clefs, des ustensiles de cuisine, des boucles et autre accessoires vestimentaires ainsi que du matériel équestre. Les armes ainsi que les armures, les pointes de flèche et les éperons sont en revanche exclus de cette étude. Le texte comme les dessins et autres croquis proviennent tout deux d'une thèse de doctorat terminée en 1980.

RESUMEN

El presente libro es un estudio de los objetos y utensilios de hierro en uso durante la Edad Media (*c*1066 to 1540 dC). Tiene como fin el ayudar a identificar, fechar y comprender los objetos férreos procedentes de excavaciones arqueológicas. Las principales categorías de objetos que se consideran son las herramientas para trabajar el metal, la madera, la piedra, para enyesar, tejer, teñir, trabajar el cuero y aquéllas utilizadas en las tareas agrícolas. Hay además apartados sobre cuchillos, tijeras, cerraduras y llaves, objetos empleados en la construcción de edificios, aquéllos utilizados en la casa, hebillas, adornos para el vestido y elementos para el aderezo de la caballería. Se han excluído armas, puntas de fechas y estribos. Tanto el texto como los dibujos derivan de una tesis doctoral concluída en 1980.

ORIGINAL ACKNOWLEDGEMENTS (1980)

The work on which the thesis was based was undertaken with the aid of a Major State Studentship between 1969 and 1972, and continued during the author's appointment to the Royal Commission on Historical Monuments (England). Unpublished objects have been examined to a terminal date of early 1980.

Many people gave assistance during the preparation of the original thesis, and I should particularly like to thank Dr G C Dunning and J G Hurst for allowing me to examine their collections of books and offprints. J W G Musty, L Biek and the staff of the Ancient Monuments Laboratory, as well as the staff of the Drawing Office of the Inspectorate of Ancient Monuments, have been of considerable help. Many excavators kindly gave access to their unpublished material, which has been incorporated here and is appropriately acknowledged in the catalogue. The finds from medieval Winchester undoubtedly include the most significant unpublished objects. Museum collections have in general only been examined for objects from stratified contexts, and I should particularly like to thank B W Spencer and J Clark (formerly Museum of London), J M Lewis (National Museum of Wales, Cardiff) , D A Hinton (formerly Ashmolean Museum, Oxford) and Mrs R Taylor (Birmingham City Museum and Art Gallery) for their help.

The compilation of the original thesis on which this monograph is based was greatly assisted by the patient supervision and helpful advice of Dr W H Manning. Mrs E M Goodall typed the text and the reductions of the line drawings are by A D Perry. My wife, Alison, deserves my final and greatest thanks, however, for without her considerable assistance in reading the text and preparing the illustrations, the original thesis could never have been completed in time.

ABBREVIATIONS

The following abbreviations have been used in the catalogues:

L: length
W: width
H: height
D: diameter
DAMHB: Department of Ancient Monuments and Historic Buildings
Sf: small find.

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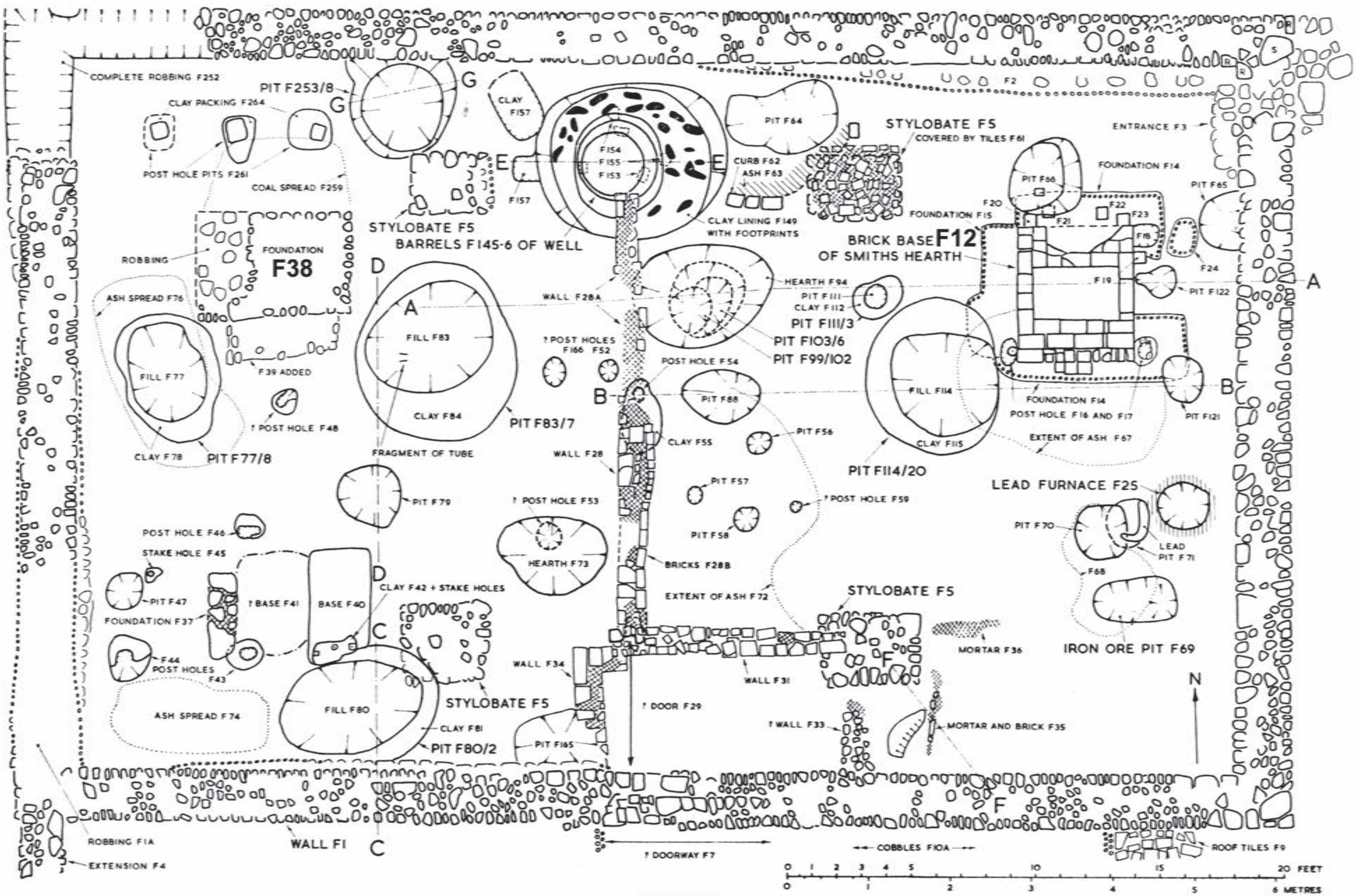

FIGURE 1.1
Forge at Waltham Abbey, Essex (after Huggins and Huggins 1973, fig 2)

1

IRON SMELTING AND SMITHING

Iron ore deposits are widespread in Britain, the main types being carbonate, haematite and limonite whose incidence is discussed by Tylecote (1962, 175–179). Quarrying with trenches as well as tunnelling is known from the Forest of Dean (Schubert 1957, 123, pls XIII–XIV) but widely occurring bell-pits are more frequent evidence of medieval deep mining of iron ore (Tylecote 1962, 284–285; Beresford and St Joseph 1979, 256, fig 107). Bell-pits near Sedgeley, West Midlands, had 1.5m diameter openings, a depth of 4.6m to 6.1m, and a maximum diameter of 3.6m.

Iron smelting and smithing produce many waste products, not all unique to a single stage, and interpretations drawn from them, particularly where they are found without structural association, should be based on scientific examination. The products of smelting include the raw bloom with its entrapped slag and attached cinders, furnace bottoms, slag and tap slag, whilst smithing of the raw bloom produces slag hammered out of the bloom and hammer scale formed on its outer surface. The final forging also produces hammer scale and fine, almost microscopic, drops of slag.

1.1 IRON SMELTING

Archaeological evidence for iron smelting is considerable and is discussed elsewhere (Tylecote 1962; 1976; Schubert 1957; Crossley 1981). A brief outline of the process is given here.

Iron ore was frequently roasted before smelting in a bloomery or blast furnace to make it more porous and more easily reduced. Medieval bloomery furnaces are of two basic types, the horizontally developed and the vertically developed bowl furnace, each with slag-tapping facilities. In use a charge of ore and charcoal was placed in the furnace and during smelting some of the lighter impurities were tapped off as slag until at the end cinders, slag and a bloom of iron were left at the bottom. The extracted bloom was consolidated on a string hearth by repeated hammering and with intermittent re-heating, the attached cinders being removed and the entrapped slag driven out to produce a bloom of wrought iron. This was then cut into pieces and if necessary rendered into bar iron for the blacksmith. Towards the close of the medieval period the blast furnace, which produced liquid iron in addition to slag, was developed. The first blast furnace definitely known to be in existence in Britain was at Newbridge, Sussex, in 1496 (Tylecote 1962, 301).

1.2 IRON SMITHING

Blacksmith's forges or smithies are known from a number of excavated sites, and include the 13th-century bloomery and adjacent smithy at Godmanchester in Cambridgeshire (Webster and Cherry 1975, 260, fig 96), where one room of a two-room building was used as a smithy and remains of four contemporary iron-smelting furnaces were found in a building to the rear. Medieval documents indicate that string hearths were sometimes attached to bloomeries (Salzman 1967, 31; Tylecote 1962, 287–289) and were sometimes separate (Schubert 1957, 126–127), and it is at present unclear whether this smithy housed a string hearth or was a conventional smithy.

At Waltham Abbey, Essex, a forge built about 1200 on the home farm of the Augustinian Abbey survived the Dissolution and stood, not necessarily in use, into the 17th century (Huggins and Huggins 1973). Iron ore and bloomery products indicate that the site, if not the building, was used for iron smelting. The forge (Figure 1.1), built as a three-bay aisled building 15.7m by 10.1m, was certainly used for making complete objects since bar iron, incomplete forgings and a series of tools (catalogued below) were found, as well as two smith's hearths surrounded by concentrations of hammer scale. One

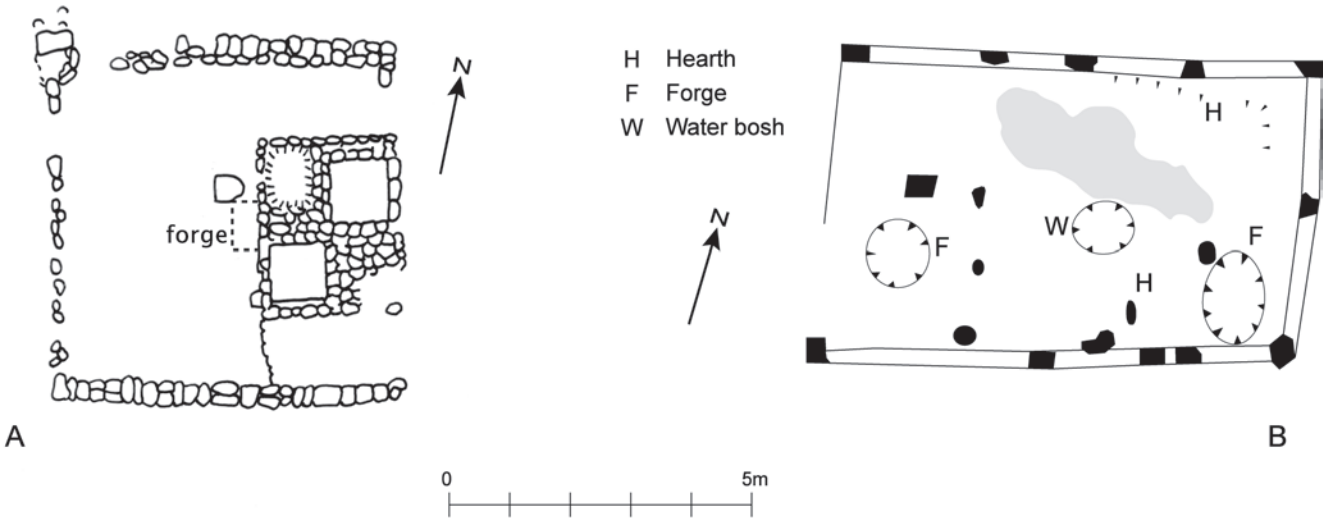

Figure 1.2
A: Smithy at Alsted, Surrey (after Ketteringham 1976, fig 19). B: Smithy at Goltho, Lincolnshire (after Beresford 1975, fig 22)

hearth (F12) consists of a rectangular brick base, 1.67m by 1.42m surviving five courses high and set on a wider foundation; the other hearth (F38) survives only as a flint and chalk foundation, 1.9m by 1.4m. Both have separate foundations which could have supported a water bosh. The more complete hearth is very similar to that in a smithy of *c*1395–1405 at Alsted, Surrey (Ketteringham 1976, 25–29, figs 19–21), where the 6.0m by 5.5m building (Figure 1.2A) had a rectangular stone hearth with fire-pit, working surface and space for bellows, as well as a large sandstone block immediately in front to support the anvil block. Hammer scale was found on the floor surrounding the stone and along the front of the hearth, and the site produced a number of tools which may be related either to the smithy or to earlier iron smelting.

