Craft, Industry and Agriculture in a Roman City: The Iron Tools from London

PhD in Archaeology

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I confirm that this is my own work and the use of all material from other sources has been properly and fully acknowledged.

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Abstract

London was the administrative centre for and largest city in Roman Britain. After centuries of excavation, *Londinium* is one of the best understood cities in the Empire. London is also home to one of the most exceptional collections of craft and agricultural tools in the Roman world. These objects represent a wide range of practices, including woodwork, metalwork, leatherwork, masonry, agriculture, and animal husbandry. Due to excellent preservation in waterlogged contexts, many are in exceptional condition.

This thesis brings together *c*.837 metal (mostly iron) tools from multiple collections, many of which have not been published before. Using a combination of detailed typological study and theoretical perspectives on technology and practice, this thesis provides an innovative insight into society and economy amongst the working people of a Roman city; a diverse population of locals, immigrants, specialists and amateurs.

A typological discussion identifies these usually neglected objects with reference to French and German literature, highlighting new types for the first time in Britain, and demonstrating a close connection to Continental working practices. These artefacts are then used as the basis for a discussion of craft and agricultural practice in London, focussing on how tools were made, used and discarded. Tools are synthesised with evidence from finished objects, waste, tool marks, structures, epigraphy, iconography and classical sources. This discussion reveals that craft practices were highly specialised, with numerous distinct professions which cannot be accurately condensed to 'woodworking' or 'leatherworking'. Tools were used in working practices which shaped peoples' lives; either limiting their opportunities of social mobility or providing avenues to express pride in their work. Several industries were controlled in part by the state, or by Roman citizens. Finally, a detailed contextual analysis reveals high levels of metalwork consumption, with deposition in the Walbrook valley largely reflecting rubbish disposal, and not ritual activity.

Chapter 1- Introduction

Londinium occupies a special place in Roman archaeology. It was the largest city in Roman Britain, with a unique history of civilian foundation. After almost two centuries of archaeological intervention, it is one of the best excavated and best understood provincial cities in the Empire. This makes London a uniquely important place for discussing the people of the Roman Empire. Roman London was home to an extremely diverse population, which included native British people, immigrants from across the Empire, soldiers, administrators, slaves and traders. This project has sought to explore the lives of Roman Londoners by focussing on a more neglected group in the city; the craftsmen and agricultural workers who made and grew things in the town.

In London, these people left behind a unique resource; their tools. London contains one of the largest and most important collections of Roman tools in Europe. Built up through more than 170 years of archaeological intervention, from early antiquarian collecting to modern commercial archaeology, the collection contains over 800 metal (mostly iron) tools. These objects represent a wide range of practices and industries, principally woodwork, metalwork, leatherwork, masonry and stonework, and agriculture. Thanks to the excellent preservation conditions in London, especially in the waterlogged Walbrook valley, many of these are in exceptional condition; some being good enough to use today. Amongst the collection are objects which have not previously been identified in Roman Britain. However, despite having long been appreciated as a significant collection, these tools have never been systematically identified, and the majority have not been published before now. This thesis is the result of a collaborative project between the Museum of London and University of Reading to finally understand these objects, and to examine what they can tell us about the people of Roman London.

London's tools are not housed in a single location, but are instead scattered across several major institutions, including the Museum of London, London Archaeological Archive and Research Centre (LAARC), British Museum, Pitt Rivers Museum, Bank of England Museum, Museum of London Archaeology (MOLA), and other museums and commercial units. The methodology for searching these collections and recording the tools can be found in Appendix 1.1. Over 1,000 artefacts were examined for this project, of which 837 are discussed here. Information about individual objects can be found in the CD appendix, as both a .pdf catalogue (Appendix 2.1) and searchable Access database (Appendix 2.2). The preliminary analysis of this data takes the form of a discursive typology (Appendix 1.2). Here, the functions and technology of tools are discussed, they are grouped into stylistic and functional types, and their dating and distribution are discussed. Comparanda are provided, with extensive reference made to Continental material. This section also contains discussions of decoration and makers' marks on the tools.

The main text of this volume presents the analysis of London's tools. From the outset, this was envisioned as a project which moves past typological analysis to consider the social significance of these objects, and to answer the question; 'what can tools tell us about the society of Roman London?' The first three chapters provide the academic context to this study. Chapter 2 provides a brief introduction to Roman London. Chapter 3 explores previous work carried out on Roman tools, highlighting the opportunities that this scholarship provides and the potential pitfalls it highlights. Chapter 4 looks at recent theoretical approaches to material culture, highlighting the ways in which theories of technology and practice can be used to expand our interpretation of this material.

Following from the recommendations of Chapter 4, the next three chapters explore London's tools as evidence of *practice*, broken into three main spheres; manufacture, use and discard. In Chapter 5, the tools are discussed as manufactured objects, focussing on where they were manufactured, how and by whom. Chapter 6, which examines the use of tools, is the most substantial section of this thesis. Taking a holistic approach, the tools are discussed alongside a wide body of data from other sources, in order to reconstruct the craft and agricultural practices in London in which tools were used. This chapter is broken into sub-sections by material type; woodwork (Chapter 6.2), agriculture (Chapter 6.3), metalwork (Chapter 6.4), leatherwork (Chapter 6.5), masonry and stonework (Chapter 6.6), pottery (Chapter 6.7), glass-work (Chapter 6.8), animal husbandry (Chapter 6.9), and skeletal-materials-working (Chaper 6.10). Chapter 7 considers the practices involved in the disposal of tools. Here, distribution and depositional context are analysed. It is argued that the nature of deposition in London is such that these sources of data are informative primarily about disposal practice, and not craft practice. Considerable space is given to a discussion of deposition in the Walbrook valley, both in the stream and on the banks.

The final chapter, Chapter 8, contains the concluding sections of this thesis. The first part reflects on the study of tools, before a short discussion relates the findings of the previous three chapters to the theoretical framework set out in Chapter 4. Finally, a set of recommendations for future work are given.

Chapter 2- Roman London

As the introductory sentence to any work on the city will tell you, London is one of the most extensively excavated and studied cities of the Roman world (Gerrard, 2011a; Perring, 2015; Millett, 2016; Wallace, 2017). However, whilst the history of these excavations is well recorded (Watson, 1998a), there is no convenient, up-to-date summary of current understanding of the Roman city. Whilst Roman London has been the subject of a number of dedicated overview works in the past (Wheeler, 1930; Home, 1948; Merrifield, 1965, 1983; Marsden, 1980; Morris and Macready, 1982), the most recent of these (Perring, 1991) is now over 26 years old. Subsequent synthesis work has been limited to short articles (Perring and Brigham, 2000; Perring, 2011, 2015) and reviews (Millett, 1994, 2016; Sheldon, 2004; Wallace, 2017), although a new monograph on Roman London is forthcoming (Hingley, 2018). Instead, a number of works have been produced synthesising the evidence for specific areas of the city (Maloney, 1990; Perring and Roskams, 1991; Wilmott, 1991; Williams, 1993; Barber and Bowsher, 2000; Cowan *et al.*, 2009), or examining particular time periods (Gerrard, 2011a; Wallace, 2014). There have been collections of short papers exploring aspects of Roman London (Bird, Hassall and Sheldon, 1996; Watson, 1998c; Clark, 2008), but the majority of new discoveries are scattered across numerous excavation reports. A number of works have looked at different artefacts from London (Eckardt, 2002; Monteil, 2004, 2008; Crummy, 2008; Wardle, 2008; Shepherd, 2008; Durham, 2010; Rangel de Lima, 2014; Fittock, 2015; Rimmel, 2015; Smither, 2016), but a proposed MoLAS project to synthesise these finds (Wardle, 2005) was never completed. Whilst it is neither necessary nor possible to review all of the developments in London's Roman archaeology over the past quarter century here, this section will provide a brief sketch of those aspects of the city most relevant to this project; its origins and development, geography and zoning, and its people. Evidence for specific industries in London is discussed in Chapter 6.

2.1 The Development of London

The city of London is situated on the north bank of the Thames (Figure 1), on a pair of gravel hills (Cornhill and Ludgate Hill) divided by three tributaries to the Thames (the Fleet to the west, the Walbrook in the centre, and the Lorteburn stream to the east). The suburb of Southwark sat on a pair of large eyots on the south bank of the Thames, linked to Cornhill by a bridge. Occupation began on Cornhill, before spreading gradually westwards over the Walbrook to Ludgate Hill, north into the upper Walbrook valley, and across Southwark onto the mainland of the south bank.

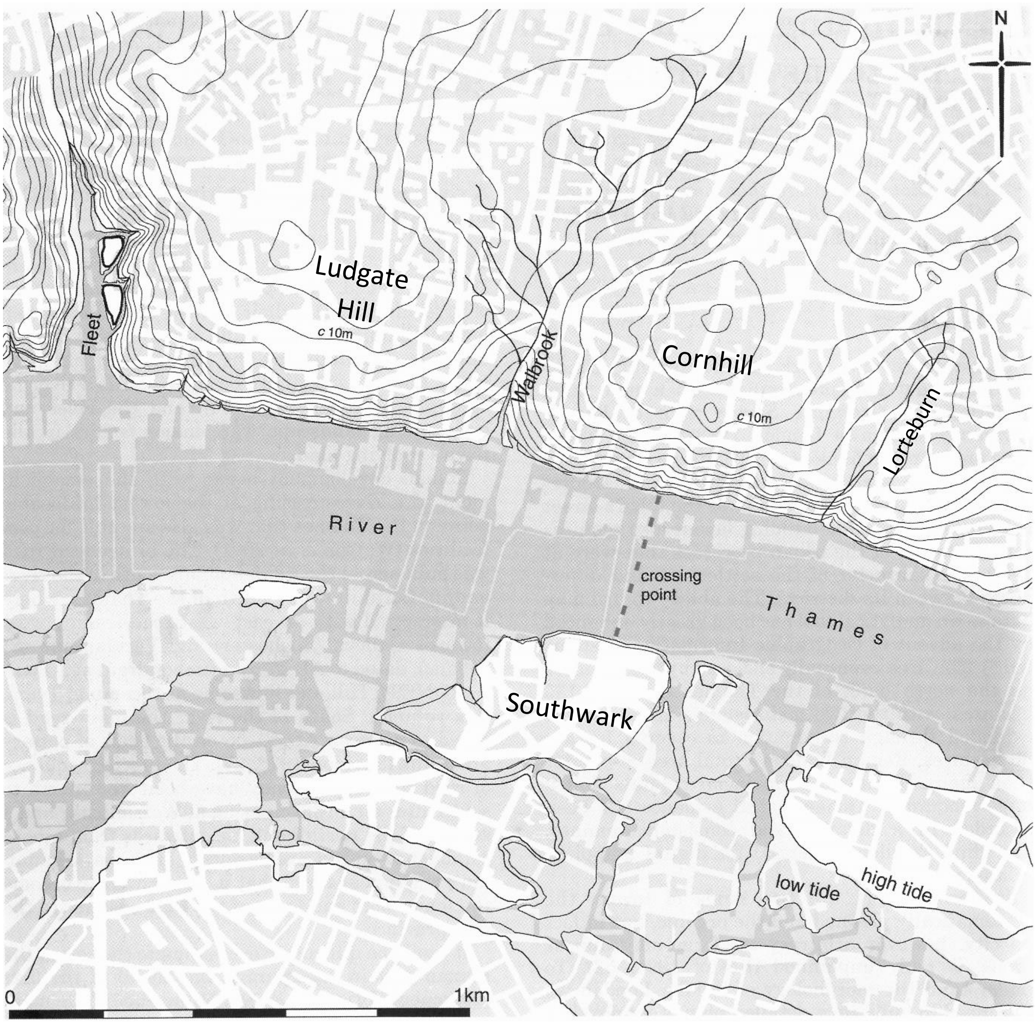


Figure 1 The natural topography of London (Rowsome, 2008, fig. 1.3.1).

2.1.1 Origins

Whilst many Roman towns in Britain developed from earlier Iron Age population centres, excavations in London have repeatedly found no evidence of a substantial pre-Roman settlement. Occupation in the area appears to have been limited to a number of timber buildings, perhaps constituting a farmstead, on the Bermondsey eyot on the south bank of the Thames (Creighton, 2006, pp. 93–4; Rayner, 2009; Perring, 2015, p. 21). Rather than developing from a tribal centre, London is thought to have been a new foundation in a 'neutral' location at a tribal boundary (Millett, 1990, p. 89; Perring, 1991, p. 21, 2011, p. 250; Creighton, 2006, p. 95; Wallace, 2013, p. 286). A timber drain under the main east/west road across the Walbrook at 1 Poultry (ONE94), dendrochronologically dated to the winter of AD 47/8 (Hill and Rowsome, 2011, pp. 257–8), provides the earliest absolute date for the city. Whilst it is not clear whether the construction of this road pre- or post-dated the establishment of the city itself (ibid), it is nevertheless clear that settlement had begun at London shortly after the conquest in AD 43.

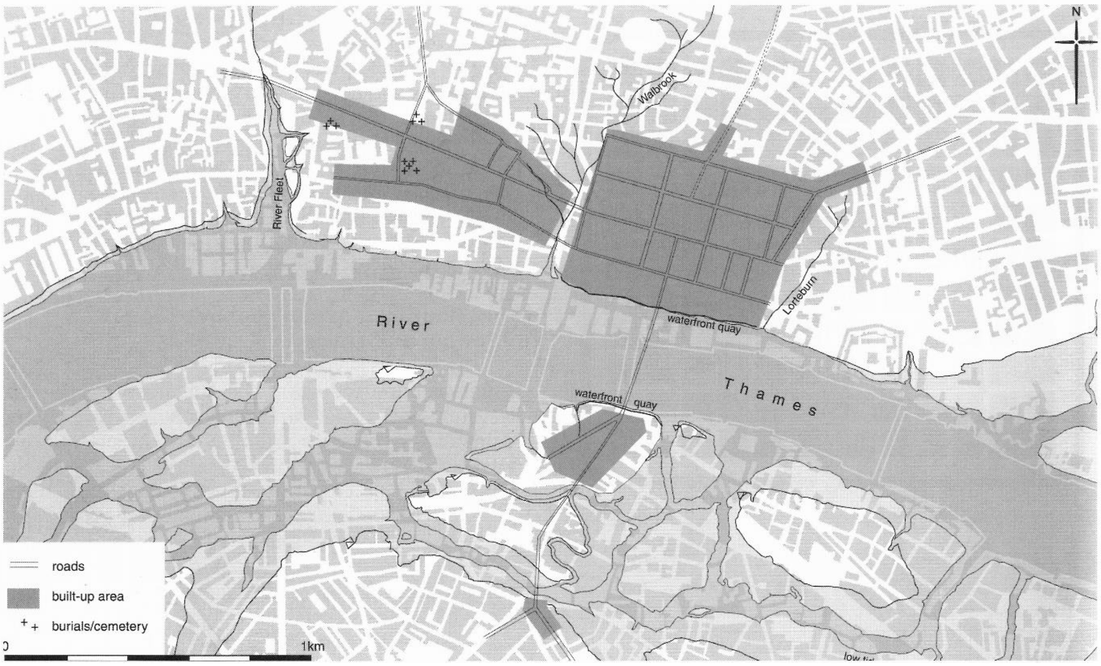


Figure 2 Pre-Boudican London (Rowsome, 2008, fig. 1.3.3).

It has often been argued that London began as an invasion-period military site. Most recently, Perring (2011, 2015, pp. 21–3) has argued that a number of recently-excavated pre-Boudican ditches were of Claudian military origin. This was dismissed in a critical review by Wallace (2013), who argued that the ditches were neither closely dateable nor obviously military in function. Wallace's (2010, 2013, 2014) work supports the more widely-established consensus (Millett, 1990, pp. 88–91; Creighton, 2006, pp. 93–107) that London was not based on either a military installation or an existing Iron Age settlement. Instead, London appears to have been unique amongst the towns of Roman Britain in being a new foundation set up largely through civilian agency (Millett, 1990, pp. 88–91). The foundation of London (particularly the building of bridges, roads, etc.) must have required some degree of state intervention (Creighton, 2006, p. 94), and London is usually characterised as a 'civilian trading port, perhaps facilitated and aided in its construction by the imperial authority' (Wallace, 2010, p. 46).

2.1.2 Early Growth (c. AD 47 – 160)

Whatever the circumstances of its foundation, London appears to have grown as a commercial centre. Although gradually furnished with public buildings (including bath-houses, temples, a forum from c. AD 80 (Marsden, 1987), and amphitheatre from c. AD 75 (Bateman, Cowan and Wroe-Brown, 2008)) and civic infrastructure (including wells and water pumps (Wilmott, 1982; Blair *et al.*, 2006), roads, a bridge across the Thames from c. AD 52 (Perring, 2015, p. 23), and timber docks and warehouses from c. AD 63 (Perring, 2015, p. 27)) most investment seems to have been in the dense strip buildings which made up the private dwellings of London's inhabitants (Perring, 2015, p. 32).