The late 14th to early 15th-century smithy at Goltho, Linconshire (Beresford 1975, 46, figs 21–22), a timber building 8.0m by 5.0m (Figure 1.2B) surrounded by a yard surfaced with smithing slag, had two pits which produced smithing furnace bottoms (Tylecote 1975). The later pit, to the SE, was used until the time of desertion. A clay-lined pit in the floor may have been a water bosh or cooling water-basin, but no blacksmith's hearth similar to those at Waltham Abbey or Alsted was found. A small quantity of bar iron, and a few tools and other objects do, however, indicate the forging of objects.

Blacksmiths frequently also acted as farriers, and the late 14th to mid 15th-century smithy at Huish, Wiltshire, was evidently used by a farrier (Thompson 1972, 115, fig 1). The building, which was destroyed by fire, was 3.0m by 2.4m and had two hearths, in one of which were two horseshoes, a claw hammer, a poker and other indeterminate objects. The forge at Waltham Abbey produced evidence connected with farriery in the form of four horseshoes, two oxshoes and 160 horseshoe nails (Huggins and Huggins 1973).

The smithies already noted are mainly on monastic, manorial or village sites, but excavation in Southampton, Hampshire, located part of the floor of a late 12th or early 13th-century urban smithy floor (Platt and Coleman-Smith 1975, I, 238, 267, 349, pl 74).

The smithy must have been an important building during the construction and occupation of castles, and several have produced relevant finds. Iron slag, bar iron, tongs, a sledgehammer, chisel and axe from Deganwy Castle, Gwynedd, are probably from a smithy. They were found together at a depth of 61mm in an isolated hole in the bailey of Henry III's castle, begun 1245 and destroyed 1263, but could be of earlier date since the site had been in intermittent occupation for many centuries (Alcock 1967). Ironworking, probably initially including the smelting of ore, was the main activity in a workshop on the motte at Lismahon, Co. Down (Waterman 1959a, 152, 155–156) during the 13th and 14th centuries, and hammer scale and forging hearth slag were found with scrap iron and bronze on the site of a 14th-century workshop at Bramber Castle, West Sussex (Barton and Holden 1977, 38, 66–67). West of the gatehouse-keep sundry nails, horseshoes, etc, were found in a probable 14th-century context with very little slag and may imply a second smithing area (Barton and Holden 1977, 67; ex inf E W Holden).

Less certain evidence comes from Lyveden, Northamptonshire, where a roughly rectangular paved area 6.5m by 4.2m with areas of burnt clay and stone, charcoal, iron slag and coal has been interpreted as a probable smithy in use *c*1200–1350 (Steane and Bryant 1975, 4–9, 21–22, figs 7–8).

At Walsall, West Midlands, a 4.0m by 11.0m building of 13th or 14th century date may have served as a forge and later as a fuel store (Wrathmell and Wrathmell 1974–75, 27–29, 51, figs 2–4, pl II).

1.3 BAR IRON AND INCOMPLETE FORGINGS

The blacksmith's raw material, other than scrap iron collected for reuse, comprised pieces of iron cut from blooms and lengths of bar iron of varying size and cross section. Purchases of iron for use in medieval building-work are often mentioned in accounts (Salzman 1967, 286–288), and the iron was both native and foreign, the former including specifically named Weardale, Gloucester and Wealden iron, and the latter particularly Spanish iron. The iron is often priced and bought by the stone or hundredweight, or in sizes called gad, seam and hes. It was sometimes just held in store, but was also bought for particular use, such as Spanish iron for window bars bought at Corfe in 1292, or for hooks and bands at Dover in 1363. Steel, often from Sweden, was also bought for tool and knife edges (Salzman 1967, 288).

A shaped, rectangular sectioned bar from Winchester (**A1**) proved on examination to be a dense, well-worked piece of wrought iron with few slag inclusions. A bar fragment (**A2**) from Deganwy Castle found with other blacksmith's equipment and iron slag, has a chisel-cut end, indicating that it is part of a once larger piece. The shape of the chisel-cut shows the characteristic way the blacksmith cut metal, since it was important not to cut entirely through the iron and dull the edge of the chisel on the hard face of the anvil. In practice the smith reduced the force of the hammer blows on the chisel just before the cut was complete, and then often broke it by hand.

Two pieces of iron (**A3**–**A4**) are known from a site with ironworking evidence at Newbury, Berkshire, but over 100 pieces of sheet iron, bar iron of square, rectangular and round section, and lengths of iron wire come from the forge at Waltham Abbey. **A5**–**A10** are a representative selection, whilst **A11**–**A15** are shaped pieces, some perhaps scrap iron or partly forged objects. Definitely identified incompletely forged objects from the site, catalogued below, include those of six auger bits and a key, but it is impossible to be certain whether other objects such as a padlock bolt head and lock wards belong to incomplete objects, are scrap, or were in actual use. Other incomplete forgings include keys from Gloucester and Goltho, the latter from the croft with the late 14th to early 15th century smithy which produced a little bar iron (**A16**). Chingley and Tattershall College produced knife moods, and **A17**, a shaped, partly forged piece of iron comes from Lyveden.

A1 BAR
Winchester, Hampshire.
Late 11th to early 12th century.
Rectangular section bar shown by metallurgical examination to be dense, well-worked wrought iron with few slag inclusions. Weight 1.28kg (2.81 lb). L 280mm.
Biddle 1990, fig 38, no. 37.

A2 BAR
Deganwy Castle, Gwynedd.
Unstratified in bailey of castle of 1245–63, on site with earlier occupation. Found with blacksmith's equipment and iron slag.
Rectangular section bar, chisel-cut across one end. L 108mm.
Excavated by W Greenhalgh. For site see Alcock 1967.

A3 BAR IRON?
Newbury, Berkshire.
12th to 13th century.
Rectangular section bar. L 31mm
Ford 1979, 25, fig 3.2.

A4 BAR IRON
Newbury, Berkshire.
Unstratified. ?13th century.
Rectangular section piece of iron. Weight 1.1kg (2 lb 9 oz). L 113mm.
Ford 1979, 25, fig 3.3.

A5 BAR IRON
Waltham Abbey, Essex.
16th/17th century destruction debris plus derived pottery from forge built *c*1200.
Rectangular section bar, one end probably chisel cut. L 104mm.
Goodall 1973a, 170, fig 11.1.

A6 BAR IRON
Waltham Abbey, Essex.
13th and 16th century.
Rectangular section bar. L 133mm.
Goodall 1973a, 170, fig 11.2.

A7 BAR IRON
Waltham Abbey, Essex.
12th/13th century.
Rectangular section bar. L 70mm.
Goodall 1973a, 170, fig 11.3.

A8 BAR IRON
Waltham Abbey, Essex.
15th/16th century.
Square section bar fragment. L 161mm.
Goodall 1973a, 170, fig 11.4.

A9 ROD
Waltham Abbey, Essex.
16th century.
Rod fragment, circular section. L 127mm.
Goodall 1973a, 170, fig 11.5.

A10 WIRE
Waltham Abbey, Essex.
15th/16th century.
Wire fragment, 3mm diameter. L 123mm.
Goodall 1973a, 170, fig 11.6.

A11 BAR IRON
Waltham Abbey, Essex.
16th century.
Octagonal section bar fragment. L 94mm.
Goodall 1973a, 170, fig 11.7.

A12 BAR IRON
Waltham Abbey, Essex.
16th/17th century destruction debris plus derived pottery from forge built *c*1200.
Tapered bar fragment, rectangular section. L 71mm.
Goodall 1973a, 170, fig 11.8.

A13 BAR IRON
Waltham Abbey, Essex.
Possibly 13th century.
Tapered bar fragment, rectangular section. L 62mm.
Goodall 1973a, 170, fig 11.9.

A14 BAR IRON
Waltham Abbey, Essex.
16th/17th century destruction debris plus derived pottery from forge built *c*1200.
Curved, rectangular section bar thickened at one end. L 210mm.
Goodall 1973a, 170, fig 11.10.

A15 BAR IRON
Waltham Abbey, Essex.
12th/13th century.
Bar fragment, chamfered sides. L 58mm.
Goodall 1973a, 26, fig 11.11.

A16 BAR IRON (not illustrated)
Goltho, Linconshire.
Late 14th to early 15th century.
A few pieces of generally rectangular section iron, found near smithy and representing metal used in it.
Goodall 1975a, 87.

A17 INCOMPLETE FORGING
Lyveden, Northamptonshire.
Second quarter 13th century.
Shaped piece of rectangular section bar. L 78mm.
Bryant and Steane 1971, 55, fig 13f.

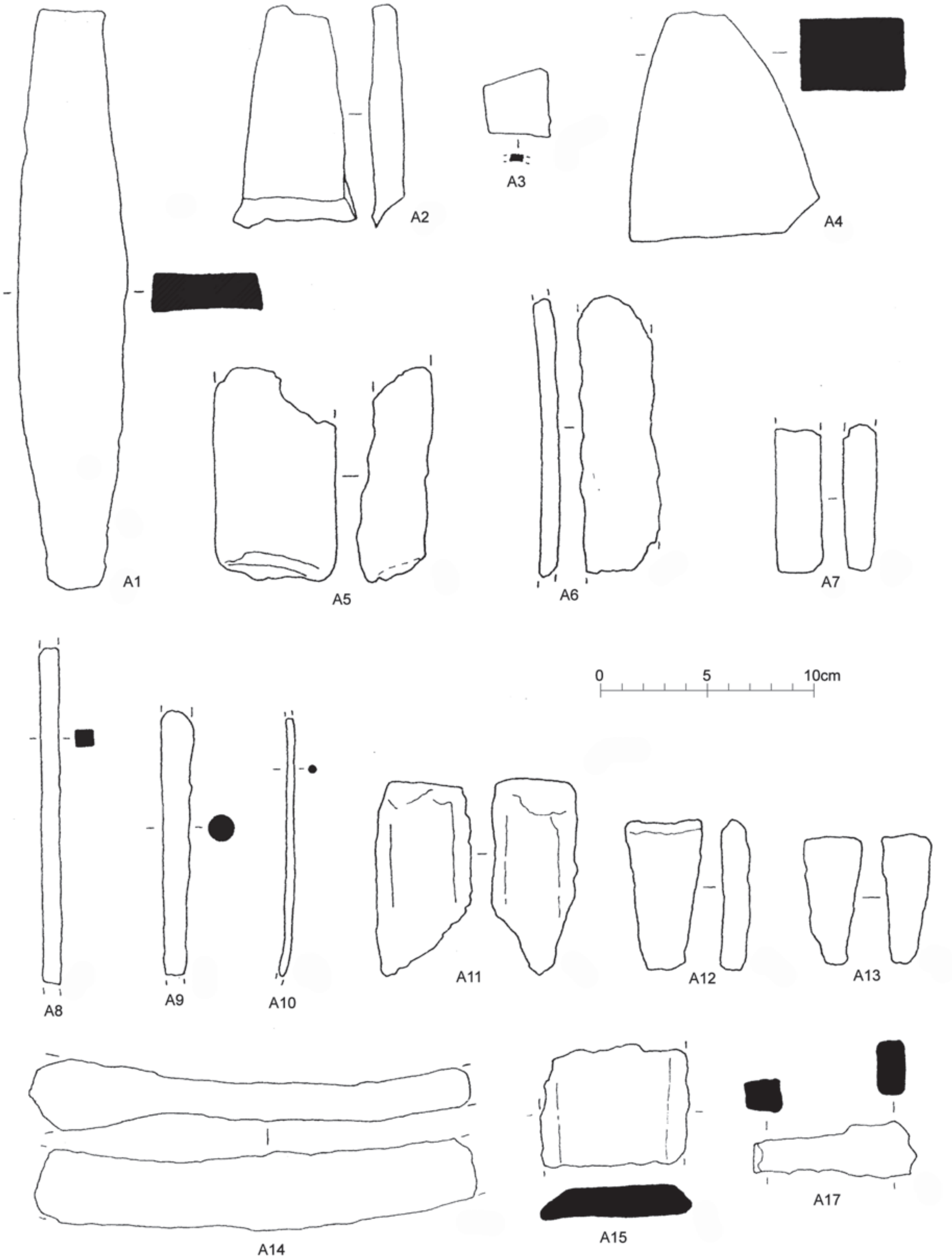

FIGURE 1.3
Iron smelting and smithing: Bar iron and partly forged objects

2

METALWORKING TOOLS

The blacksmith probably required the widest range of tools of the medieval craftsmen in metal, and this is reflected in the surviving tools which include tongs, pincers, hammers, chisels and punches. The following account draws much of its practical information about smithcraft and tools from COSIRA 1955 and Smith 1966.