Wallace (2013, p. 287) characterises pre-Boudican development as 'piecemeal and slow', despite the evident plan of the streets of the Cornhill settlement (Figure 2). The city expanded onto Ludgate Hill, but development was interrupted by the destruction of AD 60/61. The city contracted slightly after the fire, with redevelopment not taking place for up to ten years after the initial destruction in some parts of the city (Hill and Rowsome, 2011, pp. 306–7). However, a writing tablet from Bloomberg (BZY10, Tomlin, 2016, <WT45>) suggests that a degree of trade had been restored between London and Verulamium by the end of AD 62. Post-Boudican development eventually continued beyond the limits of the pre-Boudican city (Figure 3), reaching its commercial peak in the early 2nd century (Perring, 2015, p. 32). A second major fire affected the city in the AD 120s (Wilmott, 1991, pp. 34–6; Hill and Rowsome, 2011, p. 357).

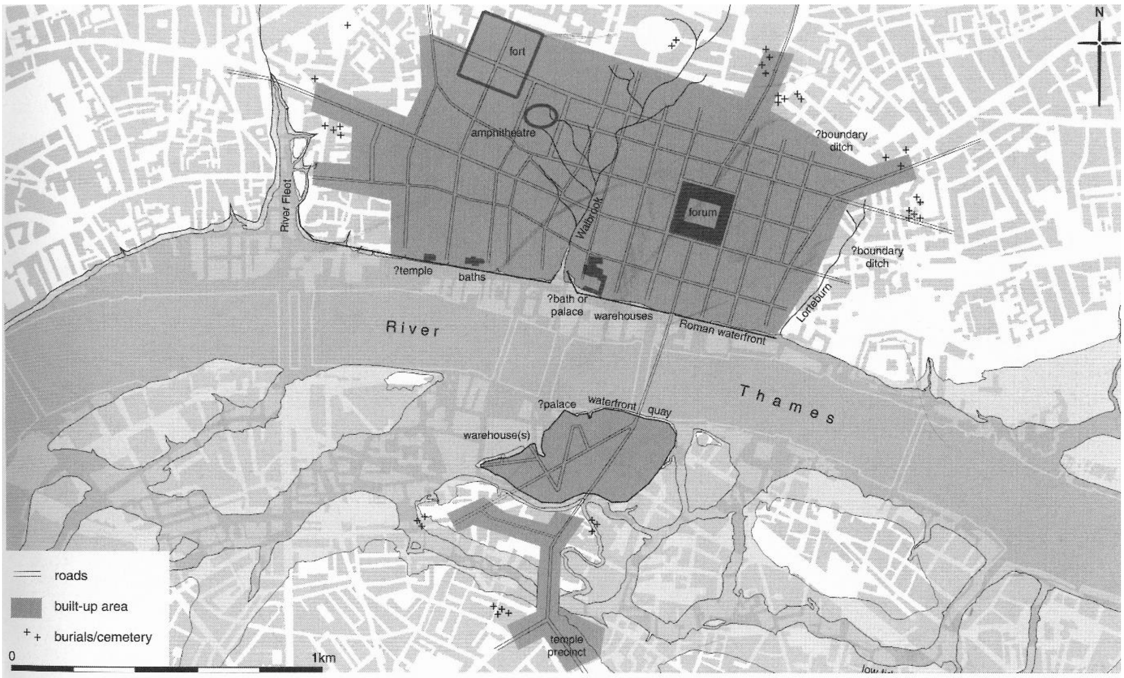


Figure 3 London in the early 2nd century (Rowsome, 2008, fig. 1.3.5).

Whilst there is broad agreement about the trajectory of development in London in this period, there is debate about where the impetus behind this development came from. Perring (2015) attributes it to the state, seeing London's growth in a number of distinct, centrally-planned 'public building programmes'. Others (Creighton, 2006, pp. 93–107; Wallace, 2013, 2014, 2017; Millett, 2016) have attributed agency to the population of London. Wallace (2013, p. 288) points to the variability in building techniques and plan arrangements to suggest that 'there was no overall authority responsible for construction and maintenance' in pre-Boudican London. Creighton (2006, pp. 105–7) interprets the development of public buildings as a series of individual benefactions through which wealthy individuals shaped their notion of what a provincial city should be, in a similar manner to that seen in Pompeii.

2.1.3 Later Developments (c. AD 160 – 450)

London appears to undergo change from the mid-2nd century, although the nature of this change is debated. Traditionally, this has been seen as a period of population decline, marked by a reduction in the number of houses, wells and rubbish pits, and the growth of 'dark earth' deposits (Yule, 1990; Marsden and West, 1992; Watson, 1998b; Perring, 2011, 2015, p. 32). Perring (2011, p. 279, 2015, p. 33) associates this with a plague of AD 165, recorded elsewhere in the Empire. However, some areas of the city appear not to have suffered any population decline in this period (Hill and Rowsome, 2011, p. 373), leading to the suggestion of 'qualitative change' in the character of the city rather than 'decline' (Perring and Roskams, 1991, pp. 120–

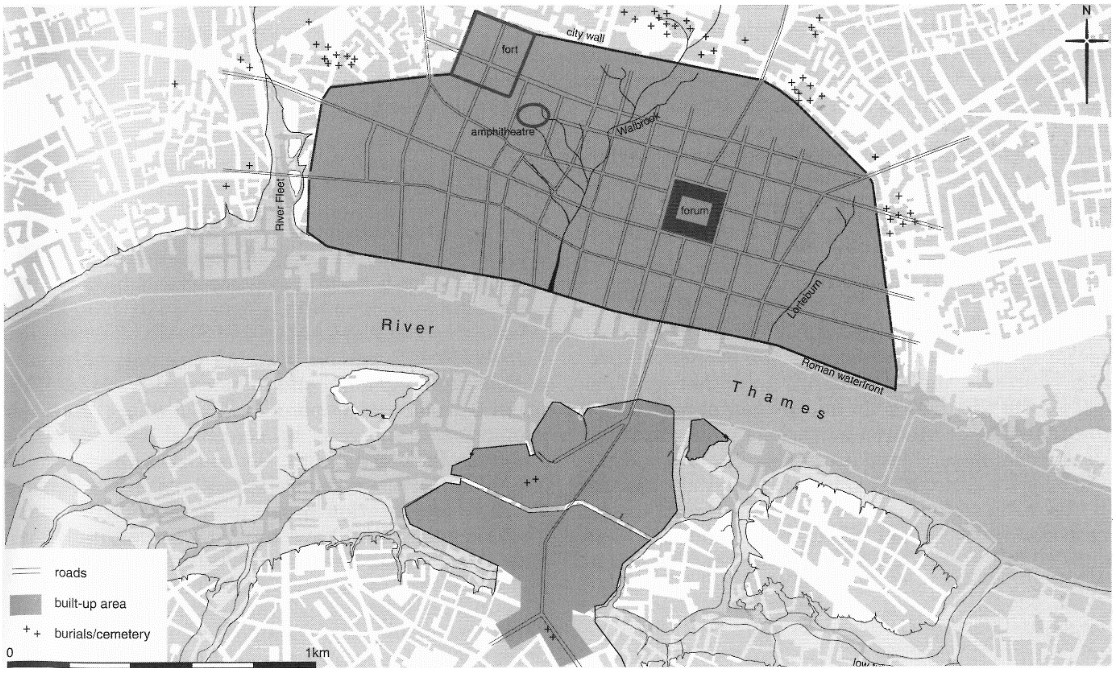


Figure 4 London in the early 3rd century (Rowsome, 2008, fig. 1.3.7).

1). These changes have been seen as an indicating a shift in London's function; away from trade and towards administration (Hill and Rowsome, 2011, p. 445).

Part of the reduction in the number of properties may be attributed to the amalgamation of narrow strip plots and the construction of larger masonry buildings 'concerned with status and display' (Hill and Rowsome, 2011, p. 370), containing larger households (Hill and Rowsome, 2011, pp. 367–9; Perring, 2011, p. 273, 2015, p. 33). Several temples were built in the 2nd century (Perring, 2011, 2015, p. 33; Killock *et al.*, 2015), and the city wall was built in the 3rd century, although the date of construction is debated (Sheldon, 2010; Perring, 2015, pp. 33–4). However, other public buildings go into decline is this period, with the forum being demolished at the end of the 3rd century (Brigham, 1990, p. 82). The port continued to be developed into the early 3rd century, but was also demolished in the late 3rd century with the construction of the riverside wall (Perring, 2015, pp. 33, 35).

Heavy truncation of the upper layers of archaeology, keyhole excavation and a lack of dendrochronological dates have obscured our knowledge of the latest phases of Roman London (Gerrard, 2011a, pp. 182–3; Perring, 2015, p. 38). Gerrard (2011a, Illus. 2-3) has recently mapped late 4th century pottery and coins in the city, suggesting that, *contra* previous models, much of the walled area and Southwark continued to be occupied in some capacity. Nevertheless, the city appears to have been completely abandoned by the late 5th century, with Anglo-Saxon occupation occurring c.1 km west of the Roman city (Gerrard, 2011a, p. 190; Cowie and Blackmore, 2012).

2.2 Geography and Zoning

There is debate in the literature on Roman London as to whether the city should be seen as a single entity or 'as an agglomeration of several specifically defined functional zones' (Monteil, 2004, p. 10). It has been argued that London's three main 'zones' (Cornhill, Ludgate Hill and Southwark) formed distinct legal entities, inhabited by different populations (Millett, 1994, pp. 433–4; Wallace, 2014, pp. 6, 44). Grimes (1968, pp. 38–9) first suggested, after the discovery of the Cripplegate Fort on Ludgate Hill, that London was divided into two zones; a military zone to the east and a civilian zone to the west. This theory was later expanded, with the eastern settlement on Cornhill characterised as a free civilian settlement, military settlement on the western hill, and a settlement of non-citizens on the south bank of the Thames (Millett, 1994, pp. 433–4; Rowsome, 1998, p. 38, 2008, p. 30).

Investigation of the differences between these 'zones' was a key component of Wallace's (2010, 2014) recent thesis on the development of the pre-Boudican city. In this work, Wallace (2010) argued for differences in the road layout (ibid, p. 94), building types (ibid, p. 145), waste disposal practices (ibid, p. 148), economic activities (ibid, pp. 157, 166) and foodways (ibid, pp. 168, 175) of these different 'zones'. Differences between these 'zones' have also been identified in the consumption of pottery and small finds (Monteil, 2004; Crummy, 2008). Others have suggested more localised activity 'zones' in the city, such as a 'zone dedicated to civic water supply' taking up an *insula* on Ludgate Hill (Blair *et al.*, 2006, p. 9). However, it would be inappropriate to assume that London was divided into static 'zones' which existed since the city's inception. Whilst Wallace (2014, p. 178) found evidence for different communities inhabiting the different 'zones' of Roman London, none of these were internally homogenous. It is perhaps more helpful to see Roman London as a place in which a number different activities and lifestyles were practiced, some of which agglomerated at different points in time, rather than artificially dividing the city into a number of topographically defined units (Creighton, 2006, pp. 106–7).

Recently synthesised evidence from the city suggests that there was little zoning of craft activities in the 1st century, with metalworking (Hammer, 2003, p. 168), glassworking (Wardle, 2015) and pottery production (Rayner, 2017) all represented by small-scale workshops scattered across the city. From the 2nd century these industries do coalesce into defined zones, however. Copper-alloy and ironworking focusses on an area in north-western Southwark (Hammer, 2003), whilst pottery (Seeley and Drummond-Murray, 2005; Rayner, 2017) and glassmaking (Wardle, 2015) are found in the upper Walbrook valley, between the stream itself and the area of the Cripplegate fort. It is not clear to what extent this pattern may have been followed by other crafts, such as leatherworking or woodworking, the waste from which is less likely to be preserved outside the waterlogged areas of the city. This 'zoning' may be disrupted in the Late Roman period, when there is evidence for glassworking (Chapter 6.8) and metalworking (Chapter 6.4) outside of these defined areas. Unfortunately little is known about the economy of the Late Roman city, and so it is difficult to contextualise these emerging trends. The London tools have a clear contribution to make to this debate, as their distribution may indicate the 'zoning' or otherwise of crafts in the city.

2.3 The People of London

Tacitus (*Annals*, 14.33) described London as 'much frequented by a number of merchants and trading vessels', and archaeological discoveries have supported this impression of London as a commercial hub. The extensive waterfronts (Bateman and Milne, 1983; Milne, 1985; Miller, Schofield and Rhodes, 1986; Brigham and Hillam, 1990) and large *forum* (Marsden, 1987; Brigham, 1990) provided the facilities for trade, whilst imported exotic goods ranging from marble (Pritchard, 1986, pp. 171–5) to food (Livarda and Orengo, 2015) show that London was receiving more long-distance trade than other towns in Britain at the time. Recent discoveries complementing this picture include an inscription from Southwark (RIB 3014), erected by a Gallic trader who referred to himself as a 'Londoner' (*Londiniensi*) (Tomlin, Wright and Hassall, 2009, pp. 30–1; Killock *et al.*, 2015), and the large numbers of writing tablets from Bloomberg, which mainly deal with financial and legal transactions (Tomlin, 2016). Traders have been seen as a key driving force in the foundation and development of the city of London (Creighton, 2006, p. 99; Millett, 2016, p. 1695).

There is also evidence of native Britons living in the city. Roundhouses from Southwark (Toppping's Wharf, Watson, Brigham and Dyson, 2001, p. 13), the Walbrook valley (CID90) and Ludgate Hill (GPO75, GSM97) (Perring and Roskams, 1991, p. 101; Casson, Drummond-Murray and Francis, 2014, fig. 20) indicate the presence of native communities around the periphery of the early town, some of whom were engaged in manufacturing beads and metalwork. 'Non-citizens' are thought to have made up a large part of the population of Southwark (Millett, 1994, p. 433), where the ironworking industry may have been dominated by native families throughout the Roman period (Hammer, 2003). Creighton (2006, p. 101) considers the possibility that native elites were involved in public benefaction.

Another significant element of London's population would have been the military. Although the existence of a conquest-period fort is disputed, two later military installations are known to have existed in London; a small fort at Plantation Place, Cornhill (FER97), which was occupied from the Boudican revolt until c. 85 AD (Dunwoodie, Harward and Pitt, 2015), and a larger fort at Cripplegate, Ludgate Hill, from c. AD 120 to the latter half of the 2nd century (Grimes, 1968, pp. 15–46; Howe and Lakin, 2004; Shepherd, 2012). Rather than forming a garrison, these installations have been interpreted as evidence of troops passing through the city to other theatres, or working in the city in administrative capacities (Millett, 2016, pp. 1696–7). Military presence in the city has also been reconstructed based on classical documents and epigraphy (Hassall, 1973, 2012), and several of the Bloomberg writing tablets relate to military activity (Tomlin, 2016, p. 56). Soldiers can also be witnessed in the artefact record (Rayner, 2009, pp. 42–4; Wardle and Rayner, 2011), although a catalogue of the military equipment from the city, in progress since 1986 (Bishop, 1989), remains unpublished. Beyond simply looking for the presence of military objects, some have looked for military-style consumption patterns in other finds from London (Creighton *et al.*, forthcoming; Crummy, 2008, p. 219), and in architecture

(Ebbaston, 1988; Millett, 1994, p. 434), arguing that Ludgate Hill was somewhat military in character even before the construction of the Cripplegate Fort.

Whilst previous interpretations of the people of London have therefore described a diverse population, including immigrant traders, soldiers, native Britons, administrators and competitive elites, the current study has the potential to tell us about a rather different group of people; those who made things. These people have received some attention in the past, often through brief discussions of their tools (Marsden, 1980, pp. 73–4; Morris and Macready, 1982, pp. 274–5; Merrifield, 1983, pp. 100–6; Hall and Merrifield, 1986, p. 37), and in a short paper by Hall (2005), but this will be the first large-scale, systematic project dedicated to understanding craft and agricultural workers in the Roman city.

Chapter 3- Previous Studies of Roman Tools

In order to contextualise this project and identify potential research avenues and pitfalls, this chapter will trace the development of thought on the study of tools. Although it is often supposed that there has been little research into Roman tools, with most Anglophone authors relying almost exclusively on the seminal works of Manning (1976b, 1985a) and Rees (1979), scholarship on the subject in fact draws on a large pool of work dating back over a century. Several major works on tools, most of which are not available in English, deserve to be part of the canon of works regularly used by those studying Roman artefacts (Gaitzsch, 1980; Pietsch, 1983, 1988, Duvauchelle, 1990, 2005, Tisserand, 2001, 2010; Hanemann, 2014).

Although superficially similar, these works derive from a range of different scholarly traditions, including secondary historical works and dictionaries (see p.15), tool and trade histories (see p.20), artefact production studies (see p.25), museum catalogues (see p.18), regional artefact surveys (see p.25), excavation reports (see p.31), ironwork hoard reports (see p.17), and reports of exceptional finds (see p.34). These different traditions will be explored in this section in broadly chronological order.

This thesis is concerned with the tools of the Roman period. However, previous scholarship from other periods can still be useful. The most relevant non-Roman literature is that which considers the Iron Age and Early Medieval periods, as there is the clear potential for continuity between these periods. Scholarship on tools of the Late Medieval period will also be relevant, as the nature of society and the evidence (semi-historical urban society in Northern Europe) is broadly comparable with that of the Roman period. Whilst this project is concerned specifically with Roman London, information from across the Roman world will be considered, with a bias towards the Northern provinces.

3.1 Classical Sources, Secondary Historical Works and Dictionaries

The oldest surviving works dealing with Roman tools are of course the works of Roman writers. Tools receive mention in a range of classical sources, including lexica and glossaries, lists of equipment, and literature (White, 1967, pp. 5–7; Ulrich, 2007, p. 15). These sources were the sole dataset of the earliest works on Roman tools; the Classical Dictionaries and encyclopaedias which aimed to provide definitions for the terms used by ancient writers. Attempts to marry the Latin terms for tools with excavated finds and monumental depictions of them have become a key theme in the study of tools ever since. This has been attempted by Ulrich (2007) for woodworking tools, Ling (1976) for the tools used in stuccowork, by several authors for agricultural and gardening tools (White, 1967; Frayn, 1979; Farrar, 1998; Kelly, 2000), and Harvey (2010) for the tools from the Boscoreale villa.

Particularly noteworthy contributions to this genre come from K.D. White (1967, 1975). By using a scientific method, White (1967, p. 6) sought to overturn the 'ill-founded conjectures' of earlier works on the principle that 'by piecing together a number of scattered references it is often possible to obtain a relatively clear picture of both the form and functions of a particular implement' (White, 1967, p. 7). White systematically combed documentary sources for references to tools, before combining the descriptions of each tool with etymological analysis of its name. This information was then compared to excavated tools, depictions of tools in mosaics, manuscript illustrations and sculpture, and tools still in use in Greece and Italy. In this way, White reconstructed the tools and techniques of Roman agriculture, providing a form of typology. A similar method was later used by Kelly (2000) for the farming tools of early medieval Ireland.

However, White's findings cannot be applied uncritically to the archaeological record. White is essentially looking for tools which could fit the descriptions in classical sources, rather than using the intrinsic evidence of the archaeological record. This fundamental logical obstacle would not easily be surmounted by White's suggestion that the archaeological material should be properly catalogued. Moreover, White's sources (classical writers in ancient Italy, 4th century mosaics from North Africa and modern tools in Italy and Greece) are much more limited in application than White claims. None of these sources derive from Britain, let alone London, and are therefore of limited usefulness to this study.

Rees (1979) and Gaitzsch (1980) also considered the evidence of classical sources, but found that 'Latin terminology contributes little to the formal identification of Roman tools' (Gaitzsch, 1980, p. 257) because 'the shapes of agricultural tools are rarely described in any detail' (Rees, 1979, p. 308). Ottaway (1989, p. 132) is similarly sceptical about the usefulness of applying Old-English names to archaeological finds. Nevertheless, Gaitzsch (1980, p. 258) and Manning (2014b) found Latin terminology useful in considering the organisation of labour in the Roman period.

3.2 Ironwork Hoards Reports

The earliest works in English archaeological literature to deal with Roman tools were publications of exceptional finds of hoarded metalwork. The most well-known are the early finds from Great Chesterford (Neville, 1856), Silchester (Evans, 1894) and Newstead (Curle, 1911), but ironwork hoards have continued to be found since, and large numbers of hoards are now known from both Britain and Continental Europe (Piggott, 1952; Manning, 1972a; Hingley, 2006; Hanemann, 2014; Humphreys, 2017a). The first of these hoards were found at a time when ironwork was rarely reported, but these finds were deemed so exceptional that many were published (although Manning (1972a) lists other hoards discovered in this period which were either published in a fragmentary manner or not at all). The museums that these collections were displayed in were also greatly influential to the early scholarship on tools. The displays of Roman tools in the Reading Museum were frequently referenced in tool histories (Goodman, 1964, pp. 184, 205), and inspired children's books of the early 20th century (Figure 5). The chapter on tools in Ward's (1911) textbook on Roman Britain is entirely based on the Great Chesterford and Silchester hoards.

These early hoard publications provided descriptions, illustrations and comparanda for these tools. Neville (1856) and Curle (1911) also attempted to provide dates for this material, which Manning (1972a) considered accurate many years later. Function was not discussed in detail, although the identifications given were essentially functional. Typological discussion has continued to be a major aspect of hoard publications, culminating in Hanemann's (2014) recent work on German ironwork hoards, which provides detailed typologies and extensive comparanda for a range of metal object types, including tools.

The Newstead and Silchester assemblages were unusual in being used to discuss the character of the sites on which they were found. At Newstead the material was used to provide ‘a sense of the life that once moved within the fort’ (Curle, 1911, p. 277). Similarly, Thomson (1924, pp. 556–619) used the evidence from the Silchester hoards to add colour to his account of the town, discussing the tools and finished artefacts together to describe the different industries and professions taking place. The location of the tool hoards was also used to attempt to locate workshops within the city (Thompson, 1924, p. 592). In many ways these works prefigured the way tools would be published in large urban syntheses many years later (see p.32). However, these interpretations are complicated by more recent interpretations of these hoards, which see them as ritual deposits which do not necessarily directly reflect ancient craft practice (Piggott, 1952; Manning, 1972a; Hingley, 2006; Humphreys, 2017a).

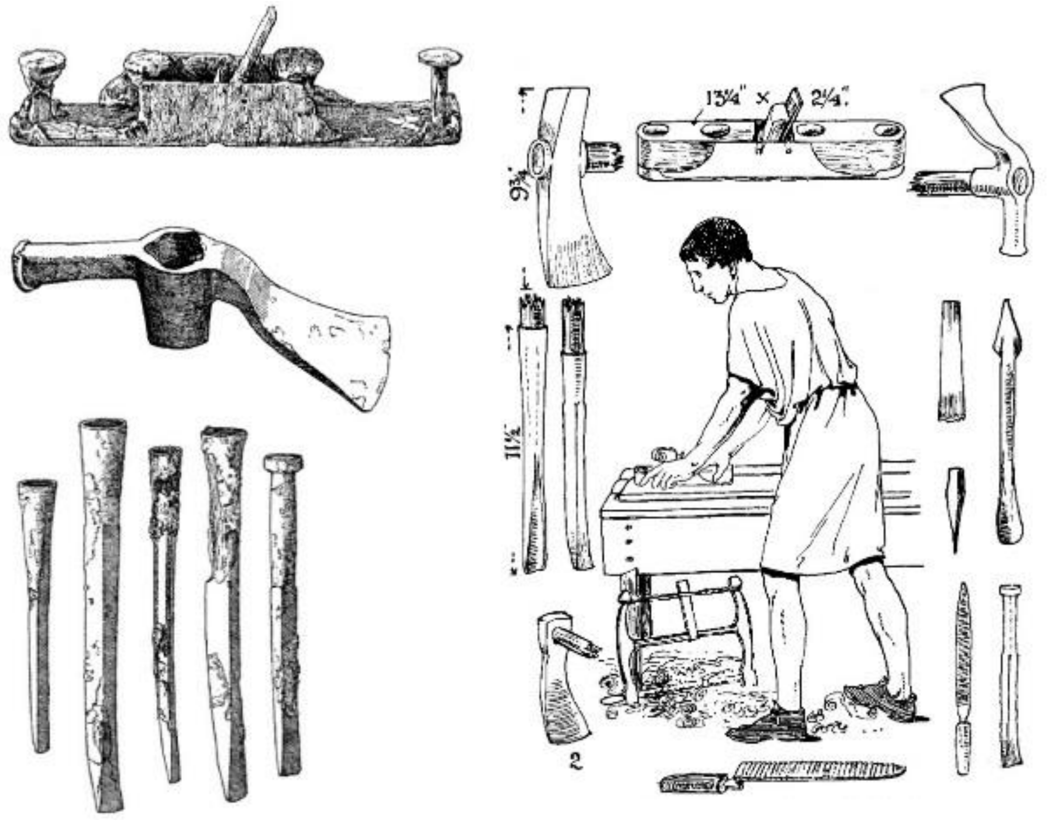


Figure 5 Roman woodworking tools from the Silchester hoard (left, Evans, 1894, figs 13, 15, 18) *and an illustration of a Roman carpenter from a children’s book* (right, Quennell and Quennell, 1959, fig. 53). *The tools from the children’s book are taken directly from those found at Silchester.*

3.3 Museum Catalogues

The 20th century saw the widespread publication of museum collections catalogues. Key early catalogues for the study of tools include Champion’s (1916) catalogue of the tools from Saint-Germain, and Flinders Petrie’s (1917) catalogue of the tools and weapons in the Egyptian collection in University College (most of which derived from his own personal collection (White, 1967, p. 20)), which also included numerous tools from across the Mediterranean and Northern Europe. More recent publications include Hayes’ (1991) publication of the European tools from the Royal Ontario Museum, and the publication of the collections of the Musée Archéologique de Saintes (Feugère, Thauré and Vienne, 1992).

Several catalogues have been produced of the collections of London’s museums, but London’s tools have never been fully published. Brief descriptions and illustrations of some of the tools later incorporated into the collections of the Museum of London can be found in the early catalogues of the Museum of London Antiquities (Roach Smith, 1854) and the Guildhall Museum (Library Committee of the Corporation of the City of London, 1903). A section dedicated to tools was incorporated into the Guildhall Museum’s later Roman catalogue (Wheeler, 1930, pp. 75–9), and other tools from London are published in Manning’s (1985a) British Museum catalogue, and in a short paper by Painter (1961). A new series of publications was proposed by the Guildhall Museum in the 1950s, including a book devoted to tools (Guildhall Museum, 1956, p. 2), but this never came about. These catalogues are therefore extremely out of date; mostly predating the major excavations of the 1950s, as well as the significant commercial excavations of recent decades. Despite a drive to publish the Museum of London’s Medieval collections in the 1990s (Cowgill, de Neergaard and Griffiths, 1987; Grew and de Neergaard, 1988; Egan and Pritchard, 1991; Crowfoot, Pritchard and Staniland, 1992; J Clark, 1995; Spencer, 1998; Forsyth and Egan, 2005), the Roman collections remain largely unpublished. In none of these catalogues are the tools used to inform discussions of the city. The Guildhall Museum’s Medieval catalogue (Ward-Perkins, 1940) is nevertheless notable for establishing some of the first typologies of medieval tools and ironwork.

By far the most influential museum catalogues for the study of tools are Manning’s catalogues of the ironwork from Newcastle’s Museum of Antiquities (Manning, 1976b, now part of the Great North Museum) and the British Museum (Manning, 1985a). Newcastle’s collection was comprised mostly of material from forts along Hadrian’s Wall, chiefly Housesteads (Manning, 1976b, p. 8), whilst the British Museum held the objects from Hod Hill, alongside numerous finds from London and East Anglia (Manning, 1985a, p. xvi). In both cases some of the artefacts had been published previously (Manning, 1976b, p. 8, 1985a, p. xvii), but in a fragmentary manner with significant omissions.

Building on his unpublished PhD thesis (Manning, 1970b), Manning’s work is primarily typological, intended to be used as reference material by other finds specialists. As well as describing the functions of the tools, Manning provided classification schemes and extensive comparanda. Both publications have been very successful, and are frequently cited in ironwork reports to the present day. This is, however, the limit of their scope. Despite the shortcomings in their data collection, by assembling these bodies of artefacts from multiple sites the opportunity existed to discuss the wider possibilities of tools as data for illuminating regional, chronological and inter-site differences. Manning's (1976b, pp. 1–8) introduction sets his Newcastle data within archaeological debates about continuation of form from the Iron Age, changes in tool form within the Roman Period, and the position of the smith and the army in Roman society, but this is not followed up in any analysis or conclusion based on the tools.

3.4 Tool and Trade Histories

3.4.1 Studies of Ploughs and Cultivation Tools

From the late 19th century, and increasingly in the early 20th century, cultivation tools became an object of intense study. The amount of research undertaken into the history of the plough is 'extraordinarily voluminous' (Fussell, 1966, p. 178) and has sparked international conferences (Michelsen, 1956) and dedicated journals (Steensburg, 1993). Spades have also been discussed (Duignan, 1944; Fenton, 1962; Gailey and Fenton, 1970; Steensburg, 1973; Myrdal and Sapoznik, 2016) as tillage tools, but to a much lesser extent, whilst harvesting tools were also explored in this period (Steensburg, 1943, see 'Regional Surveys' below).

The scholars involved in this field included many linguists, ethnographers and museum curators as well as historians and archaeologists. Like those involved in tool histories (see below), many had 'country backgrounds and practical training' (Steensburg, 1993, p. 19). As a result, a wide variety of data sources have been utilised. Common sources of information include representations of ploughs in rock carvings, sculpture and manuscript illuminations, references in classical, biblical and medieval documents and laws, the shapes of fields, preserved plough-scars, ethnographic parallels to tools in folk museums and traditional societies, and the etymology of the names for ploughs and related equipment. Some studies (Puhvel, 1964; Forni, 1997; Kelly, 2000) focus on one source of evidence, but most have used a combination (Tylor, 1881; Gow, 1914; Harrison, 1916; Curwen, 1927; Karslake, 1933; Fussell, 1933, 1966; Duignan, 1944; Payne, 1947, 1957; Michelsen, 1956; Aitken, 1956b; Aberg, 1957, 1958; Stevenson, 1960; Fenton, 1962; Manning, 1964b; Myrdal, 1993, 1997; Cheape, 1993; Hill, 2000; Fowler, 2002, pp. 182–204; Klápště, 2016). Experiments with replica implements were also common (Aberg and Bowen, 1960; Hansen, 1969; Reynolds, 1982; Rees, 1983). The physical remains of ploughs have not often been pivotal to this tradition, as so few plough elements survive. These broad datasets were not always relevant to the period or place under discussion. Bronze Age rock carvings found in the Alps, for instance, have been cited as evidence for the number of oxen used to pull ploughs in Britain (Curwen, 1927; Payne, 1947). Other studies have been more selective, and Myrdal (1993) has demonstrated how important information about plough development can be gained from just a few well-chosen sources (in this case the dimensions and weights of shares from archaeological contexts and museums, and documentary records from share factories).

The plough has been rightly described as having 'its own considerable hagiography' (Myrdal, 1993, p. 72), with much of the scholarship continually revisiting a number of key debates; namely whether the plough began as a human- or animal-powered device, the nature of plough teams and oxen formations, the relationship of the plough type to field shape, the presence or absence of wheels, mouldboards, and coulters, the adaptation of the plough to different soil conditions and agricultural schemes, the number of plough types in use at any one time, the ability of the plough to create true furrows and turn over the sod, the usefulness of ards and their ability to till heavy soils, and the effectiveness of different share types. Many of these debates have been present in the literature since the 19th century (Tylor, 1881) and continue to the present day (Fowler, 2002, pp. 182–204; Klápště, 2016).

Most of these debates are related to function, reflecting Steensburg's (1993, p. 19) view that 'the working processes of agriculture ought to be stressed, and the farming tools should be studied not from a typological viewpoint but as expressions of the work they had been carrying out.' This tradition of scholarship nevertheless placed an emphasis on standardised terminology and recording practices, even to the point of proposing international standards for plough recording (Aitken, 1956a; Michelsen, 1956). Typological discussion of Roman plough elements can be found in a number of ironwork catalogues and regional surveys (Manning, 1964b, 1985a; Rees, 1979; Pohanka, 1986; Hanemann, 2014). Aside from a few sporadic references (Tylor, 1881, p. 78; Aberg, 1957, pp. 171, 174; Manning, 1971) little attention has been paid to the ritual aspects of ploughing, although these may have been key to the deposition of plough parts (Hingley, 2006; Humphreys, 2017a).

The plough has also been seen as a marker of ethnic movement and social development. Debates about plough form have been linked to the movement of ethnic groups, and much time has been spent attempting to define the 'Celtic', 'Belgic', 'Roman', 'Anglo-Saxon', or 'Slavic' plough (Curwen, 1927; Karslake, 1933; Šach, 1956). This thread of scholarship is firmly rooted in the culture-historical tradition of many early writers, and the mechanisms of this technological exchange are often underdeveloped. The plough has also been seen as an instrument of social change, with the arrival of the heavy plough and strip field system interpreted as evidence for a medieval-style manorial system of farming (Karslake, 1933; White, 1962). Others have vigorously rejected this technologically deterministic view (Sawyer and Hilton, 1963), but debates about the effect of plough form on field shape and agricultural regime continue, particularly in medieval studies (Myrdal, 1997; Williamson, 2003).

The most accessible summary of the evidence for Roman ploughs in Britain remains Manning (1964b), although detailed analysis is also provided by Rees (1979, pp. 42–9) and White (1967, pp. 123–45). Simpson (2000, pp. 117–121) provides a discussion of the Continental evidence.