2.1 ANVILS

Representations of blacksmiths are not infrequent in medieval illuminated manuscripts, where they sometimes appear symbolically as St Eloi and sometimes as craftsmen at work in a forge. No anvils have yet been found, but illuminations indicate that they were set into the flat tops of wooden blocks which served both to raise them to the required height and to absorb some of the shock of the impact of hammer on anvil. Accounts for Dover Castle (Salzman 1967, 347) record that an anvil was bought in 1265 as well as 'a wooden block on which to put an anvil in the smithy'. The anvil was placed close to the smith's hearth for practical purposes, and a stone base surrounded by hammer scale in front of the hearth in the forge at Alsted, Surrey, (Ketteringham 1976, 25, 28, figs 20–21) probably supported such a block.

Anvils were of several types, but they are frequently depicted as simple blocks of iron, as in the 11th-century Caedmon manuscript (Figure 2.1A) or the Holkham Bible of *c*1325–30 (Figure 2.1B; and see cover illustration). Other illustrations (Figures 2.1C–D) clearly show beaked anvils with one or two conical end projections for shaping forgings, and an inventory of smith's tools at Rochester in 1363 (Salzman 1967, 347) includes both an 'anuell' and a 'bicorne', the latter evidently an anvil with two horns or cones.

2.2 TONGS

Tongs were used by craftsmen in non-ferrous metals for moving and pouring crucibles, and the down-turned jaws of **A18** are ideally shaped for gripping the rim of a small crucible.

Tongs are one of the blacksmith's basic tools, used to hold the work at all stages of forging, and the range in size and shape reflects the differing uses. Any one smith might have several pairs of tongs, and an inventory of smith's tools at Rochester in 1363 (Salzman 1967, 347) includes '8 tonges' and a 'spentonge' or gripping tongs.

Medieval tongs **A19–25** have hinged jaws with gripping faces held by rivets, which, when complete,

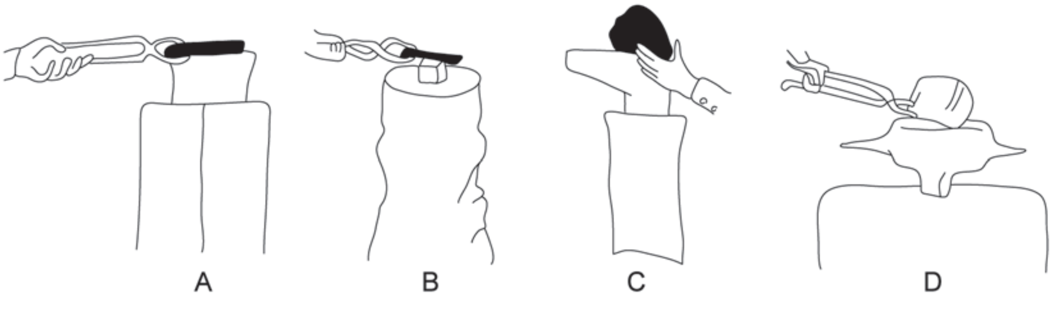

FIGURE 2.1
Anvils: representation in medieval manuscripts. A: English, 11th century. B: English, c1325–30. C: Franco-Flemish, c1340. D: English, c1250 (A: Wilson 1976, 264, pl XIII. B: See cover; C–D: Harvey 1975a, pls 120–121)

often have domed heads. The straight handles, called reins by modern smiths, are almost parallel when the tongs are in use, enabling the smith to grip and manoeuvre them conveniently. Most handles are now incomplete, but the one complete handle of **A23**, and both of **A24**, have knobbed terminals whose purpose was to prevent a loop slipped over the ends from sliding off. The loop saved the blacksmith effort when undertaking a sustained or repetitive job, since it held the handles in tension and allowed the tongs to be put down without the forging dropping from the jaws. The flattened ends of **A19** may have acted similarly, the loop being slipped over them whilst they were held together, and being prevented from sliding off by their springing apart when released.

The jaws vary in form, those of the larger pairs of tongs **A19–21** being broad and straight or gently curved with flat gripping faces suitable for holding heavy pieces of iron. The long handles, only complete on **A19**, will have enabled them to be used in forging at great heat. Smaller tongs were used when a firmer grip was required and when the iron did not require strong heat for forging, as well as for delicate, small work. The jaws of **A22–24** are either straight or gently curved, and all have flat faces; those of **A22–23** taper towards the tip and are not unlike armourers' hammers. The small pair of tongs **A25** are most appropriate for small-scale work.

2.3 PINCERS

The blacksmith frequently acted as a farrier shoeing horses, as finds from the smithies at Huish, Wiltshire, and Waltham Abbey, Essex, demonstrate. At Huish (Thompson 1972, 115) one of the hearths contained two horseshoes, a claw hammer and a poker, whilst at Waltham Abbey four horseshoes, two oxshoes and 160 horseshoe nails were recovered (Huggins and Huggins 1973).

Tongs were used during the forging of horseshoes and nails, but the shoe was removed from the hoof with pincers with curved jaws and a broad, sharp gripping edge capable of gripping a nail and levering it out. Pincers **A26** have such jaws as well as shaped handles identical to a pair held by St Eloi, patron saint of blacksmiths, as depicted in the 14th-century Luttrell Psalter (Millar 1932, 27–28, f 52, reproduced in Webber 1971, 25). The hooked end may have held a loop which closed over the knobbed end of the opposing handle. **A27**, which are slightly larger, have straight handles. Carpenters as well as blacksmiths used pincers, and these examples could have been used by either craftsman.

2.4 HAMMERS

An inventory of blacksmith's tools at Rochester in 1363 (Salzman 1967, 347) includes four sledgehammers, two large hammers and four small hammers. The sledgehammer was used during the dividing and working of blooms of iron into bars, in heavier forging such as drawing down and cutting bar iron, and for striking top anvil tools such as set hammers. The other hammers were used during later stages of forging.

Sledgehammers can be divided by use into the heavier swing sledge (today 3.63–9.07kg, 8–20 lb) set on a long handle and swung with two hands, and the lighter hand sledge (2.72–3.63kg, 6–8 lb) set on a shorter handle and swung from shoulder height. During the initial forging, as a 14th-century illuminated manuscript depicts exactly (Figure 2.2), the swing sledge was wielded by the striker, who was the smith's apprentice or labourer, while the

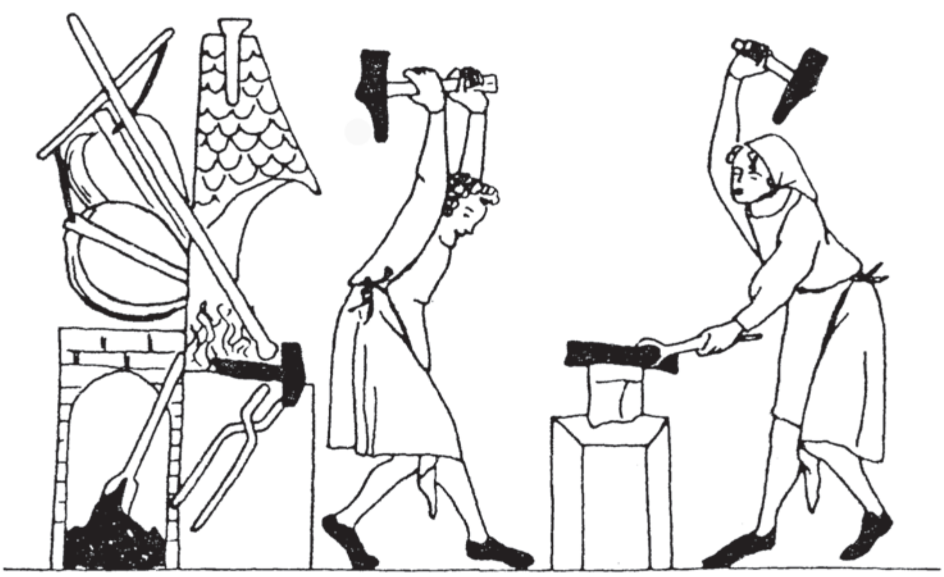

FIGURE 2.2
Blacksmiths in a forge, Franco-Flemish 14th-century manuscript (Harvey 1975a, pl 119)

smith held a hand sledge and gripped the hot iron on the anvil with tongs.

Medieval sledgehammers are of two types: **A28** a double-faced sledge, **A29–31** cross-pane sledges. **A28**, found with other items of blacksmith's equipment and iron slag, has an octagonal-sectioned head and gently rounded faces designed to spread the force of the blow without cutting the iron. The cross-pane sledges **A29–31**, with their panes set at right angles to the handles, were used to draw down the iron. **A29–30** have heads with flat undersides and cheeks which rise either side of the eye, probably to ensure more secure hafting, whilst **A31** has instead an expansion around the eye and a more centrally set cross-pane arm. Wooden handles must often have been secured in the eye by wedges or nails, either from the start or after they worked loose, and a nail survives in **A31**.

Hand hammers used for general work at the anvil are of two types: with a face and either a cross-pane or straight pane. The cross-pane is set at right angles to the handle, the straight pane in the same plane. The face of either might be used for striking tools such as punches and chisels, but the pane was used to concentrate blows on a small area during forging and spread the iron crosswise or lengthways. **A32–34** are all cross-pane hammers with flat undersides, **A32–33** having cheeks which rise either side of the eye, **A34** an expansion around the eye. The fiddle-key horseshoe nail used to secure the haft in the eye of **A32** perhaps implies that it was used by a farrier. **A35** is the down-turned pane from a cross-pane hammer. No straight-pane hammer is yet known, but the type is present on both pre- and post-medieval sites, and will have been used by the medieval blacksmiths.

The blacksmith is unlikely to have had sole use of these hammers since the sledgehammer was also used by the stonemason and the hand hammer by the carpenter, the cross-pane starting nails, the head driving them in. Claw hammers, although used by farriers shoeing horses, are discussed below under woodworking tools (Chapter 3).

Bronzesmiths and craftsmen in other fine metals must at times have used hammers similar to the lighter blacksmiths' hammers, but some of the more delicate work might have required a hammer such as **A36** with its two differing arms.

2.5 FLATTERS AND SET HAMMERS

Flatters and set hammers, smoothing tools whose function is to smooth out flaws and crude forgings, are placed on the iron and struck with a sledge or a heavy hand hammer. Modern set hammers are generally uniform in size from top to bottom, whilst the bottom of flatters spreads outwards. They may have flat or convex faces with sharp or rounded edges, according to the purpose for which they are required. The set hammer **A37** is burred by striking and has an oval convex face and rectangular eye for hafting.