3.4.2 Studies of Craft Tools

From the mid-20th century, this interest in tools spread to craft tools (Walker, 1982, p. 349), with studies emerging of both specific tools (e.g. the saw (Jones and Simons, 1961)) and functional groups of tools, such as those used in carpentry (Goodman, 1964; Salaman, 1975; Walker, 1982; Noël, 1988). A related tradition is that of industrial and trade histories. These works examined multiple aspects of different commercial processes, and frequently incorporated brief discussions of the tools used (Davey, 1961; Farrar, 1998; Sim and Ridge, 2002; Ulrich, 2007). Like studies of agricultural tools, many authors in this tradition make reference to having a practical background in the craft under consideration (Goodman, 1964; Blagg, 1976; Sherlock, 1978; Sim and Ridge, 2002), or wrote for an audience of modern tool users (Jones and Simons, 1961; Goodman, 1964) or collectors (Mercer, 1929; Groves, 1966; Salaman, 1975, 1986). An unusual paper by Childe (1944) attempted to give a brief account of the whole of human history through tools, for the benefit of the Young Communist League.

These works drew their information from a wide range of sources, including tool marks, depictions of tools in sculpture, mosaics and illuminations, documentary and literary sources, Latin terminology, analogy with modern tools, and the tools themselves. The better studies utilised these broad datasets to highlight incongruities between the different sources. Goodman (1964, p. 190), for example, noticed the differences between the types of rulers depicted on Roman tombstones and those found archaeologically, which may indicate differences between the (presumably wooden) tools used by local craftsmen, and the standardised bronze tools of officials. A similar argument has been proposed for the small bronze trysquares of the Roman period (Chapman, 1979, p. 406). However, instances like this are the exception, and the majority of these studies do not treat the data in a critical manner, especially when discussing ancient tools.

Most of the authors were not archaeologists, and it was beyond the scope of their work to survey and catalogue the excavated data. Many stress the limitations of the archaeological record (Goodman, 1964, p. 10; Blagg, 1976, p. 153; Ulrich, 2007, pp. 13–6), echoing the sentiments of contemporary archaeologists, who lamented that 'no adequate treatment of Roman tools and similar metal objects in Britain exists' (Piggott, 1952, p. 9). Whilst archaeological examples of tools were used, most studies only used well-preserved objects from large collections found in prominent museums. Frequently cited Roman examples include the Silchester, Newstead and Saalburg collections. The evidence for Roman carpenters' tools presented by Ulrich (2007), therefore, is very similar to that presented by Goodman (1964) and Liversidge (1976), albeit with the inclusion of some more recent finds and a broader selection of documentary sources. Some more archaeologically-based discussions were only simplified restatements of earlier work (Manning, 1976a, 2011; Goodall, 1981; Rees, 1981b, 2011).

Roman tools were rarely the sole focus of these studies. Many tool histories examined tools in a broad historical perspective, with ancient tools taking up a comparatively small part of the discussion. Their treatment of ancient tools was often much less rigorous than that of modern tools. Goodman (1964), in common with many other tool histories, examined tools from the stone-age until the modern period, drawing information from sources from all of Europe and parts of the Near East and North Africa, and only dividing it into broad periods such as 'Roman' or 'Iron Age'. This *longue durée* approach allowed Goodman to identify periods of technological stagnation, such as in Ancient Egypt (Goodman, 1964, p. 17), or Northern Europe in the early Iron Age (Goodman, 1964, p. 14), and periods of rapid innovation, chiefly the Roman period, and the 15th and 18th centuries (Goodman, 1964, p. 8). Perhaps the most important interpretation to come out of this tradition was the assertion that tools have changed and developed over time (Goodman, 1964, p. 8; Walker, 1982, p. 355). Whilst the forms of ancient and modern tools display 'superficial resemblances… in almost every detail of their design and construction there have been considerable changes and improvements in the course of time' (Goodman, 1964, p. 8). This observation results from Goodman's *longue durée* approach and familiarity with modern tools. Subsequent writers on woodworking tools who lacked this perspective (Noël, 1988, p. 113; Ulrich, 2007, p. 4) have continued to promulgate the idea that tools are unchanged relics of the past. However, the discussion of broad period divisions meant that changes within his single 'Roman' period, as well as geographical variations, were not noticed.

This is an issue that can even be found in studies that only examine Roman material. Ulrich (2007, p. 14) felt justified in using data from across the Roman Empire because 'there does not seem to be a wide variation among a given tool type between different provinces…there is also little change over time in terms of physical form.' This draws on Gaitzsch's (1980, p. 259) observation that 'no fundamental formal distinctions can be determined between tools from Italy and those from the northern provinces', but it was only these regions, not the entire Roman Empire, that were the limit of Gaitzsch's study. Gaitzsch also found evidence for differing traditions between the North and South, and East and West parts of the Empire, as well as differences in the types of tools found on different settlements. Form is discussed throughout many of these works, but only in so far as it affects functional interpretation. As a result no archaeologically useful typologies were developed by these authors.

Part of the issue is that in studies devoted to a specific period, tools often formed only a small part of wider projects to understand a specific ancient craft in its context. Blagg (1976) was studying stonemasons' tools and techniques as a preliminary exercise to a broader study of ancient sculpture, whilst Ulrich's (2007) chapter on woodworking tools was part of a book on Roman woodworking more generally. In the case of industrial histories, treatment of tools can be extremely cursory. This uncritical approach to the data precludes the possibility of discovering meaningful regional or chronological differences, and the result is a homogenised view of ancient tools and crafts. The lack of diversity in Roman tools is a self-fulfilling prophecy if every study 'treats the tool as a definite fact and does not engage in chronological or miniscule typological classifications' (Glušćevič, 2014, p. 56).

Practical interpretations were of prime importance to many of these studies, with common themes including function and operating technique, efficiency, and the manufacture and technology of tools. This perhaps derives from the fact that many of the authors were craftsmen themselves, or only examined tools in order to understand the production process. As such, one of the few social interpretations to be advanced in this category is a consideration of the craftsman and their position in society (Goodman, 1964; Sim and Ridge, 2002; Ulrich, 2007). Other social interpretations were certainly possible, however. Goodman (1964, p. 78) considers how geographical and cultural differences are reflected in the differing forms of 17th and 18th century Dutch and British planes, but this sort of analysis is not applied to the homogenised Roman tools. The double-headed axes produced in Minoan Crete, which Goodman (1964, pp. 20–1) dismissed as 'a bit of a dead end' and a 'gimmick', could instead have been discussed in terms of their 'religious and political significance'.

3.5 Artefact Production Studies

From the 1970s, a number of works appeared which considered how artefacts had been made. These studies are distinguished by their use of experimental archaeology and scientific analysis, focussing on the tool marks and other marks of production seen on finished objects. As such they form an interesting bridge between studies of tools and other artefact studies. In Roman archaeology, these techniques have been used on a range of wooden (Weeks, 1978; Pugsley, 2003), metal (Maryon, 1948; Manning, 1976c; Saunders, 1977; Craddock and Lang, 1983; Lang and Hughes, 2016), and stone objects (Wooton, Russell and Rockwell, 2013).

As well as reconstructing the production process in a general way, these methods can be used to examine tools specifically. For example, Hobbs (2016, p. 264) has compared the beaded rims of various vessels in the Mildenhall treasure to identify groups of marks made by the same tools. These approaches can also be applied directly to tools themselves. Tylecote and Gilmour (1986) performed metallographic analysis on a number of tools to see how they had been constructed, providing a new means of comparison beyond traditional form analysis, allowing the results to be compared to Continental examples. However, a recurring theme in these works is the discovery of tool marks that cannot be accounted for by the tools we find archaeologically (Hewitt, 1982; Walker, 1982, pp. 350–1; Sands, 1997), highlighting how incomplete the record of surviving tools is.

Although this thesis will not be performing any new scientific analysis, comparative data on tool use is available in London, where numerous excavation reports have provided sections on wooden, leather and bone objects, sometimes including discussions of tool marks. It will be important to compare these data with that gained from studying the tools themselves.

3.6 Regional Artefact Surveys

At the same time as Manning's ironwork catalogues were being compiled, a number of postgraduate theses were published which addressed many of the identified shortcomings of tool scholarship up to that point, most notably by providing regional surveys of specific tool types. The works produced in this tradition, mainly from the late 1970s to the early 1990s, remain some of the most important to the study of ancient tools.

3.6.1 Surveys of Agricultural Tools

An interesting precursor to these works is Steensburg's (1943) study of harvesting tools. Steensbug collected together all of the known reaping tools (sickles, scythes, scythe-sharpening tools and harvesting knives) in Danish museums dating from the Neolithic period onwards.

Steensburg created typologies of the flint (Steensburg, 1943, pp. 30–33) and bronze (Steensburg, 1943, pp. 68–72) sickles based on measurements of curvature, and carried out metallographic analysis (Steensburg, 1943, pp. 88–9) and controlled experiments with archaeological artefacts and replicas (Steensburg, 1943, pp. 10–26). Steensburg (1943, pp. 122–248) also constructed a history of the evolution of harvesting tools up to the present day, using data from a broad range of sources including ethnography, manuscript illuminations, sculpture, wall paintings, documentary sources and inventories, as well as his own dataset and other archaeological finds from across Europe and the Mediterranean region. This section included one of the earliest examples of distribution analysis in relation to tools, with Steensburg (1943, pp. 141–4) looking at the proportions of tools with different blade shapes in different counties. This study was in many ways ahead of its time, and the methods of data collection and analysis performed here prefigured other comparable regional surveys by over 30 years. Nevertheless, Steensburg's analysis reflects his interests; he sees tools as the result of adaptations to the landscape, and changes in tool use as a result of changes in culture and natural conditions (Steensburg, 1943, p. 243). As with the study of the plough, cultural factors not related to working processes receive little mention, and there is no discussion of context.

Work of this type on Roman agricultural tools has been carried out sporadically since the late 1970s. Rees' (1979) PhD thesis, *Agricultural Implements in Prehistoric and Roman Britain,* was the first, collecting together all of the primary agricultural tools from museums in Britain dating from the Neolithic to the Roman period. Although Rees' data was no different to that used by Manning (examination was visual, and many of the finds lacked contextual data), Rees' work is distinguished by her use of these data to answer specific research questions. By looking at site type and considering a broad geographical area, Rees was able to provide the first analysis of the distribution of tools in Britain. This demonstrated that different tools appeared on different site types. Entrenching tools and iron-shod spades, for example, were only found on sites that demonstrated a high degree of 'Romanisation', whilst spuds were only found on civilian sites. This allowed Rees to examine not only the development of tools and types, but also the differences in economy in different parts of the country, and the extent of agricultural specialisation in different areas and on different site types.

Comparable studies are available for Continental material. Pohanka (1986) has studied the agricultural tools from the provinces of *Raetia*, *Noricum* and *Pannonia*. As well as providing typologies, Pohanka discusses change over time and regional variation in these tools. Penack (1993) has collected the harvesting tools from Free Germany. More recently, Marbach has produced two surveys of the 119 pieces of plough equipment (Marbach, 2004) and 16 complete scythes (Marbach, 2012) from Roman Gaul and Upper Germania. These surveys follow Steensburg's (1943) example, incorporating metallography and calculations of geometry to produce a very technical account of these tools. These objects are also compared with those previously published by Rees (1979) and Pohanka (1986).

3.6.2 Surveys of Craft Tools

Unfortunately there has never been a comprehensive survey of the Roman craft tools of Britain. Regional surveys have been conducted on the Continent, however, by Gaitzsch (1980) and Pietsch (1983, 1988). Less systematically curated but nevertheless useful is Hoffman's (1985) compilation of images of various Roman tools from French publications, which is not accompanied by any discussion.

Gaitzsch's (1980) *Eiserne römische Werkzeuge (Roman Iron Tools)* looked at the craft tools from Italy and the Northern Provinces, most importantly those from Pompeii, although excluding household and agricultural tools. Gaitzsch considered the regional and chronological variations in these tools, and found a high degree of standardisation in form across the Northern Provinces (Gaitzsch 1980: 259), with some tools perhaps conforming to standardised measurements (Gaitzsch, 1980, p. 257). However, whilst form was constant, Gaitzsch, like Rees (1979), also found variations in the numbers of different tools represented in different cities, and on different site types (e.g. military and civilian), which may relate to differing production (Gaitzsch, 1980, p. 260), although interpretations were limited by the 'spotty' nature of the data.

These differences were expanded on by Pietsch (1983), who catalogued and re-evaluated the famous collections of iron tools from the *Limes* forts of Saalburg, Feldburg and Zugmantel. Inspired by Salaman (1975), Pietsch (1983, p. 6) attempted to discern local traditions in craft and agricultural tools by looking for variations in the formal aspects of tools, and chronological and regional groupings. Like Gaitzsch (1980), Pietsch found that most tools were distributed evenly among the sites, but differences were discernible. For example, Saalburg produced more agricultural tools, whilst Zugmantel contained more woodworking tools (Pietsch, 1983, p. 79). Tools were also more likely to come from the *vici* outside the defences than from the forts themselves (ibid), which may reveal aspects of fort organisation.

However, whilst Gaitzsch found uniformity in tool form, Pietsch was able to demonstrate variation. Civilian and military forms of tools could be discerned through the presence of lugged pioneering tools and high-quality elongated forgings on early military sites, which Pietsch (1983, p. 82) contrasted with lower quality tools more often found on civilian sites. By comparing his data to that from other sites, Pietsch (1983, p. 83) found that cultural differences inferred from other sources (such as those between *Raetia* and *Germania*) were reflected in different tool forms. Other tools found in Pietsch's survey were unparalleled elsewhere, which he saw as evidence for local traditions similar to those identified by Salaman (Pietsch, 1983, p. 83).

Changes in form over time could also be demonstrated, both by the introduction of new forms and in changes to the forms of existing tools (Figure 6). Pietsch (1983, pp. 80–2) interpreted these changes not simply in terms of technical improvement, but as responses to political and economic changes, changing production and distribution networks, ethnicity and possibly fashion. For example, new forms of tools were introduced in the 1st century (e.g. *dolabrae*), which Pietsch (1983, p. 79) associates with the arrival of the Roman army. Over time, some of these tools (e.g. entrenching tools and *dolabrae*) get smaller, which could be related to changing military tactics and the diminished importance of conquest (Pietsch, 1983, p. 80). Other tools (e.g. scythes) become longer and slimmer over time. As this would not necessarily lead to greater efficiency, it could be related to fashion and a more general trend towards exaggerated forms in Roman metalwork (ibid).

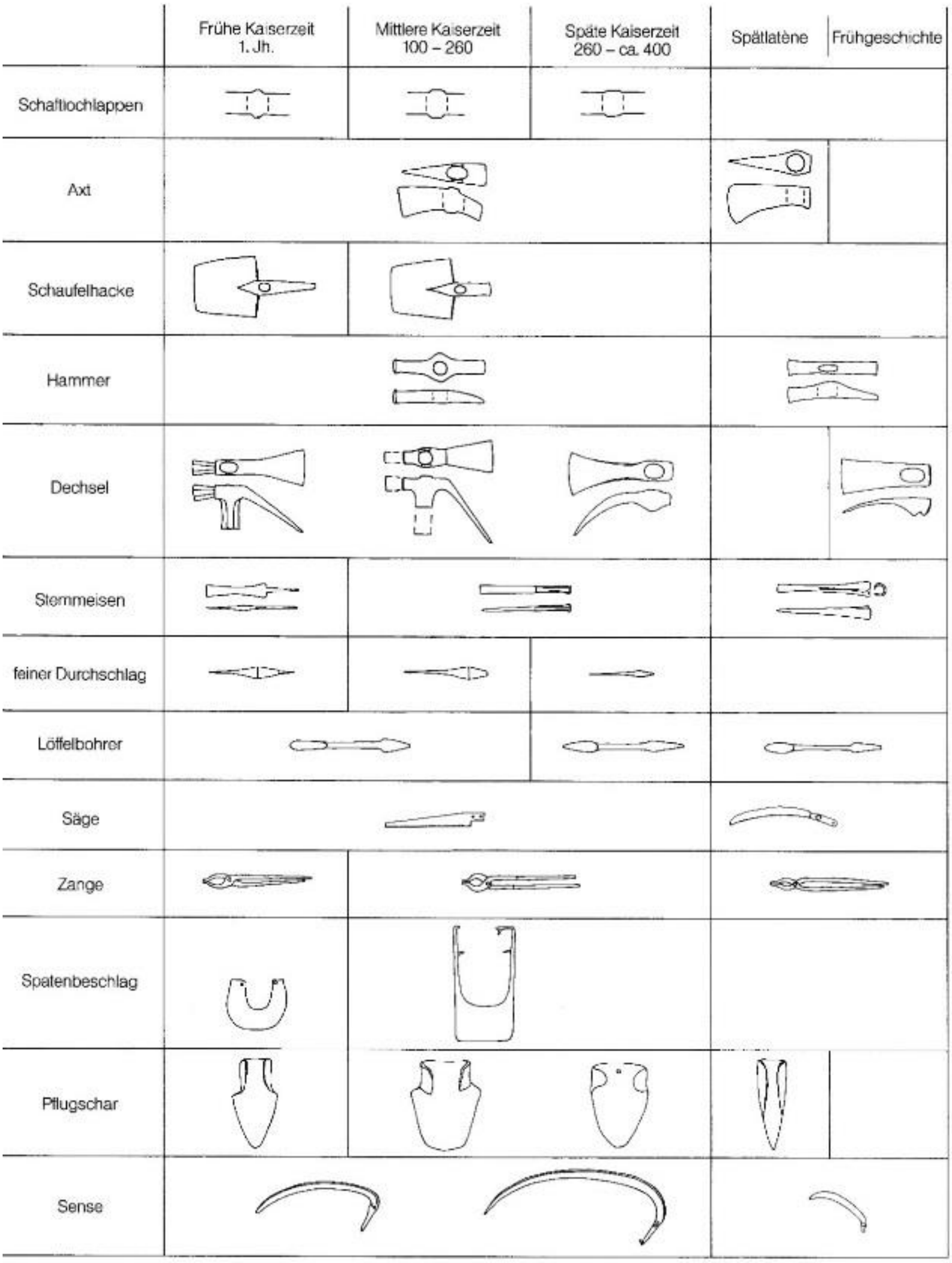


Figure 6 Pietsch's (1983) demonstration of evolving tool form between the Early (1st century), Middle (100-260 AD) and Late (260-400 AD) Roman periods. The column to the right shows tools of the Late Iron Age and Early Historic Periods (Pietsch, 1983, Abb. 26).

Pietsch (1983, p. 80) proposed that these changes occurred at times of political and economic change (the beginning of the 2nd century, and the end of the 3rd and 4th centuries), when general instability disrupted the mechanisms by which a formal repertoire of tools is disseminated. However, like most studies of tools, Pietsch's chronology is limited by the nature of the evidence. Divisions are only made between 'early', 'middle' and 'late' periods, and it is by no means certain that the changes seen between these periods occurred at the start or end of them. Further, in order to construct a chronology Pietsch used data from multiple site types; early material is mostly from legionary forts, whilst later material is more often from civilian sites. As such, it is possible that some of the differences seen could be reflections of differing traditions occurring simultaneously, but in different contexts.

3.6.3 Surveys of Non-Roman Tools

A number of comparable regional surveys exist for the tools of other periods. For example, detailed studies have been carried out of Iron Age craft tools. Fell's (1990) unpublished MPhil thesis provides a comprehensive survey of the Iron Age metalworking tools from England and Wales, including both excavated and museum finds. In a similar study, Darbyshire (1995) examined both metal- and woodworking tools, although only in the south of Britain. Fell's study included the use of x-rays and metallography, allowing her not only to create more accurate typologies based on form, but to examine the technology of the tools and ask whether their technology changed when the form remained constant (Fell, 1990, p. 303). Whilst there was not sufficient dating resolution to establish a technological chronology, this analysis did reveal developments in technology that could be contrasted with those seen in contemporary Continental finds, and used to infer specialisation and the status of metalworkers (Fell, 1990, pp. 304–7). Fell's work was also significant for examining the context of the tools, particularly their association with other metalworking evidence, allowing her to discuss the social dimensions of tool use. For example, the presence of metalworking evidence on small, undefended sites argued against metalworking being monopolised by local elites (Fell, 1990, p. 305), whilst the occurrence of metalworking evidence on a site over a period of centuries argued against the idea that metalworkers were itinerant (Fell, 1990, p. 306). Fell's contextual data also allowed consideration of the nature of deposition. Only a minority of the tools could be directly associated with metalworking evidence, with many of the rest (or potentially all of them (Fell, 1990, p. 283)) coming from burials, hoards and other potentially 'ritual' depositional contexts. This allowed Fell (1990, pp. 282, 284–5) to suggest potential ritual and cultural, as well as functional, reasons for their deposition.

Less detailed surveys have been carried out on early medieval tools. Ottaway (1995) has brought together a number of pieces of Anglo-Saxon ironwork from Britain, whilst Riley (2014) devotes a small book to Anglo-Saxon tools, unfortunately only illustrated with reproductions. Contemporary material from Slovenia is brought together by Ciglenečki (1983). An MPhil thesis by Asquith (1993) on early medieval tools from England has not been published. Later medieval tools can be found in Goodall's (originally submitted as a PhD thesis in 1980, published in 2011) *Ironwork in Medieval Britain*. Goodall drew his data from a range of sources, both published and unpublished, and from both modern and antiquarian excavations, principally Biddle's (1990) then-unpublished Winchester excavations. Each object is individually provenanced, but aspects of Goodall's selection criteria are not addressed. The published edition states that his chronological scope was 1066-1540 A.D., and that his data gathering stopped in 1980 (Goodall, 2011, p. x). However, it is not clear how sites were identified, how the objects were examined, or what the geographical scope of the study was. As such it is not possible to comment on how representative the data are.

3.7 Excavation Reports

3.7.1 Individual Site Reports

Since 1990, in Britain at least, there has been little archaeological work dealing solely with ancient tools. Manning (2011) and Rees's (2011) recent chapters in an edited volume on Roman material culture are essentially re-statements of their earlier work, although Scott (2017) has brought together some more recent tool finds from southeast Britain. This may be linked to a general decline in the number of PhD theses written on Roman small finds since the mid-1990s (Crummy, 2007, p. 65; Swift, 2007, p. 25), a trend perhaps attributable to the retirement of key supervisors. Changes to the funding of archaeological work since the growth of commercial rescue archaeology have also had an effect. Rather than dedicated volumes devoted to specific artefact types, discussions of ancient tools now take place within excavation reports.

Numerous excavation reports have included Roman period tools, and many more have doubtlessly gone unpublished. A regional survey collecting these tools together is badly needed. Published excavations which have produced significant numbers of tools include those at Alcester (Mould, 1994), Dorchester (Manning, 2014a), Gadebridge Park (Manning, 1974), Gorhambury (Wardle, 1990), Hill Farm (Manning, 1985b), Ickham (Riddler and Mould, 2010), Nantwich (Cool, 2012), Shakenoak Farm (Brodribb, Hands and Walker, 2005), Shepton Mallet (Moscrop, 2001), Usk (Manning, Price and Webster, 1995), Verulamium (Manning, 1972b, 1984a), Vindolanda (Blake, 1999, 2013b), Wanborough (Isaac, 2001) and Wilderspool (Thompson, 1965). Key Continental sites include Augst (Mutz, 1968, 1980), Haltern (Harnecker, 1997), Keszthely-Fenékpuszta (Rupnik, 2013a, 2013b, 2014), Magdalensberg (Mossler, 1974), Neuss (Simpson, 2000) and Xanten (Gaitzsch, 1993), whilst Feugère and Guštin's (2000) *Iron, Blacksmiths and Tools* contains tool assemblages from a number of smaller sites.

Discussion in these reports is often limited to identification, with finds classified based on Manning and Rees's typologies. More detailed analysis of context and distribution is sometimes attempted (Cooper, 1999; Scott, 2000), even on some small sites, but is often hampered by a lack of data (see Major, 2003, p. 77). Nevertheless, Wardle (1990, p. 138) was able to use tools to infer activity zones and agricultural schemes at the Gorhambury villa (Neal, Wardle and Hunn, 1990, p. 97), whilst Murphy and Poblome (2012) and Brysbaert and Vetters (2010) have demonstrated the usefulness of excavated workshop assemblages (including tools) for discussing social identity.

A number of tools from London have been published in excavation reports. However, these publications are problematic for our purposes, as most only give a catalogue entry and illustration for objects directly discussed in the text. Whilst Bidddle (1990, pp. 7–8) considered the publication of finds 'in a short, tabular, quantified form' to be best practise, this standardised form of categorisation is not well suited to tools, whose forms are rarely standardised and which are often misidentified. Best practice for publishing tools should always include illustration. It is also extremely difficult to link the context numbers given for tools in their catalogue entries to the features discussed in the text. For these reasons, archive documents will be used to a greater extent than published excavation reports in this project.

3.7.2 Urban Syntheses

The scattering of small datasets across numerous publications means that whilst basic information on tools is being disseminated, there is little inter-site study of the material from smaller sites, although Roux (2013) has conducted a detailed study of the finds from a number of smaller French excavations. A model for inter-site study in an urban environment is nevertheless provided by several large studies carried out in medieval urban centres. Notable examples are the multi-volume syntheses of excavations in Winchester (Biddle, 1990) and York (especially the fasicules in *The Archaeology of York* Volume 17). These reports use integrated datasets which often include tools, finished and unfinished objects, waste products, metallography, and associated structures such as workshops to study craft and industry in the context of the city. The Winchester report (Biddle, 1990) considers all industries together in one volume, with integrated distribution and chronological analysis, whilst the York series has separate volumes for different industries including leatherworking (Mould, Carlisle and Cameron, 2003), woodworking (Morris, 2000), bone and antler working (MacGregor and Mainman, 1999) and non-ferrous metalworking (Bayley, 1992), each of which provide catalogues of the relevant tools. Iron tools are also listed in the volume on ironwork (Ottaway, 1989, 1992).

Ottaway (1992) provides distribution maps for many of the finds from the Coppergate excavations, some of which showed activity areas. Iron needles, for example, were heavily concentrated in a single phase of one of the tenements, and associated with unfinished needles and a needle-making anvil, indicating the location of a needle-making workshop (Ottaway, 1992, p. 547). Barclay et al. (1990) considered the chronology and distribution of finds in Winchester on a city-wide scale, rather than within individual excavated areas. By carrying out correspondence analysis they sought to quantify associations between different aspects of the finds data ('find type' and 'material') and context data ('site group' and 'context date'). This revealed concentrations of tools in different areas, which were considered to be 'a fair reflection of the places at which they are likely to have been used' (Goodall, 1990, p. 37). However, these approaches were of less value to the study of tools than they were for other types of small finds. Needles were the only type of tool found in sufficient quantity at Coppergate to merit distribution analysis (Ottaway, 1992, p. 547). The statistical analysis carried out on the Winchester data was also hampered by low numbers, with non-ferrous and precious-metal working being 'not easily quantified' (Barclay, Biddle and Orton, 1990, p. 72). The small numbers involved also mean that the discovery that certain tool types were associated with different areas of the city does not quite escape the realm of 'stating the obvious' (Barclay, Biddle and Orton, 1990, p. 66). These reports nevertheless provide a good example of best-practice in relation to the study of tools by placing them firmly in a local context and interpreting them alongside other sources of evidence for craft and industry. The approach could be widened to include rural areas and regions as well as urban centres.

No work of this kind has been carried out on the Roman tools from any urban centre in Britain, but similar work has been carried out on the Continent. Duvauchelle (1990) and Tisserand (2001, 2010) have brought together the tools from Avenches and Vertault respectively, and used them to discuss craft and agriculture within the settlements. Detailed work has been carried out on the *Oppida* of Bibracte (Mölders, 2010) and Manching (Jacobi, 1974). The tools from these sites are mapped and discussed in relation to chronology, context and function, with both works including discussions of craft specialisation. This approach has also been carried out on a much wider scale in Switzerland, where evidence for industrial activity, including tools, has been synthesised from the entire country, with a focus on the lives of artisans (Amrein *et al.*, 2012).

3.8 Exceptional Finds

The most impressive work looking at the tools from single excavations relate to assemblages formed in exceptional circumstances, such as shipwrecks (Jansma and Morel, 2007) or the Vesuvian eruption (Allison, 1997, 2006; Simpson, 1997; Harvey, 2010). Harvey (2010) has studied 23 iron tools from the villa at Boscoreale. Examining the distribution of the tools within the villa, Harvey (2010, p. 709) noted a number of hoes in a room in the main villa building itself. The fact that some hoes were rusted together as though stacked (Figure 7) may indicate that these tools were being stored for later in the year, whilst the tools being used at the time of the eruption (late summer, perhaps harvesting tools) may have been kept in unexcavated outbuildings (Harvey, 2010, p. 709). This may indicate that the tools were the property of the villa owners, not the servants or tenant farmers who used them, demonstrating the possibility of using tools to infer aspects of social organisation. This observation highlights the difficulty in linking archaeological data with actual tool assemblages, even on sites with tools preserved in-situ such as this. This puts into perspective comments like those made by Major (2003, p. 77) that 'the sparsity of material evidence for what one might assume to be the main activity of the site, i.e. farming, is surprising given the number of small tools recovered.' It also reinforces Fell (1990, p. 274) and Rees' (1979, 1981a, 2011) comments on 'the weakness of dependence upon tool type as a sole source of evidence' (Rees, 2011, p. 90).

Figure 7 Two iron hoes rusted together, and therefore potentially stacked. From the villa of Boscoreale, Italy (Harvey, 2010, fig. 3).

3.9 Discussion: Issues and Opportunities in the Study of Tools

This review of the previous scholarship has revealed a number of trends and themes in the study of ancient tools, which form the background to the current study. In particular, this review has highlighted a number of recurring issues with the use of tools in advancing our understanding of the past. Many studies have had a poorly defined scope, leading to unsustainable generalisations being made about large geographical areas or time periods. Studies have also focussed almost exclusively on functional interpretations of tools. Few studies have attempted to use tools to study the people and society of the ancient world, beyond some attempts at identifying craft specialisations and attributing tools (particularly ploughs) to particular cultural groups. In this project, the scope will be restricted to Roman London, with the particular aim of studying the people and society of the city.

3.9.1 Data Sources

Museum collections have been extremely important to the study of tools, providing large bodies of material for analysis. Not only have they reflected archaeological scholarship (the tools on display in the British Museum closely reflect the way they were catalogued by Manning (1985a)), but by keeping this material known and accessible they have allowed unpublished objects to be revisited long after the original excavation, shaping scholarship in the process. However, there are problems associated with the use of museum collections. Many studies have been frustrated by poor collections practice; poor initial identification (Manning, 1976b, 1985a), loss of objects (Cunliffe, 1972; Pietsch, 1988; Harvey, 2010), and a lack of contextual data or information about the selection process. As a result, some writers (Goodall, 1980) have ignored undated museum finds altogether, although this approach would be unsuitable for the London material (Merrifield, 1995, p. 28).

Museums are no longer the sole source of information about Roman tools, however. Large amounts of material from major museums and excavations across Europe has now been published (Rees, 1979; Gaitzsch, 1980; Pietsch, 1983, 1988; Hoffman, 1985; Pohanka, 1986; Duvauchelle, 1990; Hayes, 1991; Blake, 1999; Tisserand, 2001, 2010; Hanemann, 2014), although with a distinct bias towards modern day Germany and France. Whilst studies should ideally also incorporate finds from smaller excavations, this material has rarely been collected together at a regional level, and is dispersed across small publications and in unpublished archives. Fortuitously, in London most of these resources are brought together in a single institution, the London Archaeological Archive and Research Centre (LAARC). Recent publications, grey literature and archived finds will therefore be key sources of evidence for this study, alongside objects kept in museums.

3.9.2 Interpreting Places

Specific sites have usually been explored through the distribution and chronology of tools, but there are many obstacles to using tools in this way, especially in London. Many tool collections have not been scientifically excavated, and lack provenance and contextual dating. Whilst variation in tool form over time has been demonstrated, there are few forms that are understood well enough to provide dates for unprovenanced objects. Statistical analysis of distribution (e.g. through Correspondence Analysis) has been hampered by the small size of the datasets. Many studies have compensated for these deficiencies in their data with a certain amount of abstraction. Common methods have included breaking sites into large units rather than individual contexts (Pietsch, 1983), or studying large regions and making comparisons between sites (Rees, 1979; Gaitzsch, 1980; Pohanka, 1986).

A more fundamental issue is that no previous tool studies (with the exception of Fell, 1990) deal adequately with context formation processes. The number of tools found archaeologically is tiny compared to the number that must have been used (Saunders, 1977, pp. 13, 17). Iron can be easily recycled, and large iron objects are often considered too big to lose accidentally (Fell, 1990, p. 281; Hingley, 2006; Bishop, 2011, pp. 115–24). Tools are therefore likely to enter the archaeological record only under very specific circumstances (Saunders, 1977, p. 16), and Fell (1990, p. 283) considered it likely that the majority of Iron Age metalworking tools were deposited in a ritual manner. Excavation biases also affect the types of sites and regions that are excavated (Manning, 1970a, p. 18; Ciglenečki, 1983, p. 45), whilst the high quality of objects kept in museums demonstrates the level of selection taking place during early excavations. It is not therefore possible to use the presence of tools uncritically as evidence of activity on a site (Rees, 1981a; Fell, 1990, p. 274) as 'the archaeological record records the location of deposition, not of activities' (Hill, 1995, p. 94). These factors must be addressed, and the depositional processes properly understood, if the archaeological record is to be correctly interpreted (Hill, 1995, pp. 1–2).

These issues can partly be compensated for by discussing tools alongside other sources of evidence, although waste material, which has been seen as a more reliable indicator of craft activity (Jacobi, 1974, p. 262; Barclay, Biddle and Orton, 1990; Fell, 1990, p. 274), is also subject to culturally-determined depositional practices (Costin, 1991, pp. 25–6; Hill, 1995, p. 65; Hingley, 1997, p. 15; Garrow, 2012). Syntheses of craft activity in medieval cities provide a particularly good model for the study of craft in Roman London, showing how tools, waste, structural evidence and documentary sources can be combined.