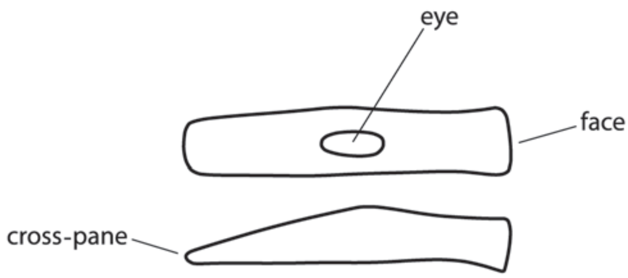

FIGURE 2.3
Hammers: terminology

2.6 CHISELS AND SETS

Chisels and sets are principally blacksmiths' tools for cutting iron, the chisel struck with a hand hammer and generally hand held, the set struck with a sledgehammer and either hafted or rodded. Cold and hot chisels and sets cut cold and hot iron respectively, although certain differentiation between them is not always possible and is unlikely to have applied in practice. Modern chisels for cutting cold iron are made from steel containing about 0.875 per cent carbon, those for cutting hot iron of steel containing 0.75 per cent carbon, the difference being accounted for by the softness of hot iron which can be cut by a correspondingly softer metal. An awareness of the property of steel is demonstrated by chisels **A50–51**, both of which have been shown to have steeled tips and wrought iron bodies. **A43** is completely wrought iron, although it may have been intended to weld on a steel edge.

The blacksmith did not have sole call on these tools, and some of the smaller chisels may have been used by craftsmen in other metals, particularly by bronze-founders for trimming risers and flashes off castings. Cold chisels are also used by masons, but on the whole their chisels tend to be longer and stouter than the smiths' and have flaring blades.

Cold chisels

The cold chisel is today short and thick, often just long enough to be held in a clenched hand and having a relatively sharp edge to enable it to cut cold metal. **A38–42** are all incomplete, **A38** and **A40** having burred heads but lacking cutting edges, and the remainder vice versa.

Hot chisels

Hot chisels, unless held with a wire loop, must be long enough to keep the hand away from the heat of the job and slender enough to be driven into the soft, hot metal. The blade may be sharp or slightly rounded in section.

A43–51 vary considerably in size, a variation which reflects both the range of bar iron to be cut and objects to be forged. Most of the hot chisels are complete and retain expanded and sometimes burred heads, and metallurgical examination has shown **A50**–**51** to have steeled blade edges and wrought iron stems. **A43**, which is of wrought iron without a steel edge, may be a hot chisel at an intermediate stage of forging. Precision was needed when forging items such as locks and purse frames, and some of the smaller chisels may have been used in their manufacture.

Cold sets

Cold sets resemble cold chisels but are stouter. **A52–54**, all from the forge at Waltham Abbey, Essex, are variously incomplete, **A53** having a burred head and, like the others, no indication of an eye for a haft. All may have been rodded, namely held by an iron rod wrapped round the body a couple of times with enough left over to form a handle. Cold sets are today sometimes hafted, but the defect of the haft lies in its rigidity which, although giving better control, can severely jar the holder's arm or break when the tool is struck by a sledgehammer.

Hot sets

Hot sets, the equivalent of a hot chisel but with a face for striking and an axe-like blade, are capable of more precise work than cold sets and are now usually hafted. The hot set from the smithy floor at Goltho, Lincolnshire, **A55**, has a burred face and the asymmetrical blade shape suggests that it may be a reused axe blade fragment.

2.7 PUNCHES AND DRIFTS

Punches are used to make holes in hot iron and drifts to enlarge, open out or smooth the hole. Certain identification of punches and drifts is impossible, since a headless stout punch may resemble a slender drift. Punches are also used in woodworking to sink nail heads, and these cannot easily be distinguished from blacksmiths' punches and drifts.

Punches

Punches used by the blacksmith to make holes in hot iron can be round, rectangular or any other required shape, and unless rodded or hafted must be long enough to keep the hand away from the forging.

The majority of surviving punches, where sufficiently complete, have heads burred by hammering and stems tapering either to a flattened tip or to a point. **A56–69** are all of rectangular section with flattened tips while **A60–65** taper to points and are of rectangular or square section. **A61–62** are unusual in having a circular section to the upper, hand-held part of their stems. **A66–67** also taper to points but are of octagonal and circular section respectively. **A68** is also octagonal but lacks any taper to its rounded, flat tip, whilst **A69** resembles it but is incomplete.

Punches **A56–69** could have been hand-held, but **A70–73** must have been held by iron rods looped round their thickened stems. All have burred heads and none of their stems has any indication of an eye for a haft.

Particular jobs often required their own tool, and punches **A74–75** may both have punched nail-holes in horseshoes. Horseshoes contemporary with them all had countersunk nail-holes, that is nail-holes set within a rectangular recess, and they may have punched the actual hole through the countersinking, itself produced by a tool such as **A57**. **A74–75** may also, however, have been used to make holes in strap hinges and similar objects.

Drifts

Drifts are normally shorter and stouter than the punches used to make the holes that they are smoothing or enlarging, and they characteristically have a short taper to the head and a longer one to the tip, a shaping which allowed them to be driven right through the hole. **A76–85** are of square, rectangular and circular section at the tip, and vary considerably in size. The larger drifts **A76–77** may have been used on such objects as hammer heads and picks.

2.8 FULLERS

Fullers are used by the blacksmith for making shoulders before drawing down, and for drawing iron in a particular direction. Small hand-held fullers resemble chisels and sets but have rounded noses; larger fullers are rodded. **A86** may be a fuller, which would today be used in conjunction with a bottom fuller set in the anvil.

2.9 MANDRELS

Two Shene inventories, for 1444 and 1473, mention mandrels (Salzman 1967, 348). The earlier records '5 mandrels, 6 iron bolsters specially made for 6 mandrels, ... 4 mandrels for hinges', and the later 'a round iron mandrel, 4 square iron mandrels for making hinges'.

Modern floor mandrels take the form of cones which can stand up to 1.37m (4½ ft) high and are used for forming hub bands, rings, hoops, etc. Hand mandrels are essentially small bars of iron, sometimes tapering and of round or rectangular section, which in use either rested on the face or edge of the anvil and were used for forging small rings and collars and for bending iron. The size and shape of the hand mandrel is determined by that of the object being forged, and the circular section mandrels may substitute for or complement the beak of an anvil. **A87–90** are possible hand mandrels, two with whittle tangs for insertion in a handle, two with riveted tangs. **A87–88** have tapering, circular-sectioned arms, suitable, amongst other objects, for forging small circular hose and shoe buckles. **A89–90** have straight, rectangular-sectioned arms. It must be emphasized that the identification of **A87–90** as mandrels is not certain.

2.10 NAIL-HEADING TOOL

The bolsters mentioned in connection with the mandrels in the Shene inventory were iron plates with holes in them which were placed under the iron being punched. **A91** is probably too slight to be a bolster, but it may be a nail-heading tool equivalent to the '3 nailtol' of the 1363 Rochester inventory or '2 iron naile tooles' of the 1473 Shene inventory (Salzman 1967, 347–348). In use the tapered shank of the nail was dropped into the appropriate hole in the tool, with the smaller opening uppermost, and the head formed by hammering.

2.11 FILES

Metalworkers, farriers and carpenters all used files, but the difference between them lies in the form of the teeth, the woodworkers' file having coarser teeth than the metalworkers' to prevent it becoming clogged with dust. The file was an important finishing tool for the metalworker, who used it to remove rough edges, smooth out casting marks and give the final shaping to an object. It was especially useful for the delicate work of such craftsmen as the locksmith, but it must have been universally used, farriers employing it for example to sharpen their knives and smooth newly forged horseshoes. Such a variety of tasks will have required files of varying size and cross section, as modern examples testify, but few medieval examples survive. **A92** is flat with diagonally cut teeth.

2.12 FIRE TOOLS

The medieval smithies at Waltham Abbey and Goltho both produced coal used to fuel the blacksmith's hearth, but neither produced the poker, rake or shovel used to manage it.

Pokers are used to loosen the fire and stir the fuel, letting out gases and allowing the bellows to operate more efficiently. Modern pokers take the form of a long iron rod, tapering to the tip from a simple loop handle but **A93**, from one of the two hearths in the smithy at Huish, has a socket evidently for a wooden handle.

Modern rakes with L-shaped ends and loop handles may double as pokers, but more characteristically they have a split end and down-turned arms. They are used to loosen the fuel, gather it together and separate out clinker. No medieval example is known.

Some of the medieval spades and shovels with iron-shod blades (**F6–17**) may have been used by blacksmiths to replenish fuel or remove ashes, since they resemble one shown in a 14th-century illumination (Figure 2.2) resting against the opening of a coal store serving a blacksmith's hearth. Shovels with entirely iron blades will have been more appropriate for some uses, but they are infrequent medieval finds. **F18** was probably used to fuel a glass kiln.

A18 TONGS
South Witham, Lincolnshire.
1137–85 to *c*1220.
Incomplete arm from small pair of tongs with down-turned jaws. L 64mm.
Goodall 2002, 100, fig 7.3, no. 28.

A19 TONGS
Criccieth Castle, Gwynedd.
Site *c*1230–1404.
Tongs with flat, straight jaws and long handles with flattened ends. L 269mm.
O'Neil 1944–45, 42. National Museum of Wales, Cardiff 41.246.1.

A20 TONGS
Deganwy Castle, Gwynedd.
Unstratified in bailey of castle of 1245–63, on site with earlier occupation. Found with blacksmith's equipment and iron slag.
Gently curved jaws, handles broken. L 251mm.
Excavated by W Greenhalgh. For site see Alcock 1967.

A21 TONGS
Gloucester, Gloucestershire.
Late 12th/13th century.
Narrow, straight jaws, handles broken. L 212mm.
Excavated by H Hurst.

A22 TONGS
Weoley Castle, West Midlands.
Around 1270–1600.
Tapering, straight jaws, broken handles. L 240mm.
Taylor 1974. For site see Oswald 1962. Birmingham City Museum, WC366.

A23 TONGS
Old Sarum, Wiltshire.
Principally medieval, to 14th century.
Gently curved jaws, knobbed end to one handle, other broken. L 198mm.
Salisbury and South Wiltshire Museum, O.S.D2.

A24 TONGS
Netherton, Hampshire.
Mid 14th century.
Gently curved jaws, handles with knobbed ends. L 146mm.
Goodall 1990-27.

A25 TONGS
Winchester, Hampshire.
12th, ?13th century.
Both arms broken. L 78mm.
Goodall 1990-3, fig 41, no. 40.

A26 PINCERS
Denny Abbey, Cambridgeshire.
On floor of period 1169–1308, ? in use to 1539.
Pincers with broad jaws. Longer handle, has knobbed terminal, other hooked and broken. L 254mm.
Goodall *et al* 1980, no. 9.

A27 PINCERS
Norwich, Norfolk.
In 1507 fire deposit.
Pincers with broad, curved jaws and plain straight handles.
L 290mm.
Carter *et al* 1974–47, 47, pl 1.4.

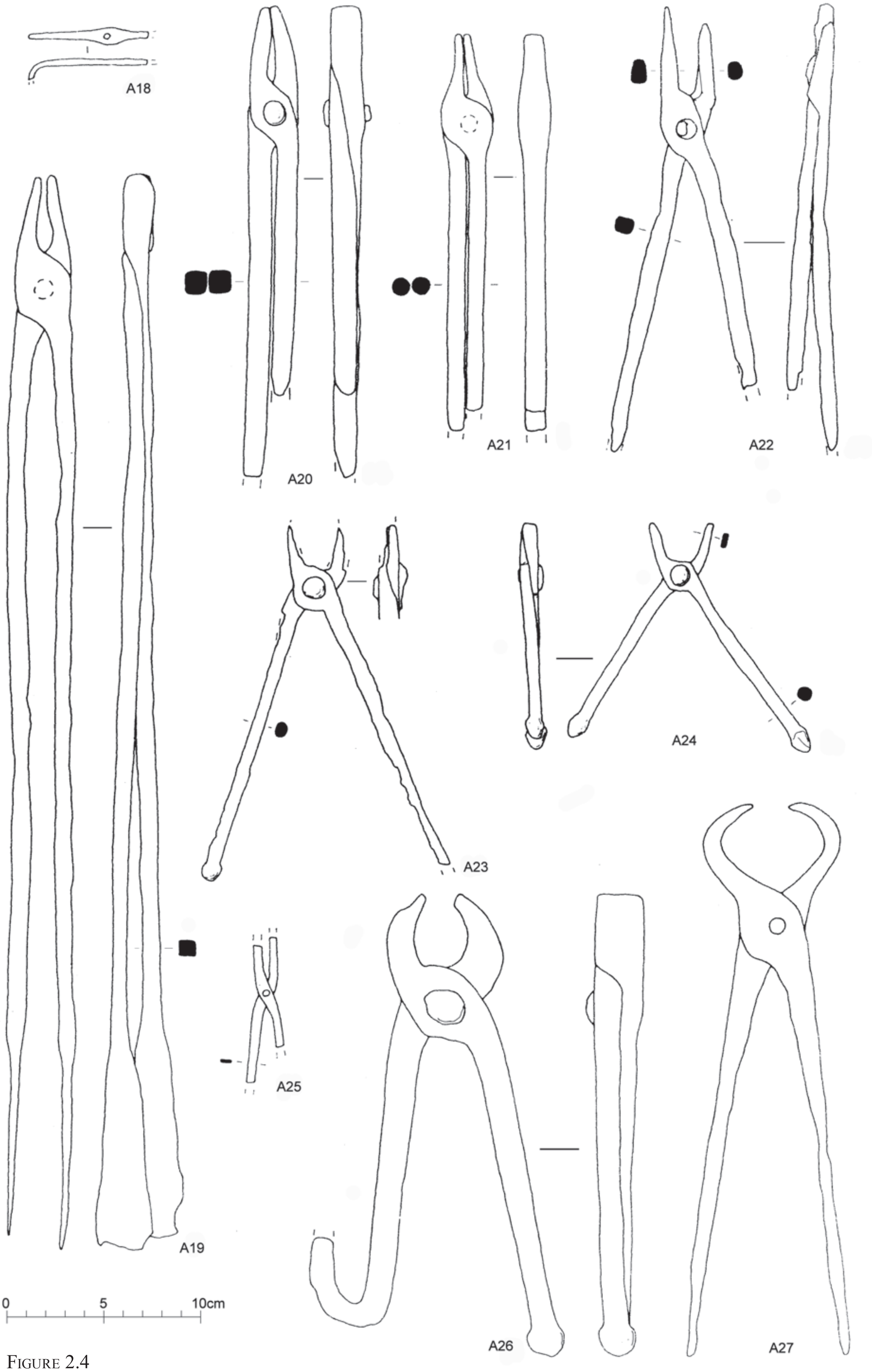

FIGURE 2.4
Metalworking tools: Tongs and pincers

A28 SLEDGEHAMMER
Deganwy Castle, Gwynedd.
Unstratified in bailey of castle of 1245–63, on site with earlier occupation. Found with blacksmith's equipment and iron slag.
Double-faced hammer of octagonal section, expanded around the rectangular eye.
L 157mm.
Excavated by W Greenhalgh. For site see Alcock 1967.

A29 SLEDGEHAMMER
Thetford, Norfolk.
11th century.
Cross-pane hammer of rectangular section with flat underside.
Cheek rises beside eye. L 121mm.
Goodall 1984.

A30 SLEDGEHAMMER
Castell-y-Bere, Gwynedd.
Site *c*1221–95.
Cross-pane hammer of rectangular section with flat underside. Cheek rises beside eye.
L 221mm.
Butler 1974, 97, fig 9.15.

A31 SLEDGEHAMMER
Weoley Castle, West Midlands.
Around 1270–*c*1380.
Cross-pane hammer with rounded face and expansion round eye which retains part of wooden handle and securing nail. L 175mm.
Taylor 1974. For site see Oswald 1962.
Birmingham City Museum, WC361A.

A32 HAMMER
Old Sarum, Wiltshire.
Second half of the 11th century.
Cross-pane hammer of rounded section towards face, rectangular to pane.
Fiddle-key horseshoe nail in eye. Cheek rises beside eye, flat underside. L 85mm.
Stone and Charlton 1935, 184, fig 3.1.

A33 HAMMER
Wintringham, Cambridgeshire.
Early 14th century.
Cross-pane hammer of octagonal section towards face, rectangular to pane.
Cheek rises beside eye, flat underside.
L 104mm.
Goodall 1977a, 257, fig 46.62.

A34 HAMMER
West Hartburn, Durham.
Site 13th to 16th century.
Cross-pane hammer, pane broken.
Expansion around square eye. L 105mm.
For site see Still and Pallister 1964; 1967.

A35 HAMMER
Winchester, Hampshire.
13th century.
Down-turned pane from cross-pane hammer. L 30mm.
Goodall 1990-8, fig 60, no. 401.

A36 HAMMER
Ellington, Cambridgeshire.
Second half 12th to second half 13th century.
Slender hammer of rectangular section with slight expansion around eye.
One long pointed arm, other short and blunt.
L 48mm.
Goodall 1971, 68, fig 12.19

A37 SET HAMMER
Ospringe, Kent.
Around 1483–1550.
Burred head, rectangular eye for haft, oval convex face. L 111mm.
Goodall 1979c, 129, fig 130.1

A38 COLD CHISEL
Waltham Abbey, Essex.
Lowest silt in well dug *c*1300, filled in late 15th or early 16th century.
Burred head, broken rectangular-sectioned stem. L 204mm.
Goodall 1973, 170, fig 11.16.

A39 COLD CHISEL
Waltham Abbey, Essex.
16th century.
Broken rectangular-sectioned stem. L 201mm.
Goodall 1973a, 170, fig 11.17.

A40 COLD CHISEL
Deganwy Castle, Gwynedd.
Unstratified in bailey of castle of 1245–63, on site with earlier occupation. Found with blacksmith's equipment and iron slag.
Burred head, broken rounded rectangular stem. L 55mm.
Excavated by W Greenhalgh. For site see Alcock 1967.

A41 COLD CHISEL
Theodoric's Hermitage, West Glamorgan.
Site 13th–15th century.
Broken stem with blade. L 86mm.
National Museum of Wales, Cardiff, 49.140.23.

A42 COLD CHISEL
Theodoric's Hermitage, West Glamorgan.
Site 13th–15th century.
Broken stem with blade. L 103mm.
National Museum of Wales, Cardiff, 49.140.23.

A43 HOT CHISEL
Winchester, Hampshire.
Mid to late ?13th century.
Enlarged head, waisted rectangular-sectioned stem. Broadening to blade.
Blade found to consist of ferrite and slag.
L 176mm.
Goodall 1990-3, fig 41, no. 41.

A44 HOT CHISEL
Stonar, Kent.
Around 1275–1330.
Expanded head, rectangular-sectioned stem.
L 166mm.
Excavated by N Macpherson-Grant.

A45 HOT CHISEL
Thetford, Norfolk.
?11th century.
Expanded head, rectangular-sectioned stem.
L 104mm.
Goodall 1984.

A46 HOT CHISEL
Northampton.
Later 15th century.
Burred head, rectangular-sectioned stem.
L 82mm.
Goodall *et al* 1979, 273, fig 119.63.

A47 HOT CHISEL
Goltho, Lincolnshire.
Unstratified on croft occupied from late Saxon period to late 14th or early 15th century.
Burred head, octagonal-sectioned stem.
L 80mm.
Goodall 1975a, 87, fig 41.89.

A48 HOT CHISEL
South Cadbury, Somerset.
11th–12th century.
Burred head, rectangular-sectioned stem.
L 72mm.
Alcock 1995.

A49 HOT CHISEL
Southampton, Hampshire.
11th–12th century.
Burred head, rectangular-sectioned stem.
L 73mm.
Harvey 1975b, 276, fig 250.1971.

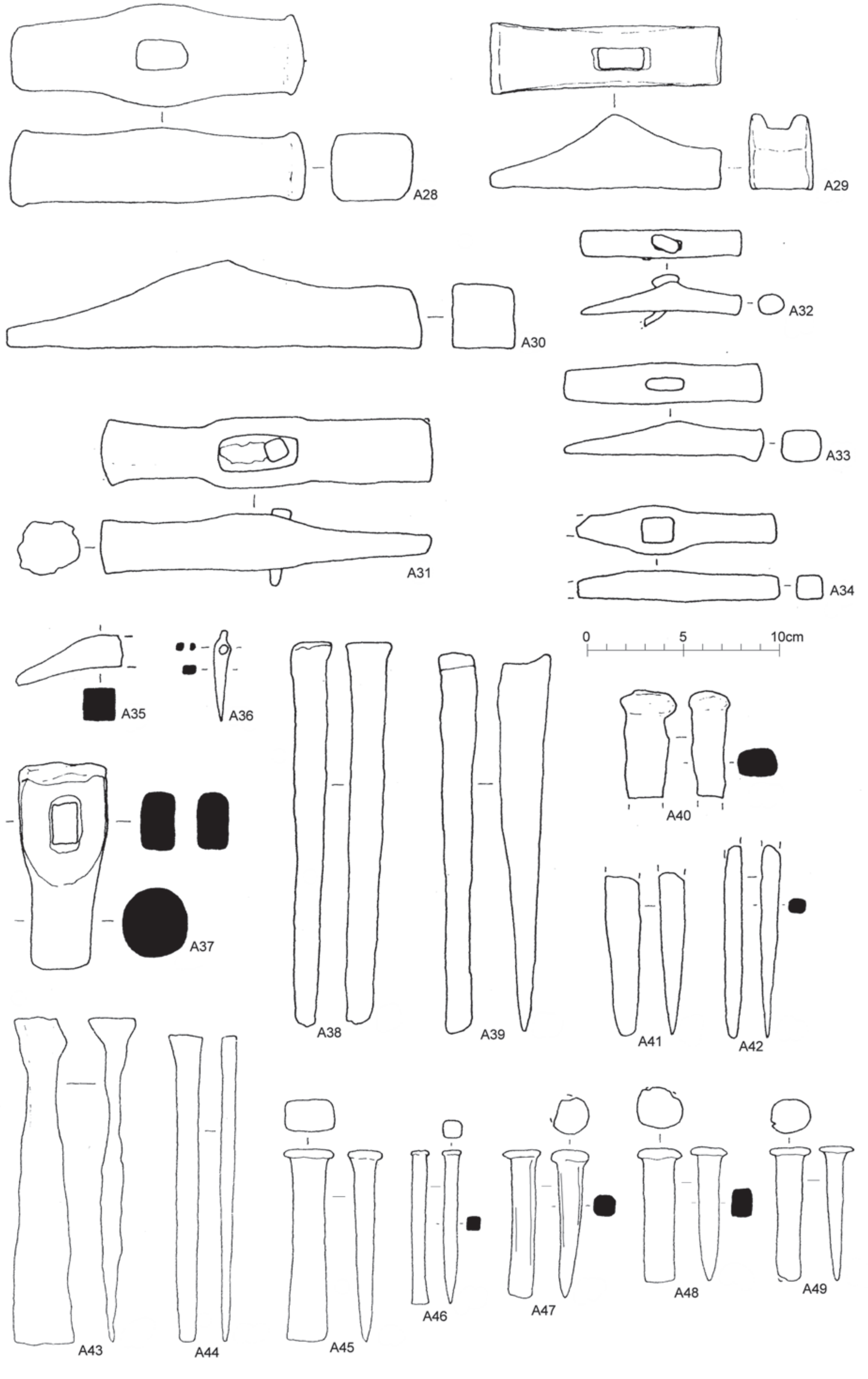

FIGURE 2.5
Metalworking tools: Hammers, cold chisels and hot chisels

A50 HOT CHISEL
Winchester, Hampshire.
16th to 17th century.
Burred head, rectangular-sectioned wrought iron stem, steel edge. L 62mm.
Goodall 1990-3, fig 41, no. 43.