3.9.3 Interpreting Technologies

An alternative way of interpreting tools would be to embrace their form and function, rather than stressing their archaeological context. This may seem regressive, as functional analysis has been key to the study of tools in the past, to the detriment of their potential social interpretations. This tendency has also been identified in Roman military studies 'partly because of the armed service background of some of the specialists' (Gardner, 2007, p. 29), and it is certainly true that ancient tools have often been written about by modern tool users. This is not surprising; tools have been frequently overlooked by other authors, and a degree of technological knowledge is often considered necessary to identify and understand them. Many writers (Puleston and Price, 1873, p. 76; Champion, 1916; Manning, 1976b; Swift, 2017, p. 16) recommend seeking the opinions of modern tool users when identifying archaeological objects. Whilst not diminishing the value that modern tool users have brought to the study of ancient tools, informed archaeological perspectives are clearly lacking, and we should explore what insights modern archaeological theory can give us on the use of functional data to advance social interpretations (Chapter 4). By adopting a practice theory perspective and structuring our discussion accordingly, we can see tools as major parts of actions which were fundamentally 'practical', but embedded in and integral to wider society.

3.10 Conclusions

This review of previous work has therefore provided a number of requirements for a successful study of the Roman tools from London. A tightly defined scope is necessary, and 'Roman London' fulfils this brief. However, this study should be careful not to assume that the social conditions of the city were the same across time and place. It is important that this study uses as broad a dataset as possible, utilising objects from multiple museums and archives, including unpublished finds. The objects themselves will have to be studied alongside other evidence for crafts in the city, such as documentary and epigraphic evidence, waste, finished objects and structural remains. Simple approaches to the distribution and chronology of these tools are not enough, and particular attention needs to be paid to their archaeological context and taphonomic history. Finally, as well as having research questions focussing on the people and society of Roman London, we need to situate these in recent archaeological theory in order to make the most of this data.

Chapter 4- Theoretical Background

4.1 Introduction

Chapter 3 has established that the majority of previous studies of tools have neglected to use them to study ancient people and past societies, instead focussing on tools as objects of intrinsic interest and evidence for ancient industrial and agricultural capability. In order to redress this, people and society will form central elements of the discussion pursued in this study. However, this remains a broad aim, and one that requires a certain amount of reflection before appropriate research objectives can be formulated under the umbrella question 'what can tools tell us about the people and society of Roman London?' The relationship between archaeological material and ancient lifeways is not straightforward, and there are many practical and theoretical obstacles to using the data in this way. This chapter will evaluate relevant theoretical perspectives in order to create a suitable framework in which to interpret the tools from London. The discussion is structured around the few pieces of work which have sought to expand the use of tools as archaeological evidence, and is broken into three sections, examining theoretical perspectives on technology, identity, and agency.

4.2 Technology

Discussions of technological capability have been central to archaeological narratives since the inception of the discipline, and the evolution of thought in relation to Roman technology from the Renaissance onwards has been traced recently by Greene (2009). As we have seen, tools have previously been approached in primarily technological terms. Early approaches to technological development were often framed in terms of 'evolution' or linear 'progress', seeking to identify the key developments which led to modern technologies being the way that they are. As we have seen, similar discussions have been a recurring theme in previous literature on tools. Where important observations have been made to challenge the idea of technological 'stagnation' (Greene, 2009, p. 70) in the Roman period (Goodman, 1964), these are nevertheless presented as part of a story of increasing complexity from ancient times to the modern day. Technological debates around tools have rarely been framed in social terms, but this does not accurately reflect developments in the theoretical literature on the history of technology (Greene, 2009, pp. 76–83). There is considerable scope for expanding the types of technological discussions we apply to this data.

4.2.1 Social Constructionism

Particularly relevant to this project are the Social Construction of Technology (SCOT) movement and related developments in post-processual archaeology (Killick, 2004; Greene, 2009, pp. 80–3). SCOT began in the 1980s amongst a diverse group of scholars interested in the history of technology, and is explored most fully in the works of Bijker (Bijker, Hughes and Pinch, 1989; 1995, 2010). SCOT's socially-focussed perspective comes from the conceptualisation of technologies as solutions to specific problems. Any given problem may have a number of possible solutions, and 'the choice of a particular technology from a pool of satisfactory alternatives may be strongly influenced by the beliefs, social structure and prior choices of the society or group under study' (Killick, 2004, p. 571). Seeing technology in this way breaks down the perceived boundaries between different spheres of human activity (technological, social, political etc.) and instead places them in a single 'seamless web', thus allowing technologies to be used as a tool for studying society. This focus on technologies as choices has been taken up in a wide range of spheres of archaeological thought related to the post-processual movement (Lemonnier, 1989; Sillar and Tite, 2000; Killick, 2004, p. 571), and can be seen in Murphy and Poblome's (2012) recent discussion of the Roman potters' tools from Sagalassos.

Initially, SCOT was concerned with interpreting the development of individual technological artefacts (see Bijker, 1995 for an influential discussion of the bicycle). At the core of this was the radical tenet that these artefacts do not 'work' outside of their wider social context. Since different groups will encounter different problems, requiring different solutions, no artefact or technology can be interpreted as universally 'working'. Instead, their functionality is 'socially constructed' by actors and groups. Bijker (1995, 2010, p. 68) terms these 'relevant social groups'; networks of actors defined by shared interactions around a particular object. Where there is agreement between actors, they can create shared 'technological frames' relating to the artefact (Bijker, 1995, pp. 123–5, 2010, p. 69).

An issue with this formulation of SCOT is that it is focussed on interpreting periods of innovation and change. In SCOT terms, new artefacts have 'interpretative flexibility' as their properties are not yet agreed upon (Bijker, 1995, pp. 73–5, 2010, p. 68). SCOT sees different 'relevant social groups' as defining multiple different objects, with different properties, based on their different 'technological frames'. This period of 'interpretative flexibility' is succeeded by one of irreversible 'stabilisation' and 'closure' (Bijker, 1995, pp. 84–6, 2010, p. 69), as different 'relevant social groups' come to develop a single conception of the artefact in question. As archaeologists, we may question whether 'closure' is as irreversible as Bijker (1995, p. 87, 2010, p. 69) claims. Bijker's study of the bicycle ends in 1890, for example (Edgerton, 1999, p. 115), and its interpretation may not remain 'stabilised' in an archaeological time frame. However, a more fundamental issue is that the artefacts dealt with in this thesis do not show evidence of rapid or frequent change. Does this mean that we cannot explore society except in moments of change?

4.2.2 Technologies in Use

Edgerton (1999) provides a very different perspective, distinguishing between discussions of technological 'innovation' and those of 'use'. Discussing 'technologies in use' gives a radically different picture of the technological landscape, allowing for an appreciation of the significance of 'traditional' or established technologies that have been seen as 'out-of-date, obsolete, and merely persisting' (Edgerton, 1999, p. 112). This perspective also reorients our focus from inventors and innovators towards the majority of the users of technology; a perspective which 'also involves a massive shift in social class, social status, gender and race of people involved with technology' (Edgerton, 1999, p. 116). Clearly these perspectives are highly relevant to a study of craftspeople through their tools.

SCOT perspectives are not unhelpful in this paradigm, however. SCOT later moved on from focussing on individual artefacts to a wider focus on 'technological systems' and 'technological culture'. This period highlighted how technologies are not only shaped by society, but act to shape it through 'co-production'. This approach also highlighted how technological frames can act to 'close-in' actors to a certain way of using technology, whilst 'closing-out' others who do not have the knowledge required to utilise it. By adopting perspectives from practice theory (see p.44), there is no reason that we could not see this co-production being driven by routine practices and 'technologies in use' rather than innovation.

4.2.3 Conclusions

Theoretical approaches to technology therefore provide several avenues for using tools as evidence to study past societies. A key recognition must be that whilst we will seek to explore periods of innovation, the bulk of our discussion will be of 'technologies in use'. By characterising the differential use of tools in terms of 'relevant social groups' and 'technological frames', we can explore social interactions and agent networks. By examining Roman technology in the city at the level of 'systems' and 'culture', we can see how technological practices acted to shape Roman society, and the interactions between groups. Moreover, by accepting the concept of the seamless web, we are required to look beyond the purely technical in order to explain technological change and stability in the Roman city.

4.3 Identity

4.3.1 Cultural and Personal Identity

Outside of the restricted world of tools, discussions of Roman artefacts as indicators of the makeup of past societies have focussed on the concept of 'identity'. Largely this has been within the paradigm of 'Romanization'; the process by which provincial societies and their artefacts became more like those of the classical world. Introduced by Haverfield (1905, 1913), the concept was originally closely allied to the culture-historical world-view, and heavily influenced by classical texts. Since then, however, 'Romanization' has become a cornerstone of most major archaeological works in Britain (Frere, 1967; Millett, 1990; Mattingly, 2006), and continues to dominate discussions of identity to this day (Pitts, 2007, p. 695).

In the literature on tools, the terminology of Romanization is most in evidence in regional surveys, particularly that of agricultural tools by Rees (1979). In Rees' discussion of the social distribution of different tools, site types and geographical areas are described as more or less 'Romanized', with the implication that some tools are more indicative of a 'Romanized' society than others. There is no discussion of this, however, and Rees' use of the term can be seen largely as a result of the time in which she wrote. More explicit use of the concept of 'Romanization' in relation to tools can be found in the work of Tisserand (2011). From the emergence of new forms between the Late Iron Age and Roman periods, Tisserand (2011, p. 892) argues for a fundamental change in attitudes towards professional skill; Iron Age craftsmen would adapt their method of working to suit different tasks, whereas Roman craftsmen would employ a wider range of tools.

Whilst this observation is sound, we may question to what extent it is appropriate to characterise this change as a product of 'Romanization', rather than as one which 'happens in the Roman period'. In recent years, 'Romanization' has been subject to an infamously prolonged post-colonial critique (e.g. Clarke, 1996; Hingley, 1996; Forcey, 1997; Webster, 2001; Mattingly, 2006, 2011; Heeren, 2014; Woolf, 2014). Although initially attempting to rehabilitate the term with a focus on the mechanisms of cultural change (Millett, 1990; Heeren, 2009b), subsequent discussions have focussed on replacing 'Romanization' with new terms which more accurately reflect the ways in which cultures become mixed (see Webster, 2001 for 'creolization') or interact on global and local scales (see Heeren, 2014; Pitts and Versluys, 2014; Woolf, 2014 for discussions of 'globalization').

Moreover, discussions of identity have moved on from being purely framed in cultural terms (although this remains key to much of the literature (Pitts, 2007, p. 695)). Recent studies have examined how status, gender, age, professional and regional identities were defined and articulated through artefacts (Allason-Jones, 2001; Swift, 2004, 2017; Pitts, 2007; Eckardt, 2014), with emphasis on the situational, conflicting and changeable nature of these labels (Hill, 2001; Gardner, 2007, pp. 19–20, 2011, pp. 12–3). The changes in tool use identfied by Tisserand (2011) could therefore be tied to discussions of changing professional identity, rather than being linked solely to cultural identity. A growing number of works have looked at aspects of the lives of Roman craftspeople (Polfer, 1999, 2001, 2005; Mac Mahon and Price, 2005; Chadron-Picault, 2010; Wilson and Flohr, 2016), although these are rarely explicitly framed in terms of identity.

4.3.2 Craft Specialisation

Rather than ascribing increased specialisation to the introduction of 'Roman' culture, could we not investigate the significance of specialisation on its own terms? There is a large body of work devoted specifically to this subject (Brumfiel and Earle, 1987; Costin, 1991; JE Clark, 1995; Wailes, 1996a; Archeological Papers of the Americal Anthropological Association, 1998, 2007). Tracing itself back to the work of Childe (Wailes, 1996a), this scholarship has a structuralist flavour, typified by Costin's (1991) work, which provides cross-culturally applicable 'typologies' of craft specialisation. Much of the focus has been on describing the different speheres of experience of specialisation (full time vs part time, dependant vs independent, etc. (Costin, 1991; Wailes, 1996b, p. 5)), although the usefulness of these dichotomies has been questioned (Costin, 1998, p. 5). This scholarship has nevertheless highlighted the importance of seeing specialists as part of wider networks, and recent works have incorporated a range of approaches highlighting how specialisations are borne out of and changed through practice (Costin, 1998; Brysbaert and Vetters, 2010).

Many of these studies have linked the degree and type of specialisation seen to wider themes on the economic and social development of societies (Brumfiel and Earle, 1987; Wailes, 1996a; Archeological Papers of the Americal Anthropological Association, 2007), but specialisation has also been linked directly to personal identity (Costin, 1998; Brysbaert and Vetters, 2010). However, whilst the multiple possible ways in which craft practice and social identity interact have been explored (Costin, 1998, pp. 7–9), there is a tendency in the literature to assume that the 'highly specialized technological practices involved in craft production probably would have increased the value of a finished object and will have reflected back upon the artisan's social role' (Brysbaert and Vetters, 2010, p. 27). Is this necessarily the case? Does a modern worker in a furniture factory, whose activities and tools are specialised for extremely restricted tasks, have higher social status than an artisan carpenter, who practices a wider range of woodworking tasks? An important consideration in this thesis will be how the nature of craft practices shaped people's differential experiences of lives as craft specialists.

4.3.3 Conclusions

Whilst studies of Roman tools have rarely dealt with themes of identity outside of 'Romanization', it is clear that a more holistic approach to the subject is highly relevant. Cultural change and imperialism are appropriate topics to discuss with the evidence from Roman London; the city was a new foundation in a colonial context, and tools and working practices may provide evidence of migration or cultural change at the lower levels of society. However, any such discussion of the London data must take account not only of the post-colonial critique of 'Romanization', but also of reasons for changes in tool form and use not restricted to cultural change. A key aim of this study will be to examine aspects of the self-identification of people in the Roman period which relate specifically to working practices; professional and skills-based identities, gender identities and changes over the lifecourse. By focussing solely on one settlement (Roman London and its hinterland) and one 'class' of people (urban workers), I will seek to differentiate between the identities and experiences of ancient people with a previously unseen level of resolution.

4.4 Agency and Practice

With these aims in mind, it is necessary to consider how archaeologists have conceptualised the relationship between their data and the past societies which they attempt to study. Small finds were rarely used as a major data source in early works by the culture-historical and structuralist generations (Gardner, 2007, p. 32). When they were used, these scholars saw portable artefacts, and material culture in general, as passive reflections of innate, biologically or socially determined identities (Pauketat, 2001, p. 74; Pitts, 2007, p. 699; Robb, 2010, pp. 494–5). Change and stability in object form were seen as direct results of evolution and natural selection, albeit culturally as well as environmentally determined (Pauketat, 2001, pp. 75–6). The meanings of these artefacts were to a degree universal and could be 'read', and from them the nature of society could be inferred (Pauketat, 2001, p. 74; Barrett, 2014, p. 264; Fewster, 2014). A detailed discussion of these theories in relation to the study of iron objects is given by Ottaway (1989).

In contrast, perhaps aided by the rise of computer databases (Biddle, 1990, p. 8) and GIS software (Gardner, 2007, p. 32), small finds studies have occupied a particularly prominent place in recent archaeological studies of identity in the Roman period (Allason-Jones, 2001; Eckardt, 2002, 2014, Swift, 2004, 2017; Gardner, 2007; Pitts, 2007). In these studies, the ways in which objects were used has taken pride of place. Although sometimes criticised for seeing artefacts as passively reflecting identity (Pitts, 2007, p. 700; Van Oyen and Pitts, 2017), many of these studies have emphasised the active ways in which material culture was used to construct and negotiate identities. Rather than being universal, the meaning of artefacts has been seen as situational and altered through 'practice' (for an illustration of this in relation to mortaria, see Cramp, Evershed and Eckardt, 2011).

This emphasis on the importance of artefact use and individual action can be related to a theoretical paradigm which has recently become prominent in Roman archaeology; that of agency or practice theory. Whilst paradigms of identity focussed on the ways in which individuals negotiated their way through established societies, agency highlighted the ability of individuals to make conscious decisions to change the circumstances of that society. It has been seen as the key concept in 'putting people back in the past' (Robb, 2010, p. 493), emphasising the actions of individuals over the processes of history. However, 'agency' is a notoriously slippery term which has gone through several permutations since the 1990s (Robb, 2010).

In many early models agency could only be found in the goal-orientated actions of ambitious individuals (Gero, 2000; Pauketat, 2001, p. 77; Gardner, 2007, p. 41; Robb, 2010, pp. 496–7). This limited discussions of agency to the political sphere (Robb, 2010, pp. 496–7) and created a universal, self-aggrandising male agent (Gero, 2000) of non-specific motivation (Robb, 2010, p. 496) who could, like any other aspect of structuralist society, be identified in any culture through specific material indicators.