A51 HOT CHISEL
Winchester, Hampshire.
Early 12th century.
Burred head, rectangular-sectioned wrought iron stem, steel edge. L 45mm.
Goodall 1990-3, fig 41, no. 42.

A52 COLD SET
Waltham Abbey, Essex.
12th–13th century.
Broken, octagonal-sectioned stem. L 156mm.
Goodall 1973a, 170, fig 11.14.

A53 COLD SET
Waltham Abbey, Essex.
With derived 12th, 13th century pottery.
Burred head, broken rounded-sectioned stem. L 116mm.
Goodall 1973a, 170, fig 11.17.

A54 COLD SET
Waltham Abbey, Essex.
Late 13th, early 14th century.
Broken, octagonal-sectioned stem.
L 111mm.
Goodall 1973a, 170, fig 11.13.

A55 HOT SET
Goltho, Lincolnshire.
Late 14th to early 15th century. From floor of smithy.
Burred head, asymmetrically shaped blade of rectangular section. L 77mm.
Goodall 1975a, 87, fig 41.90.

A56 PUNCH
Hen Blas, Clwyd.
Probably 13th century.
Rectangular section, tip damaged. L 148mm.
Leach 1960, 23, fig 13.13.

A57 PUNCH
Kettleby Thorpe, Lincolnshire.
14th to early 15th century.
Burred head, rectangular-sectioned stem.
L 104mm.
Goodall 1974a, 33, fig 18.12.

A58 PUNCH
Winchester, Hampshire.
Late 13th century.
Rectangular section. L 102mm.
Goodall 1990-3, fig 41, no. 45.

A59 PUNCH
Hen Caerwys, Clwyd.
Around 1450–1520.
Broken, rectangular-sectioned stem. L 88mm.
Excavated by G B Leach.

A60 PUNCH
Loughor Castle, West Glamorgan.
Site *c*1106 to late 13th century.
Burred head, rectangular-sectioned stem.
L 204mm.
Excavated by J M Lewis.

A61 PUNCH
Hen Blas, Clwyd.
12th–14th century.
Circular-sectioned stem becoming rect-angular. L 132mm.
Leach 1960, 23, fig 13.15.

A62 PUNCH
Hen Blas, Clwyd.
12th–14th century.
Circular-sectioned stem becoming rect-angular. L 112mm.
Leach 1960, 23, fig 13.16.

A63 PUNCH
Dyserth Castle, Clwyd.
Site 1241–63.
Broken, rectangular-sectioned stem. L 61mm.
Glenn 1915.

A64 PUNCH
Winchester, Hampshire.
12th century.
Rectangular-sectioned stem. Mostly ferrite and slag. L 58mm.
Goodall 1990-3, fig 41, no. 44.

A65 PUNCH
Dyserth Castle, Clwyd.
Site 1241–63.
Rectangular-sectioned stem. L 57mm.
Glenn 1915.

A66 PUNCH
Waltham Abbey, Essex.
Lowest silt in well dug *c*1300, filled in late 15th, early 16th century.
Burred head, octagonal-sectioned stem tapering to oval tip. L 102mm.
Goodall 1973a, 170, fig 11.19.

A67 PUNCH
Gomeldon, Wiltshire.
13th–14th century.
Burred head, circular-sectioned stem.
L 73mm.
Musty and Algar 1986.

A68 PUNCH
Northolt Manor, Greater London.
1300–1350 with 13th-century residual material.
Burred head, octagonal-sectioned stem, rounded tip. L 199mm.
Excavated by J G Hurst.

A69 PUNCH
Gomeldon, Wiltshire.
13th–14th century.
Burred head, square-sectioned stem.
L 101mm.
Musty and Algar 1986.

A70 PUNCH
Dyserth Castle, Clwyd.
Site 1241–63.
Burred head, octagonal-sectioned stem becoming rectangular. L 83mm.
Glenn 1915.

A71 PUNCH
Goltho, Lincolnshire.
Croft A: late Saxon to late 14th or early 15th century.
Burred head, rectangular-sectioned stem slightly waisted below head. L 92mm.
Goodall 1975a, 87, fig 41.88.

A72 PUNCH
Northampton.
Later 14th–15th century.
Burred head, rectangular-sectioned stem.
L 89mm.
Goodall 1979b, 71, fig 17.18.

A73 PUNCH
Waltham Abbey, Essex.
12th–16th century.
Burred head, rectangular-sectioned stem.
L 108mm.
Goodall 1973a, 170, fig 11.20.

A74 PUNCH
Glastonbury Tor, Somerset.
Probably 10th–11th century.
Rectangular-sectioned stem, shaped tip.
L 141mm.
Rahtz 1970, 53, fig 23.8.

A75 PUNCH
Thetford, Norfolk.
11th century.
Rectangular-sectioned stem, tapering to head and shaped tip. L 98mm.
Goodall 1984.

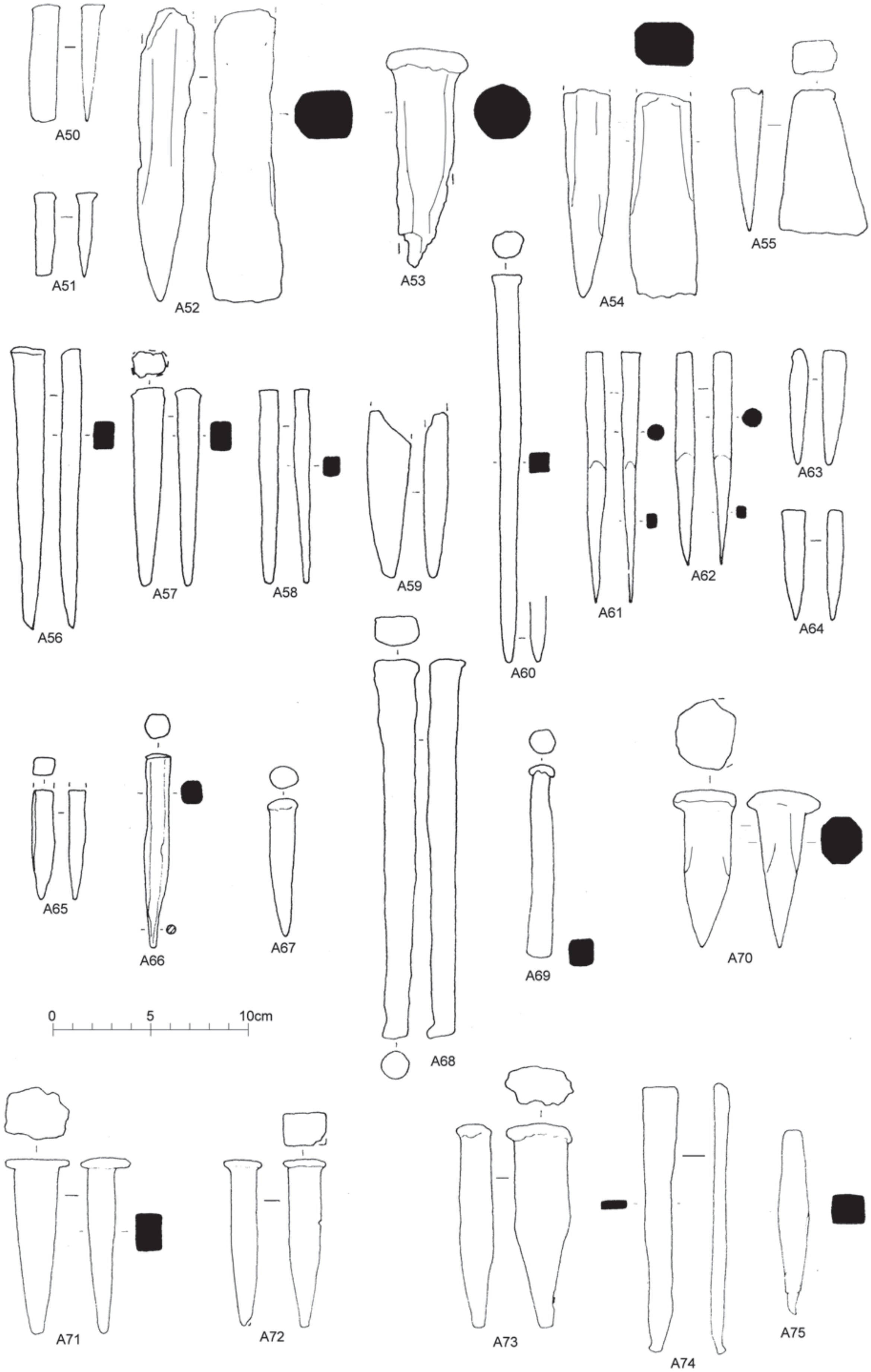

FIGURE 2.6
Metalworking tools: Hot chisels, cold and hot sets, and punches

A76 DRIFT
Castell-y-Bere, Gwynedd.
Site *c*1221–95.
Damaged rounded-sectioned head becoming rectangular. L 182mm.
Butler 1974, 97, fig 8.12.

A77 DRIFT
Weoley Castle, West Midlands.
Around 1270–*c*1380.
Rounded-sectioned head becoming square. L 163mm.
Taylor 1974; Oswald 1962, 25.

A78 DRIFT
Waltham Abbey, Essex.
16th century.
Circular-sectioned stem becoming square. L 103mm.
Goodall 1973a, 170, fig 11.18.

A79 DRIFT
Alsted, Surrey.
Around 1270–1400. From ironworking site.
Rounded-sectioned stem becoming rect-angular at blade. L 85mm.
Goodall 1976a, 56, fig 35.38.

A80 DRIFT
Cambokeels, Durham.
Later 14th to early 16th century.
Rectangular-sectioned stem. L 84mm.
Bowes Museum, Barnard Castle. For site see Hildyard and Charlton 1947; Hildyard 1949.

A81 DRIFT
Hen Caerwys, Clwyd.
Around 1450–1520.
Rectangular-sectioned stem. L 81mm.
Excavated by G B Leach.

A82 DRIFT
Southampton, Hampshire.
12th century.
Rectangular-sectioned stem. L 75mm.
Harvey 1975b, 277, fig 250.1974.

A83 DRIFT
Seacourt, Oxfordshire.
Pre-1400.
Broken, rectangular-sectioned stem. L 62mm.
Biddle 1961–62, 177, fig 30.2, scale 1:4, not 1:3.

A84 DRIFT
Bramber Castle, West Sussex.
14th century. From workshop area in M1.
Rectangular-sectioned stem, circular at tip. L 70mm.
Barton and Holden 1977, 64, fig 20.2.

A85 DRIFT
Bayham Abbey, East Sussex.
Late 15th, early 16th century.
Rectangular-sectioned stem. L 68mm.
For site see Streeten 1983.

A86 FULLER (?)
Kilton Castle, Cleveland.
15th century.
Burred head, shaped rectangular-sectioned body. L 100mm.
Excavated by F A Aberg.

A87 MANDREL (?)
Dyserth Castle, Clwyd.
Site 1241–63.
Tapering circular-sectioned body, whittle tang. L 126mm.
Glenn 1915. Natural Museum, Wales, Cardiff, 15-248/14.

A88 MANDREL (?)
Dyserth Castle, Clwyd.
Site 1241–63.
Tapering circular-sectioned body, whittle tang. L 71mm.
Glenn 1915. Natural Museum, Wales, Cardiff, 15-248/21

A89 MANDREL (?)
Writtle, Essex.
Around 1306–*c*1425.
Rectangular-sectioned arm with double-riveted tang. L 166mm.
Rahtz 1969b, 87, fig 48.71.

A90 MANDREL (?)
Weoley Castle, West Midlands.
Site *c*1270–1600.
Rectangular-sectioned arm with double-riveted tang. L 124mm.
Birmingham City Museum, 18341. For site see Oswald 1962.

A91 NAIL-HEADING TOOL (?)
Cambokeels, Durham.
Later 14th to early 15th century.
Broken strip with three differently sized countersunk holes. L 82mm.
Hildyard 1949, 199, fig 3.18.

A92 FILE
Manor of the More, Rickmansworth, Hertfordshire.
1520–30.
Flat file with diagonally cut teeth and whittle tang, incomplete. L 136mm.
Biddle *et al* 1959, 184, fig 19.36.

A93 POKER
Huish, Wiltshire.
From hearth in 14th to mid 15th century smithy.
Roughly circular-sectioned poker, tip lost, socket damaged. L 290mm.
Shortt 1972, 120, fig 4.

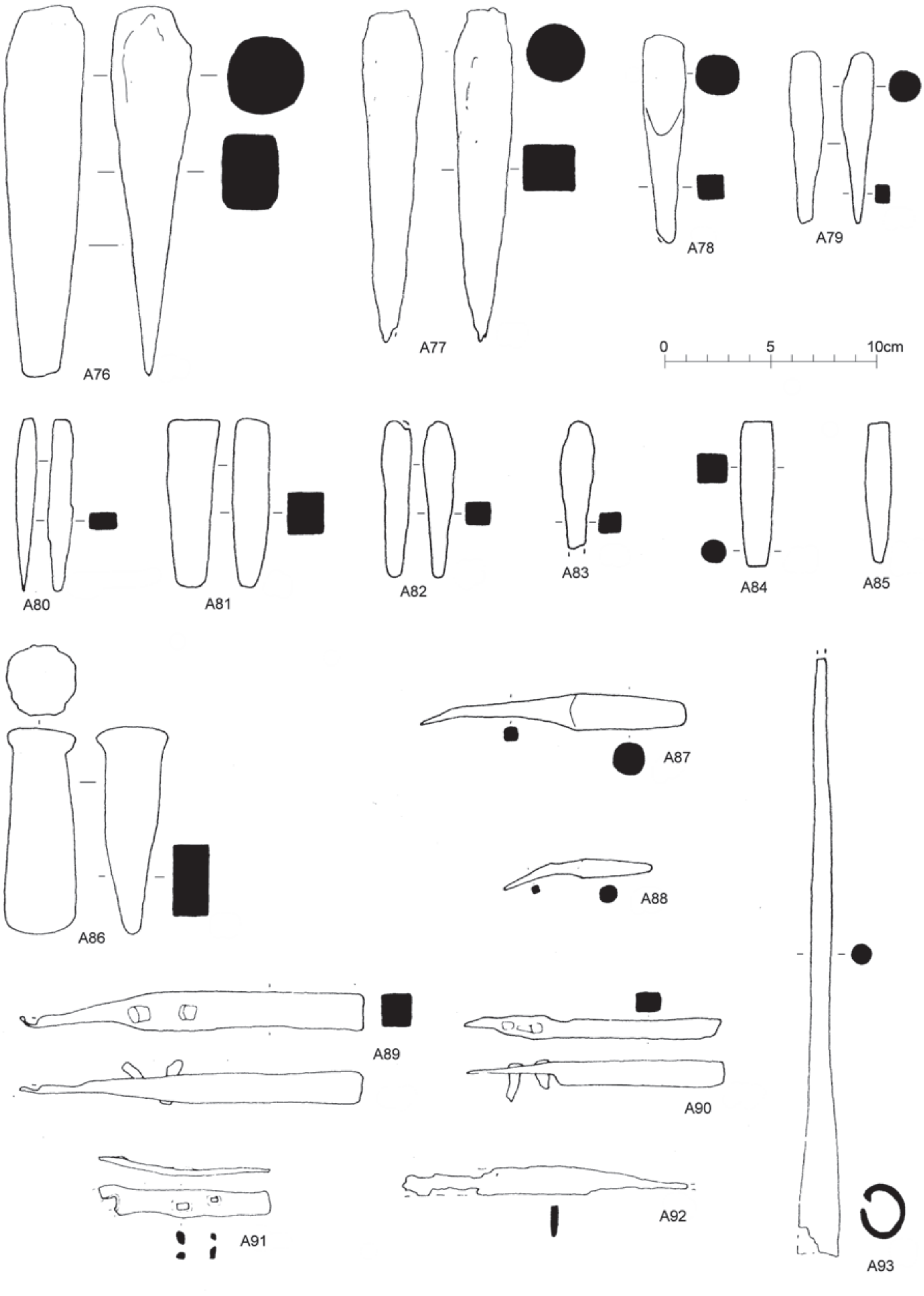

Figure 2.7
Metalworking tools: Drifts, fuller, mandrels, nail-heading tool, file, and poker

3

WOODWORKING TOOLS

Woodworking was one of the most important crafts of the medieval period, embracing such trades as those of the carpenter, wheelright, millwright, and shipwright. Wooden building remained the rule during the medieval period, just as it had before, and it is of interest that even in the royal establishment as late as 1344 there were 138 carpenters against only 24 masons (Harvey 1975a, 123).

Tools used in the woodworking and allied trades range from those used for felling, splitting and sawing timber to those used for shaping, fitting and even dismantling it.

3.1 AXES

The axe, the woodworker's basic tool, was used for felling trees, splitting and trimming trunks and branches, and smoothing and dressing a range of timbers from posts and planks to spokes. Modern crafts have, or had, specialised axes which feature in trade catalogues (Salaman 1975, 46–66), but the diversity of forms which these demonstrate must be comparatively modern. Medieval axes, which must have been used for as many purposes, are not as infinitely varied and can be divided into six main types, excluding battle-axes. Types 1–6 (Figure 3.1) may be correlated with Ward Perkins' classification (1967, M55–63) as follows:

1, 2 = I
3 = III
4 = II
5 = IVB
6 = IVA

The named parts of the axe are shown in Figure 3.2. Medieval woodworking axes, including those used for dressing planks, generally have blades with a sharpening bevel on both sides of the cutting edge, and few have fully developed sockets. Stamped marks are found on only one axe, and that is from a late Saxon to 17th-century context, and no axe has any decoration on the blade. The illustrated axes in the *London Museum Medieval Catalogue* undoubtedly incorporate a significant number of post-medieval axes (Ward Perkins 1967).

Type 1

The woodman's axe (Type 1), a sturdy tool with a thick, heavy blade, was mounted in a long handle and used for felling trees and cutting and splitting trunks in the manner shown in the Bayeux Tapestry (Stenton 1957, 16, pl 38). The known medieval examples **B1–10** have flaring symmetrical blades and lugs, which are generally rounded, above and below the eye, to enable the handle to be securely hafted. Most of these axes, when sufficiently complete, have polls or thickened butts which make them steadier to handle and easier to direct, and also allowed them to be used as hammers or be hammered themselves. A Bible of *c*1100 (Ward Perkins 1967, 56) shows such an axe being used with a heavy mallet to split a log. Felling axes seem also to have been used for trimming logs, the carpenter cutting such notches in the log as a guideline for trimming and then chopping out larger V-shaped cuts before working along the side of the plank, cutting deeply and splitting off wood close to the line. Two 16th-century illustrations by Rodler (Salzman 1967, 196) and Jost Amman (Rifkin 1973, 95; Goodman 1964, 30) show this method in use, and each also shows a bearded axe lying in wait for subsequent close trimming and smoothing.

Type 2

Axes of Type 2 have asymmetrically flaring blades with down-turned rear edges, the larger examples of which may have been used as felling axes in the manner of Type 1 axes. In general, however, they are slighter in construction and lack the poll of the other axes, and are likely to have been used as hatchets for lopping and chopping wood. The larger axes **B13–14** have lugs below the eyes, but the smaller axes **B11–12** are plain.

Axes **B12–14** show the usual method of forging axes by wrapping the iron around the eye and hammer-welding it against the back of the blade.

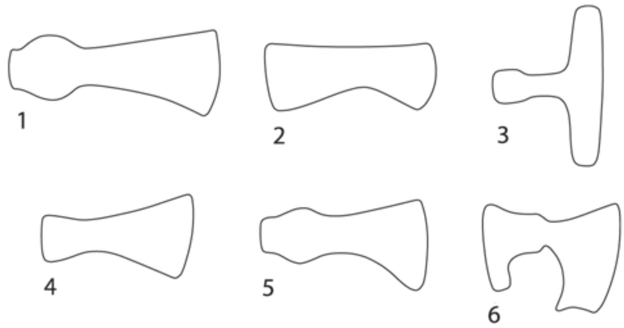

FIGURE 3.1
Types of medieval axe

Type 3

Type 3 axes have long, narrow rectangular blades attached to sockets by slender shanks, and the Bayeux Tapestry (Stenton 1957, 169, pls 38, VII) shows such axes being used by carpenters dressing planks and shipwrights trimming them. This type of axe, known from a number of pre-Conquest sites, is one of the most common types of axe shown in medieval representations of carpentry, appearing as late as the 14th century (Ward Perkins 1967, 58). The incomplete blade and shank fragment **B15** is, however, the only firmly dated medieval example.

Type 4

Axes with triangular-shaped blades constitute Type 4, and were probably used for trimming and dressing timber. The fore-edges of **B16** and **B18** are straight and rise in line with the eye, but that of **B17** is slightly curved.

Type 5

Type 5 axes have bearded blades with pointed heels set below the base of the eye or socket. These axes were probably used for trimming, a job for which their broad blades are well suited. The complete axes **B19–21** all have polls and lugged eyes, the poll being particularly suitable for heavy hammering, including the pounding together of joints in timber-framed buildings. **B22** is an incomplete blade fragment.

Type 6

Type 6 axes have bearded blades with flat heels set below the base of the eye or socket. **B23–25** conform to the type of side-dressing axe shown in the 16th-century illustrations noted above. The axes were lying around waiting to be used for trimming once the main waste wood had been removed by stouter axes. **B23–24** have sockets, and although **B25** has the more usual medieval lugged eye, it may nevertheless be of post-medieval date. It is unusual in having its blade set to one side, viewed from above.

Axe fragments

B26–27 are blade fragments retaining part of the cutting edge, each however too incomplete to classify.

3.2 ADZES

Adzes, which differ from axes by having their blades set at right angles to the handle, are used for removing heavy waste, levelling, shaping or trimming the surfaces of timber. There are few actual medieval examples, but variation in blade forms amongst those that survive reflects the range of jobs they had to perform. The broad blade of **B28** is suitable for adzing planks, but more specialised adzing will have been carried out by **B29–30** which have narrow, slightly flaring blades. The slender poll of these latter adzes was used to drive in nails which could not be removed from timber but which had to be driven in sufficiently to be cleared by the adze blade. Salzman (1967, 342) notes that during work at Restormel Castle in 1343 6d was spent on 'an ades for smoothing old timber, because the timber is so full of nails that the carpenters would not set their own tools to it', and more recently Mercer (1968, 92–93) records that early 20th-century shipbuilders also used the peg-shaped hammer polls of their adzes to sink the nails below adze level. It is of interest that the shipwright in the Bayeux Tapestry (Stenton 1957, 169, pls 38, VII) appears to be using a short-handled adze with broad blade and poll.

Adzes **B29–30** may just be narrow enough to have been used for cutting mortices, which is what **B31** with its simple eye and narrow, parallel-sided blade must have been used for. Mortices were often started with augers and chisels, but adzes are likely to have been used for those in the major posts of timber-framed buildings, and for long chase mortices.

3.3 SLICES

The slice is a long, broad chisel with a socketed handle which was driven by hand pressure rather than by a mallet. The tool is used with a planing and pushing action

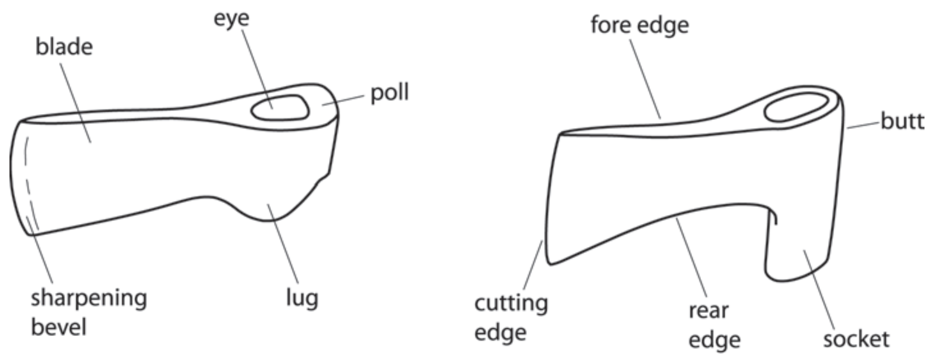

FIGURE 3.2
Axes: Terminology

to pare-off shavings, and is employed by the shipwright for fairing and removing waste from the deck and elsewhere, and especially from places where the adze cannot reach. It also has a more general application for cleaning up the sides of large mortices in construction work and for levelling surfaces.