Later studies, which saw agency and practice as social mechanisms, grew out of a dissatisfaction with these structuralist models (Robb, 2010, p. 495; Fewster, 2014). Developed in parallel by Giddens (1979, 1984, 1993) and Bourdieu (1977, 1990), and building on a Marxist foundation (Gardner, 2007, p. 41; Robb, 2010, p. 499; Fewster, 2014), this new model questioned the way in which previous paradigms had seen people either as totally constrained by an ill-defined 'society', or as independent agents working from outside it. Instead, they saw individuals (agents) and society (structure, or *habitus*) as working in a mutually enabling duality. In these models, structure existed in the form of learned mental rules, which were created, perpetuated and challenged by human action. Agency, meanwhile, was possessed by all people, but was facilitated through and shaped in reference to structure. Humans learnt the principles of the structure they inhabited through practice and, as knowledgeable agents, they drew on these rules in future actions. These actions, with their attendant expected and unexpected consequences, became part of the structure and influenced future actions. This perspective was significant in changing agency from a property that certain people could express in specific circumstances to the mechanism by which every society was continually reconstituted, and has been highly influential in archaeology.

Practice theory's reach has been huge, and it now acts as a link across multiple areas of debate. Practice theory has been invoked in discussions of cultural change (Pauketat, 2001; Gardner, 2007), identity (Costin, 1998; Gardner, 2002, 2007, 2011; Pitts, 2007), gender (Gero, 2000), and the scale of historical process (Pauketat, 2001; Gardner, 2007, pp. 21–2). These models are also closely related to the actor-focussed models of technological change proposed by the SCOT movement (Bijker, 1995, p. 192). As such a framework of practice theory would be the obvious choice for a study of tools. It is therefore worth critically considering how it can advance the specific agenda of using tools to study Roman society in London.

4.4.1 The Advantages of Agency

One potential criticism of practice theory would be that it does not necessarily advance discussion beyond that of the 'representational' archaeologies of identity. When done well, and where suitable data existed, these studies already focussed on how objects were used, whilst practice theory executed badly could fall into the same traps that earlier studies had been accused of; seeing certain practices as inevitably linked to specific people and identities (Pitts, 2007, p. 702; Gardner, 2011, p. 18). Key studies have also been criticised for failing to move from the theory into meaningful interpretations (Pitts, 2007, p. 702; Cool, 2009, p. 5).

In this regard it is significant that some have seen the two traditions as working in tandem rather than opposition (Robb, 2010; Van Oyen and Pitts, 2017, p. 7). Moreover, a properly executed practice theory builds new models of changeable structure from practice rather than simply relating practice to rigid established narratives. This requires a reorientation of perspective; objects and practices cannot just be seen as reflecting, indicating or being shaped by society, but are instead participants in the active creation and negotiation of that society. With this in mind, perhaps the broad research question should be rephrased as 'How did the manufacture, use and disposal of tools interpret, enact and change society in Roman London?'

Practice theory is also significant in ascribing value to all aspects of human action, not just the overtly expressive aspects such as identity creation. This point is particularly relevant for the study of tools, as these are objects that have been seen as primarily practical and mundane rather than symbolically important. Practice theory allows us not only to understand 'the routine activities of those people, how they changed, and what those changes meant' (Gardner, 2007, p. 47), but to approach what those small actions *did*.

One outcome of this is that it allows the problematisation of periods of stability as well as change (Pitts, 2007, p. 709; Robb, 2010, pp. 508–14; Gardner, 2011, pp. 13–4). Tools are notorious for changing form slowly, and this has been characterised in terms of 'stagnation'. However, this ignores the continual human actions and decisions involved in reproducing tool forms (Ottaway, 1989, p. 96) or learning to use tools. By considering practice, we can ask why a craftsman would make a tool to a particular form, whether new or not, what actions led to that decision, how the manufacture was executed, and what the consequences for further action were.

Finally, practice theory allows for the discussion of more nuanced forms of agency than previous models. Chisels are poor indicators of political ambition and imperial strategy, but as objects of everyday use they could certainly be used to discuss how individuals were able to identify goals, foresee outcomes, access information, preserve social and economic balance, and build relationships (Gero, 2000, p. 35). Robb (2010, pp. 507–8) suggests that rather than 'activities', archaeologists should study practice as 'projects'; complex and sometimes long-running composite activities designed to achieve a specific goal. Practical projects can be seen as instrumental parts of 'projects of the self', which Robb (2010, p. 507) characterises as 'long-term undertakings which involve the engagement of the self: being a potter rather than making a pot.' This strategy helps move the identity debate beyond outward expressions of political or cultural allegiance, towards personal identities which incorporate individual achievement, knowledge and skill as expressed through routine practice; factors which Robb (2010, p. 508) considers to be 'both archaeologically inferable and socially central.'

4.4.2 Issues of Agency and Evidence

Nevertheless, we should be careful not to push the evidence, or the theory, too far. Practice theory was originally created with reference to a wide variety of mechanisms of social engagement, particularly speech (Gardner, 2007, p. 47; Fewster, 2014, p. 6). Transferring this theory to archaeology, where only a small number of the residues of the practices that involve material engagement survive to us, could be seen as reductive. By effectively ignoring interactions that do not leave a material trace, do we have too narrow an understanding of practice to make meaningful statements about the past? Moreover, is it really appropriate to ascribe total explanatory value to practice over, for example, abstract thought (Gardner, 2007, p. 19, 2011, p. 17)? These questions are somewhat academic as archaeologists can only work with the surviving materials, but care should be taken not to dismiss these aspects of life as irrelevant simply because we cannot see them.

4.4.2.1 Scales of Evidence

Fewster's (2014, 7) proposal for a solution in ethnoarchaeology requires historical and oral evidence, and as such is not suitable for Roman Britain. Better solutions may be found in traditional archaeological methods (Gardner, 2011, p. 17). The obvious way forward is to gather as much data as possible from multiple sources in order to produce a clearer picture of the practices involved in setting up, carrying out and completing a project. Studying only one class of the objects used in these projects will never give a full picture of practice or the 'fields of action' (Robb, 2010) for tool use in Roman London. Therefore Chapter 6 will examine London's tools alongside other sources of evidence, such as waste, toolmarks, structural, epigraphic and iconographic evidence. This methodology is archaeologically sound, building on the recommendations of Chapter 3, and also evocative of the 'thick description' that was central to the SCOT and ethnographic method (Bijker, 1995; Barrett, 2016, p. 1682). Nevertheless, we must acknowledge that we cannot reconstruct craft practices in their social setting in their entirety (Killick, 2004, p. 573).

Gardner (2007, p. 49, 2011) highlights the importance of context, which can be studied at various levels to answer different questions. However, we have already discussed the issues with a contextual approach (Chapter 3). Archaeological material is (almost universally) found in *depositional* rather than *use* contexts, limiting the degree to which practice can be inferred. This has been identified as a limiting factor in Gardner's own work (Eckardt, 2014, p. 12), and is particularly problematic for the London tools, many of which have very poor contextual information. Examining a higher level of context allows us to better use poor quality data (Gardner, 2011, p. 18), for example through inter-site comparisons (Eckardt, 2002, 2014; Cool, 2006). This approach is unfortunately limited in that it requires a great deal of assumption, not only about the nature of the sites involved, but crucially about the function of objects across time and space (Eckardt, 2002, pp. 26–30). Nevertheless, it is inevitable that when dealing with incomplete data 'the resolution at which specific types of practice can be examined will be correspondingly variable' (Gardner, 2011, p. 17). These issues can be overcome to a certain extent by drawing patterns from the data rather than fitting the data into pre-designed schemes (Eckardt, 2002, pp. 29–30; Gosden, 2005, p. 199). One method for doing so would be by using more sophisticated comparative tools, such as Correspondence Analysis (Baxter and Cool, 2010), although these are problematic to use on tools (Chapter 3).

4.4.2.2 The Nature of Agency

A more fundamental issue is that the individual agent is all but invisible archaeologically. Poor dating methods often fail to pick up rapid change in artefacts at the level required to identify individual agency, whilst most change in material culture, especially in tools, appears to take place over decades and centuries. From this evidence it is difficult to understand the everyday negotiations of social rules that built up to these changes.

Collective Agency

One possible solution has been to seek agency in collective institutions (Gero, 2000, p. 37; Gardner, 2007, p. 47; Robb, 2010, p. 503). Institutions have been seen both as ossified elements of structure (Gardner, 2007, p. 43) and as active agents (Gero, 2000, p. 37; Gardner, 2002, p. 339). To take the obvious Roman example of the army, it could be argued that soldiers had different agencies within the institution than outside it, and that the responsibility for these actions was collective rather than individual (Robb, 2010, p. 503). The army had effects and carried out projects that extended beyond individual lifespans (Gardner, 2007, p. 43); no individual soldier, or even Emperor, was responsible for conquering Britain, for example. To some extent this is related to power structures; in this case the rules and conventions (the structure) of the army allowed certain individuals (Emperors, Generals) to exert much greater influence over the actions of others (soldiers) than was possible in most civilian social structures.

Nevertheless, I do not see 'collective' or 'institutional' agency as a solution to this issue. No individual is ever acting without reference to broader social and situational norms, whether in an 'institution' or not. The rules of the structure of the army had to be perpetuated through the actions of individuals, giving them the power to drive change (James, 2001; Gardner, 2002, p. 344). Gardner (2007, p. 47) draws a sensible distinction between collective *action* and individual *agency*, and whilst these may not always be archaeologically separable, the same division will be followed here. SCOT theory also provides a useful perspective on this issue, as the concepts of 'relevant social group' and 'technological frame' allow for the understanding of individual actors behaving in a similar, seemingly coordinated manner, without diminishing the individual agency of the actors themselves.

Materiality and Material Agency

A more radical proposition has been to think of objects themselves as agents or 'actants' (Ottaway, 1989, pp. 119–20; Reckwitz, 2002, p. 208; Gosden, 2005; Robb, 2010, pp. 504–5; Van Oyen and Pitts, 2017); corporeal 'things' that directly engage with, participate in and shape human practices. A key part of this argument has been to highlight the ways in which the physical properties of objects constrain, enable, and provoke human action and thought (Reckwitz, 2002, pp. 209–212; Jones, 2004, p. 330), and in a way do things independently within society (Van Oyen and Pitts, 2017, pp. 10–12). For example, objects can travel, 'making social reproduction between temporal and spatial limits possible' (Reckwitz, 2002, p. 210). This view has become increasingly popular in recent archaeological studies, although it has not been universally accepted (Reckwitz, 2002, p. 210; Ribeiro, 2016; Van Oyen and Pitts, 2017, p. 11).

It is interesting to consider where 'material agency' might fit into a SCOT framework, in which objects are defined entirely by how human agents interpret them (Bijker, 2010, p. 66). The supposition that materials have properties which influence human action is somewhat at odds with SCOT's central argument that 'artifacts do not have intrinsic properties, but need to be socially constructed' (Bijker, 1995, p. 264). There is nevertheless an acknowledgement in Bijker's (1995, p. 182) work that the 'properties' of materials (what Swift (2017) may term 'affordances') did have some influence on the ways in which they were used. A total rejection of physical reality is unhelpful, but it must be appreciated that within the boundaries of what is physically possible there is always room for choice (Killick, 2004, p. 572), and this is where human agency becomes relevant. Objects are fundamentally incapable of thought or negotiation; the key processes that define agency. To give them explanatory power equal to that of thinking humans surely risks sliding towards technological determinism (Gosden, 2005, p. 204).

It is perhaps more constructive to think of objects in structural terms. Some have expressed this very literally, simply replacing the 'structure' in Giddens' work with 'material' (Barrett, 2001, p. 152; Jones, 2004, p. 330), but Barrett (2001, p. 156) argues more eloquently that 'the historical significance of the material is… not represented by its form… but lies in the diverse contexts of the social practices in which it was situated.' This view, in which the physical world provides the 'material facilities' for human agents to 'inhabit' (Barrett, 2001, pp. 153, 158; Gosden, 2005, p. 197) is the most satisfactory, accounting as it does for the real influences objects have without diminishing the unique human component.

4.5 Conclusions

This review has shown that there are several related theoretical frameworks available in which the Roman tools from London can be discussed. Key to further interpretations will be the principles of practice and agency, which have come to form the backbone of modern interpretations of identity and technology. We must see tools as important constituent parts of technologies which were created within a specific social context, shaped by social organisation, status, culture, etc. At the same time, the physical actions involved in practicing these technologies reflected and changed the very society which created them. Therefore, rather than asking what tools can tell us, this thesis will instead be asking how the practices in which tools were involved served to create and change the society of Roman London, with a particular focus on the lived experience of professional identities. Discussion will therefore be structured around these practices, with the remainder of the thesis divided into three parts that explore the practices involved in the manufacture (Chapter 5), use (Chapter 6), and disposal (Chapter 7) of London's tools. It is also clear that the tools will need to be integrated with a wide range of other of evidence in order to reconstruct their place within complex practices.

Chapter 5 – Manufacture

Style, Provenance and Practice

5.1 Introduction

This section will examine the evidence for where, how, and by whom tools were manufactured in London. This section is not intended to be a comprehensive study of Roman ironworking, and no scientific analysis, such as metallography or x-rays, was carried out. Instead, this section will draw information largely from the finished forms of objects to establish what this can tell us about the different groups involved in manufacturing in London. This section is divided into two parts; the first examines the evidence for different manufacturing traditions which may demonstrate the presence of different cultural groups in London; the second analyses tools as evidence for manufacturing practice in London.

5.2 Provenance and Identity

We have already seen that London has been characterised as a city with a diverse population, comprising immigrants, natives, soldiers and traders (Chapter 2). It is possible to relate some of the variation in the forms of the tools from London to production by these different social groups (cf. Costin, 1991, fig. 41).

5.2.1 Evidence of 'Natives'

Whilst obviously pre-Roman objects (e.g. socketed iron axeheads (Manning and Saunders, 1972)) from Greater London were not routinely catalogued for this project, a number of tools were found which may have been Late Iron Age or early Roman in date. However, only two of these tools, CHI01-02, were found in central London, the majority coming from Greater London (Table 1). The tools therefore do not provide evidence for the presence of native craftsmen in London, instead supporting the notion that the city was settled by 'Roman' immigrants from the outset.

Cat No.	Place Collected	Site Type
ADZ01	Unknown	Unknown
ADZ02	River Thames, Mortlake [Surrey]	Greater London
AXE05	Unknown	Unknown
CHI01	Moorgate Street, Moorgate, London EC2. Unstratified.	Walbrook
CHI02	Bank of England, Threadneedle Street, Bank, London EC2 [1928-1934]. Unstratified.	Walbrook
HEA06	London	Unknown
PLO01	Found below peat on the Wandsworth foreshore.	Greater London
PLO02	Walthamstow. Unstratified. Site contained Bronze Age to Anglo-Saxon material.	Greater London
SIC05	Brentford, London [Hounslow]. Unstratified.	Greater London
SIC06	Brentford, London [Hounslow]. Unstratified.	Greater London
SIC07	Hammersmith, London [Hammersmith and Fulham; Richmond-upon-Thames; Hounslow] [River Thames]	Greater London
SIC11	Kingston-upon-Thames, London [River Thames] [1913]	Greater London
SIC12	Found below peat on the Wandsworth foreshore	Greater London
SIC17	Brentford, London [River Thames]	Greater London
SIC25	From 'the site of pile-dwellings, Hammersmith'. Unstratified.	Greater London

Table 1 Late Iron Age / Early Roman tools from London.

5.2.2 Evidence of Local Manufacture

It is often presumed that the majority of the tools found in London were made here, and therefore that London was home to a number of specialist tool-producing workshops (Morris and Macready, 1982, pp. 274–5; Hall, 2005, p. 132; Scott, 2017, p. 316). That this was the case is indicated by the presence of makers' stamps, particularly those of the chisel-maker *Martialis* (CHI09, CHI31) and the knife-maker *Basilius* (Wardle, 2011c, p. 392; Scott, 2017, p. 316), which are only found in London (see p.621).

However, assigning local provenance on a typological basis to the un-stamped tools from London is very difficult. The majority of the tools from London are of types that can be paralleled across the Empire. For example, Hayes (1991, No. 157, 159) illustrates mattocks from Palestine and Egypt which show only minor differences to those in London (MAT01-02). It is therefore possible that tools with these forms were made anywhere in the Empire. Nevertheless, both Hanemann (2014, p. 473) and Pietsch (1983, p. 21) identify types of objects which are more common in Britain than elsewhere in the Northern provinces. Of these types, only Type 4 hoes (HOE05-06) are found in London, demonstrating that at least some of the tools used here were manufactured in Britain. A small number of tool types appear to be unique to London (Type 5 awls (AWL043-50), Type 1.2 chasing tools (FIN11-13), Type 2 solid-handled gouges (GOU06-09)).

However, it is far from clear that these represent 'local' types indicative of local manufacture, rather than object types that are only recognisable thanks to the excellent preservation conditions in London.

5.2.3 Evidence of Trade and Immigration

There is good reason to think that some of the tools used in London were not manufactured here, and these objects may provide evidence of trade and migration. A number of makers' stamps (those of *Agathangelus* (BRU07), *Hermes* (BRU03) and *Aprilis* (CHI29)) can be paralleled elsewhere in northern Europe, indicating that these objects were produced in specialist Continental workshops and traded to Britain (see p.621). Other examples of imported tools may include the heavily decorated twitch (TWI01), thought to have been an imported art object from Italy based on the style of the busts (Francis, 1926, p. 102). Agricultural tools such as PLO02-03, SIC18, SIC22, SIC34 and HOE02-03, which are rare in Britain but common in Europe, may also have been imported.