The modern slice (Salaman 1975, 143–144; McGrail 1977, 62–63) has a blade 50–100mm in breadth and up to 760mm in overall length. The deep socket, frequently flanged on the older tools, has a flat lower face set in line with the back of the blade in order to keep the hand clear when paring a flat surface. **B32–33** have blades which are characteristically bevelled only on the upper face, **B33** having a worn blade and retaining part of its wooden handle. Both these slices come from contexts more appropriate to general carpenters' tools than those of shipwrights.

3.4 CHISELS

Woodworking chisels with narrow rectangular blades sharpened at one end and hafted at the other are used for edging, notching, hollowing and morticing wood, and for carving it. They are subdivided according to the shape and thickness of the blade, which determined the type of work undertaken, and the main groups are firmer, paring, morticing, and carving chisels.

Firmer chisels are general purpose tools with a flat blade with parallel sides strong enough to be struck with a mallet. They are used to roughly side-cut wood along a scribed line prior to finer paring as well as to cut out mortices already begun with an auger. Modern firmer chisels often have a single bevel to the cutting edge combined with bevelled edges for better clearance when working in corners (Salaman 1975, 139) but **B34**, probably a firmer chisel, has a plain blade with a double bevelled cutting edge.

Paring chisels, which cannot always be distinguished from firmer chisels, generally have long, thin, lighter blades and are used with shoulder or hand pressure rather than with mallets. In woodworking they followed the firmer chisel, smoothing its rough cuts and being used for fine paring and trimming. **B35**, probably a paring chisel, has a plain blade with a double bevelled cutting edge.

Morticing chisels used with mallets have stout blades with a sharp bevel to the cutting edge. These chisels, as their name implies, were used to cut mortices and the like direct from the wood without the preliminary augering associated with the use of firmer chisels on the larger mortices. **B36** is an incomplete morticing chisel with a single bevelled cutting edge, and **B37–38** are similar incomplete blades.

B39, apparently with a blade at either end, may be a carver's tool. The flaring blade resembles the modern spade chisel used in carving during lighter finishing operations (Salaman 1975, 126, fig 205m).

3.5 GOUGES

Gouges are similar to chisels but have hollow cross-sectioned blades for cutting curved surfaces. No medieval gouge is yet known.

3.6 AUGER BITS

Augers with iron bits set in transverse wooden handles were used to bore holes in wood. Timber-framed buildings, roof trusses, and other timber constructions including smaller items such as furniture and panelling required holes for wooden pegs, and augers were also used to start cutting mortices which were then finished with firmer chisels. Small bits were used for such purposes as boring holes in knife and tool handles for the insertion of whittle tangs. Medieval documents (Salzman 1967, 345) record 'an iron augur for making holes in bemes' at Westminster in 1443, and a 'waternawger' in 1404 and a 'wateravger' in 1419, both needed for work at London Bridge. Representations of augers show straight and winged handles being worked with two hands, as well as breast augers which were given additional force by pressing the chest on a pad set on top of the shank. Salzman (1967, 345) notes that breast augers are mentioned in ship-building accounts but apparently not in ordinary building accounts, and the Bayeux Tapestry (Stenton 1957, 169, pls 38, VIII) clearly shows one in use during the construction of a ship, as does a medieval manuscript illustrated by Mercer (1968, fig 162). Larger augers with tapering blades were used by wheelwrights to hollow the inside of the felloes of wheels, as an illustration by Jost Amman shows (Rifkin 1973, 97). In common with many other medieval tools, the blades of auger bits must often have been steeled. The London Bridge accounts record the payment of 4d in 1382 'for steeling a nauegore' (Salzman 1967, 345).

Auger bits are of three main types: spoon bit, gouge bit and twist bit, each with a shank and terminal which fitted into a wooden handle. The terminals are lanceolate, tapered or eyed, the latter as yet only represented in manuscript illuminations. The lanceolate and tapered terminals seem to have fitted loosely into rectangular holes in the wooden handles, since none shows signs of having been pinned or riveted in position, or having had a clenched tip. The lanceolate terminal, tapering in side view from a broadened base, is the most common as well as the most practical form since it gave plenty of leverage to the handle. The tapering terminal, rather like that of an auger would cause the edges of the head to rub the socket in the handle, eventually rounding it and preventing the bit turning fully and cutting efficiently.

Blanks for auger bits

The forge at Waltham Abbey in Essex produced six blanks for auger bits, a typical example **B40** having a lanceolate terminal yet to be drawn out and a shank awaiting the blade. The blank is probably of wrought iron to which a steeled blade would have been forged.

Spoon bits

Spoon bits are the most common type of auger bit to be found, surviving in greater numbers and with a wider size range than either gouge or twist bits. The blades have a gouge-shaped body with a spoon-like nose, both the edges and nose being sharpened. The spoon bit cut chiefly downwards, ceasing to cut sideways as soon as the maximum width of the blade was reached. Most blades have parallel edges, although a number have a slight taper. The spoon bit is efficient since the sharpened edges enabled it to cut when rotated in either direction, and the sharpened nose cut the centre of the hole, leaving no core.

Medieval spoon bits have been classified according to terminal form and catalogued in increasing order of size.

Type 1

Spoon bits with lanceolate terminals **B41–68** range in length from 77mm to 415mm, and their blades in width from 4mm to 27mm. The terminals are generally an elongated lozenge shape in front view, the elongation sometimes being extreme, and the shanks are generally rectangular or octagonal in section. The smaller bits have blades which are proportionately longer in relation to the length of the shank than the larger bits partly as a consequence of their size and partly because the upper part of the blade held the shavings during use, the nose allowing them to be withdrawn from the whole which was thus kept clean. The narrowest blades, particularly those of **B41**, **B44**, **B48–49**, **B51–52** and **B57**, are suitable for boring holes in knife handles whereas the widest, **B62**, **B64**, **B67–68**, are better suited for starting mortices and drilling peg-holes for major structural timbers.

Type 2

B69–71, the few spoon bits with tapering terminals, grade in size from 95mm to 247mm in length, their blades from 6mm to 14mm in width. The shanks are again rectangular or octagonal.

Type 3

Representations of augers not infrequently show wooden handles set through the eyed terminal of a spoon bit. Rodler's illustration of 1531 (Salzman 1967, 196) shows just such a spoon bit in the foreground. No actual medieval example is yet known, but earlier and later examples of the type all seem to be larger bits used for building or boat construction. The eye would allow considerable pressure to be exerted on the bit.

Incomplete spoon bits

B72–73 are spoon bits with broken shanks lacking their terminals.

Gouge bits

Gouge bits have hollowed blades sharpened along the edges and a sharpened nose which is either cross-cut or rounded downwards but never spoon-shaped. In contrast to the spoon bit, the gouge bit produces a cylindrical cut in the wood, leaving a plug-like core which has to be removed, and in consequence gouge bits are smaller in length and blade width than spoon bits, ranging from 90mm to 170mm in length and from 6mm to 13mm in width.

Type 1

Gouge bits **B74–79** have lanceolate terminals. The blades vary considerably in depth and have cross-cut and rounded noses.

Type 2

B80 has a tapering rectangular terminal and a cross-cut nose.

Incomplete gouge bits

B81–82 have broken shanks and lack their terminals, but both have rounded noses, the former more acutely shaped.

Twist bits

Twist bits have solid shanks, rounded or rectangular in section, with a short spiral groove at the tip, and are suitable for cutting small round holes in timber, particularly for boring pilot holes for nails, etc, where the cleanness of the hole is not of great importance. Doors of ledge and batten construction may have the ledges pegged to the battens, but nails driven through strap hinges to fix them to this double thickness of wood would not have gone in straight and holes were probably bored for them, as was done on the 12th-century church door at Stillingfleet, North Yorkshire (Addyman and Goodall 1979, 90, fig 9).

The twist bit is today called a gimlet bit and is, like the gimlet, in effect a miniature auger (Salaman 1975, 82, 208). Salzman (1967, 345) quotes a 15th-century poem which mentions a 'wymbylle', that is, a wimble or gimlet, but otherwise the only reference he records is mention of a 'gemelot' at Nottingham in 1416. **B83–86** are twist bits, although **B84** is not certainly medieval, and its shank with its thickened, parallel-sided section immediately below the head differentiates it from **B83** and **B85**. Three of the bits, however, are certainly late medieval.

Type 1

B83–85 are twist bits with tapering rectangular heads, the most practical type for these small bits which range from 130mm to 140mm in length and from 4 to 8mm in blade width. Such bits would not require the pressure needed to justify a lanceolate head.

Type 2

Twist bits with eyed heads are known amongst modern tools as shipwrights gimlets (Salaman 1975, 208, fig 209, nos 1955–56), but no medieval example is known.

Incomplete twist bits

B86 is an incomplete bit lacking its head.

Incomplete auger bits

B87–92 are auger bits with heads and incomplete shanks or blades, the latter unclassifiable. All have lanceolate heads.

3.7 SAWS

Saws were used in woodworking to convert trees into planks, to make joints, and for general bench work, and the range of types available reflects these diverse uses. Few actual medieval saw blades survive but according to Goodman (1964, 125) pictorial representations indicate that four main types were in use, namely the large frame or pit-saws used for ripping timber into boards, the small frame saw for bench work, the hand-saw, and the two-man cross-cut saw.

Saw teeth are cut in differing ways (Salaman 1975, 405), with rip teeth, for cutting along the grain, filed straight across at right angles and presenting a series of chisel-like edges which cut away the wood. Cross-cut teeth, for cutting across the grain, are filed at an angle of about 60 degrees in alternative directions. The tips of these teeth, known as points, sever the wood fibres, and most modern saws have them bent or set sideways, alternately right and left, in order to cut a kerf or saw-cut slightly wider than the thickness of the blade to prevent it binding in the wood.

Large frame saws

Axes are shown in use in the Bayeux Tapestry (Stenton 1957, 169, pls 37–38) felling trees needed for building the invasion fleet, and the axe and wedge appear to have been usual tools used in medieval tree felling. Tree trunks, if not split with an axe and wedge, were sawn with pit-saws. The term pit-saw is to some degree a misnomer, since in addition to being sawn over a pit, timber was also mounted on a sawing horse or on trestles for the same purpose. Salzman (1967, 343) notes that there are occasional references to the digging of saw-pits. In 1535, when Hengrave Hall was being built, 10s 8d was paid 'for makyng xvj sawye pitts at Sowe wood', and in the same year, after timber had been sawn for use at Hampton Court, 20 saw-pits were filled up. The saw-pit was in fact a trench in which the bottom sawyer stood, with the timber supported over the pit and the top sawyer standing on top guiding the saw. Excavations at Barton Blount, Derbyshire, revealed an early 15th-century saw-pit 3.20m long, 0.91m wide, 1.83m deep, with oak and ash sawdust at the bottom (Beresford 1975, 45, fig 20, pl VB). Goodman (1964, 132) notes that medieval representations often show the timber mounted on a trestle, as in a 15th-century illustration reproduced by Salzman (1967, pl 19), or on a trestle and crutches. Salzman (1967, 343) notes only a single reference to trestles, in the account for building 'The Bell' at Andover in 1534, where there is mention of 'grett naylis to make sawyng trestilles'. No pit-saw blade fragment is yet known.

Cross-cut saws

The cross-cut saw with a straight blade of the same width throughout and two large handles at each end (Goodman 1964, 143) is thought by Salzman (1967, 342–343) to be the equivalent of the whip-saw of medieval documents. It