More generally, the almost complete adoption in London of 'Roman' tool forms, and the lack of 'Iron Age' types, indicates that the foundation of London may have been accompanied by the importation of tools and the immigration to London of Continental craftsmen. This is particularly strongly suggested by the presence in London of Continental object types which usually pre-date the conquest, such as the possible bench knife BEN01, spear-shaped spatula SPE08, and three-piece tongs (Humphreys and Marshall, 2015).

A number of Late Roman axes from London provide evidence for the continued importation of objects or migration of craftsmen throughout the Roman period. AXE23 belongs to Hanemann's (2014) Type 4, which appears to have been manufactured in the unconquered parts of Germany (Hanemann, 2014, Abb. 299), and could indicate the presence of immigrants from outside the Empire. Type 5 and Type 15 axes (AXE24-25) were almost certainly manufactured in the area around modern-day Hungary and Austria, over a short period between c.300-350 AD (Hanemann, 2014, p. 346). Whether axes of the more 'normal' Roman types (Types 1-3) were imported is impossible to state with certainty. One such axe (AXE22) was deposited in a grave following a tradition that developed in Late Roman Gaul (Chapter 7.7). It is therefore possible that this axe was also imported, although this cannot be established on typological grounds.

5.2.4 Evidence of the Military

A number of tools from London may indicate production by the military. The most easily recognised are shaft-hole tools with rectangular lugs around the eye. Lugs of this type first developed on military sites (Hanemann, 2014, p. 345), although it is unknown whether they were exclusively manufactured by the military. Military production has been suggested for ADZ03 specifically (Manning, 1985a, p. 18), but may also be the case for any of the shaft-hole tools from London with rectangular lugs around the eye (ADZ03-04, AXE16-22, MAT01). Other tool types associated with the military are the 'military' type mattock MAT02 and the Type 5 hoe/'entrenching tool' HOE07 (Figure 8). Type 2 spear-shaped spatulas (SPE08) are strongly associated with German military frontier sites, and may be of military manufacture. Manning (1985a, p. 32) has also suggested that the crowbar CBR01 may be of military manufacture, although this is not certain.

It is not impossible that these tools were manufactured in London by or for the military. Early military production in the northern provinces is likely to have taken place in *fabricae* on military installations, a number of which have been identified with varying degrees of certainty (Bishop, 1985, p. 5; Bishop and Coulston, 2006, pp. 234–6). Forts were established in London at Plantation Place (Dunwoodie, Harward and Pitt, 2015) and Cripplegate (Grimes, 1968, pp. 15–46), and some of the 'military' type tools from London may have been manufactured in *fabricae* here. However, some 'military' tools, such as MAT02, pre-date these forts, whilst the evidence for industry within them is minimal. Hearths and charcoal were found at Plantation Place, although these probably post-date the fort's abandonment (Dunwoodie, Harward and Pitt, 2015, pp. 58–9). As the Roman army was known to source equipment from towns in the Mediterranean region (Bishop, 1985, pp. 16–7; Bishop and Coulston, 2006, pp. 233–4), it is also possible that urban settlements, such as London, supplied the army (Bishop, 1991, p. 25). It has been suggested elsewhere that the pottery and glass making industries around London were related to military contracts or supply networks (Wardle, 2015; Rayner, 2017, pp. 355–7). Alternatively, these items may have been produced in a military style by veteran smiths.

Figure 8 Tools of possible military manufacture from London (Top row; adzes ADZ03 and ADZ04. Second row; axes AXE16-18. Third row; axes AXE19-20. Fourth row; axe AXE21; entrenching tool HOE07. Bottom row; mattocks

However, it would be by no means unusual for objects manufactured by the military to end up in a civilian settlement. Soldiers would not have been confined to military sites (James, 2001, fig. 22), and military equipment is found on a number of settlements with no permanent military garrison (Bishop, 1991). Although identifiable typologically as 'military' objects, these tools would have functioned no differently to their 'civilian' counterparts. They may have been used as military surplus (James, 2001, p. 83), or may not even have been recognised as having a 'military' origin. HOE07 demonstrates the complexities of associating tools with a 'military' presence in the city. Tools of this general type are strongly associated with military sites, and are thought to have been part of military kit, used for erecting fortifications (Manning, 1970a, p. 19; Rees, 1979, pp. 307–8; Pietsch, 1983, p. 21). However, HOE07 is a variant on the rarer rectangular-bladed type, which is associated with civilian rather than military sites in Britain (Rees, 1979, p. 307). As this type is found on Continental military sites (Pietsch, 1983, p. 21), it is possible that this tool represents an imported military tool. It may therefore demonstrate the presence of a veteran from a Continental unit, rather than the presence of the military or military smiths in London.

5.3 Form and Manufacturing Practice

The typology section (Appendix 1.2) of this thesis has divided the tools from London into a number of 'types'. These types were defined to be analytically useful to archaeologists; identifying features which may indicate the function, dating or provenance of an object. However, 'types' can also be interpreted in terms of manufacturing practice. As the iron tools from London were all made by free-hand forging rather than through mechanised production practices, we can view object form in terms of agency. Objects may have been manufactured using varied materials and methods, and with the differing understandings of the desired shape and properties of the finished product. The ability of smiths to successfully execute these shapes relied on practical knowledge and the ability to overcome problems experienced throughout these processes (Keller, 1994). It is also clear from the typological analysis that not all of the tools from London fit equally easily into neat typologies. 'Standardisation' of form is often seen as a key indicator of specialised production, where 'increased standardization indicates production by a decreasing number of production units' (Chapman, 1996, p. 75). Swift (2017, p. 15) and Costin (1991, p. 37) also relate standardisation to the scale of production, with smaller production runs leading to less standardisation.

Care must nevertheless be taken to ensure that our systems of categorisation are not arbitrarily creating patterns in the material record. The issues of using typology to discuss manufacture can be explored with the rake tines from Copthall Court. Sixteen tines (RAK23-34, 36-9) were found together, and are presumed to have come from a single tool, although this is not known for certain. We might therefore expect them to have been made by the same person or workshop. However, under the rake tine typology devised by Pietsch (1983, p. 72) and formalised by Duvauchelle (1990, pp. 45–6), which divides objects based on the shape of the shoulder between the tang and blade, these tines would be split between Types 1, 3 and 4. From this we might infer that these tines were manufactured by a team of different smiths with different backgrounds. However, this ignores a number of features that these objects have in common. They all have the same highly unusual tang type, which is only seen on one other rake tine from London. They are all similarly sized, and appear to have been manufactured in the same way, the only difference being the degree to which metal was drawn out at the shoulder, and in which direction it was drawn. These shared features are surely more important than shoulder shape, and suggest that the variation that we see in these tines is due to the fact that the smith was not interested in making rake tines with a uniform shoulder shape. Relying on a single-criteria typology can therefore be misleading.

5.3.1 Degrees of Standardisation

Establishing relative scales of 'standardisation' and variation between object types is not simple. It is not the case that some objects are unambiguously more or less standardised than others. In several instances, it was found useful to create bi-partite typologies of London's tools. This is because some objects clearly had somewhat 'standardised' elements (such as blade or handle shapes), which could be combined in a number of non-standardised ways.

Figure 9 Rake tines from Copthall Court with different shoulder shapes (Left-right; RAK26, RAK36, RAK39).

This can be seen in a range of agricultural tools in London, particularly sickles and reaping hooks. In part, this diversity may reflect the wide range of potential functions these tools fulfilled, or the wide date range that they potentially derive from. However, it is noticeable that whilst very few of these tools closely resemble one another, a number of recurring features can be seen amongst them. The same is also true of spades. Together, these objects may represent the flexibility that smiths had in producing agricultural tools. As long as the tools worked, those using them may not have been interested in exactly how the handle was attached to the blade, or how the tines were formed. This would have allowed smiths with a wide variety of backgrounds to make and market agricultural tools.

Other tools can have more tightly defined forms. Type C spatulas, for example, always exhibit the same form of shoulder decoration, possibly indicating that they were manufactured in specialist workshops. The majority of the axes from London fit into a small number of closely similar types, although they show no standardisation of size. Adze-hammers also show a limited range of forms, with two adzes of the same type (ADZ03 and ADZ05) being extremely similar in size (Figure 175), although no two adze-hammers are exactly the same. This 'standardisation' may indicate a higher degree of specialisation of manufacture, and may be evidence that woodworking tools were produced in larger numbers than other object types, or by specialist producers. Further study through metallography or x-rays could reveal whether this similarity of overall form is a product of the use of similar manufacturing techniques, or whether smiths were using different techniques to arrive at similar end products. Fell (1990, p. 303) has explored these issues in relation to Iron Age tools.

The link between specialisation, standardisation and scale of production is not unambiguous, however. The chisels CHI09 and CHI31 have makers' marks which indicate that they were potentially produced in the same workshop (see p.621). These objects nevertheless have very different forms. CHI09 conforms very closely to the 'standardised' shape of a Type A-4 chisel, whilst CHI31 is a variation on the rarer Type C-2, which cannot be paralleled elsewhere. These tools potentially indicate that 'specialist' workshops in London were producing a mix of standardised and individualised tools.

5.3.1.1 Metric Standardisation

The question of standardisation of measurements is very difficult to approach archaeologically. Tools will have been subject to wear from use and re-sharpening, as well as corrosion after burial. Their dimensions are therefore likely to be smaller now than they were at the point of manufacture. To this we must add the fact that most Roman tools were made by freehand forging, which does not produce objects of precise sizes. The measuring tools available to the Roman craftsman, such as folding rulers, were marked with only lines or dots at *digitus* or *uncia* points (Ulrich, 2007, p. 54), and as such measurements of less than this would be inaccurate. As such, it would be wise to be extremely cautious about suggestions of standardised measurements at fractions of *unciae* or *digiti*.

On this basis, very little evidence was found in London to support the suggestion that tools were made to standardised dimensions or weights (either internally consistent ones, or ones based on standardised measurements) as has been suggested in the past (Gaitzsch, 1980, p. 257; Mutz, 1980, p. 126; Pohanka, 1986, pp. 261–2). No patterning could be seen in the sizes of Type C drill bit tangs, for example, which is surprising. This lack of standardisation may have meant that drill bits were not universally interchangeable, and craftsmen had to make sure that they had a stock of the correct dimensions to take a particular drill bit. However, standardisation may be visible in some of the more unusual tools from London, such as Type E chisels, plane irons and broad-bladed axes. This may indicate that whilst standardised blade sizes were not considered important for the majority of London's tools, a few specialist workshops were manufacturing tools in this specific way, perhaps to facilitate their movement through long-distance trade.

5.3.2 Cross-Type Styles

Another observable feature of the tools from London is that some elements of form are seen across multiple object types. Murphy (2017, pp. 110–13) has recently highlighted how 'hybrid' and 'oddball' forms in pottery can be used to explore the 'fluidity' of object creation, in direct opposition to the traditional archaeological focus on typology and standardisation. The potential implications of these 'cross-type styles' for the study of tool manufacture can be exemplified most clearly in an unusual Type 6 (*bidens*) hoe from Rushall Down, Wiltshire

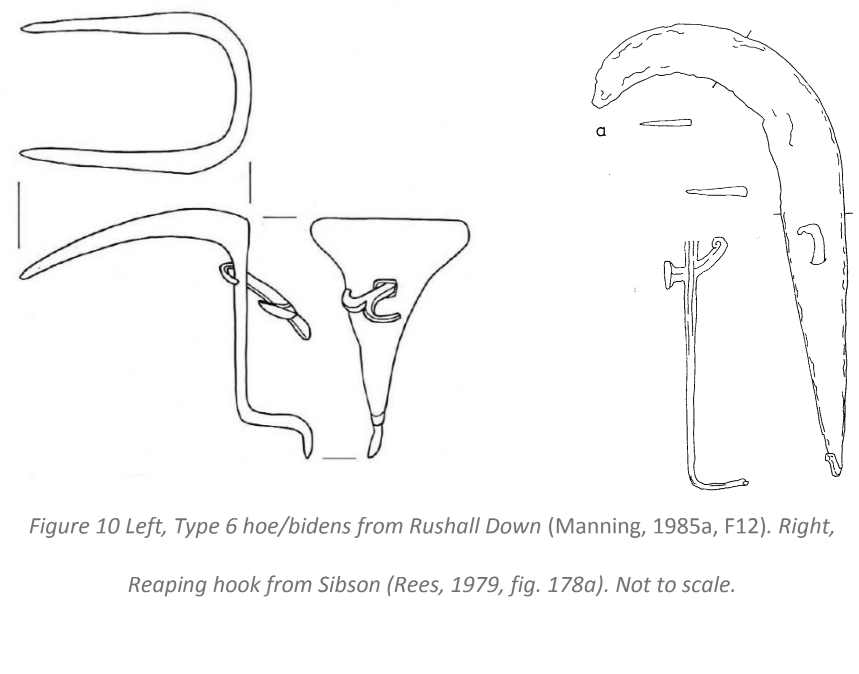


Figure 10 Left, Type 6 hoe/bidens from Rushall Down (Manning, 1985a, F12). *Right, Reaping hook from Sibson (Rees, 1979, fig. 178a). Not to scale.*

(Manning, 1985a, F12). Rather than the more familiar shaft-hole or socket, this hoe has a very peculiar plate tang, which ran along the outside of the haft, with the tip clenched through it. A rivet halfway along this plate also secured the iron head to the wooden haft. This has previously been interpreted as the result of 'rather misplaced ingenuity' by 'a smith of some eccentricity' (Manning, 1985a, p. 47). However, this underestimates the complexity of thought that went into its creation.

Tangs of a very similar form can also be seen on pruning hooks (Rees, 1979, fig. 178a, 185a) and scythes (Pietsch, 1983, Taf.24, 538-9). This indicates that the smith who made the Rushall Down tool was not 'eccentric'; rather, when presented with the problem of how to attach this object to the haft, they adopted a solution that they were familiar with from manufacturing harvesting tools. They may have been inexperienced in making cultivation tools, potentially indicating that these objects were usually manufactured by different groups. Alternatively, this could be seen as a positive choice to use a hafting method which they considered to be superior. In either case, this demonstrates the work of a smith indoctrinated in the technical frame of harvesting-tool-makers, practicing cultivation-tool-making. In London, we can see several other examples of elements of form which transcend object type.

5.3.2.1 Diamond-Shaped/Octahedral Handles (Figure 11)

Type 1 awls/bradawls and Type 4 chisels share similar expanded 'diamond-shaped' handles (Figure 11). Although the similarity of these objects is often remarked upon (Manning, 1985a, p. 40; Manning in Tylecote, 1985) the two are easily distinguishable as Type 4 chisels are always octagonal-sectioned, whilst Type 1 awls/bradawls are square-sectioned in the centre (although they may have bevelled front or rear edges). This difference is possibly functional. If the majority of Type 1 awls/bradawls were in fact bradawls (see p.384), the square-sectioned handles may have served as a finger grip, allowing them to be rotated. It is possible that these object types demonstrate a 'style' of carpentry tool design shared across multiple artefact types. This is difficult to prove, however, as so few Type 1 awls/bradawls have preserved tips. Although mostly bradawls, at least one from London (AWL004) may have been a leatherworking awl.

Figure 11 Type 1.1 awl/bradawl (Left, AWL002) and Type 4 chisel (Right, CHI10) from London (with replica handles).

A similar double-pyramid shape can also be seen in certain forms of ingots (Manning, in Tylecote, 1985; Serneels, 1998, fig. 33, 9-10). These ingots are larger than the awls and chisels, so the relationship is not as simple as these tools being made from partially re-worked ingots. Instead, it is possible that these objects were made using the same blacksmithing techniques. Ingots of this type are not found in Britain, however (Manning, in Tylecote, 1985), possibly indicating that these tools were made using imported smithing techniques. Further analysis is required to establish exactly what techniques were used, but it is possible that the bulbous handle was formed by upsetting (Sim and Ridge, 2002, p. 62).

5.3.2.2 Razors and Stitching Awls (Figure 12)

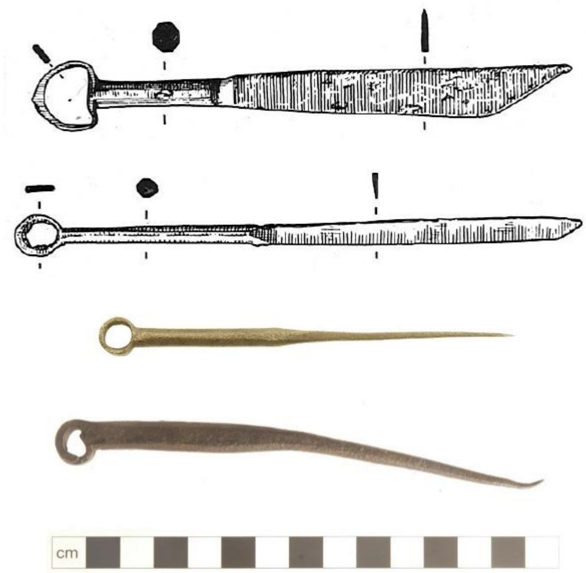


Figure 12 Knives of Manning's Type 2 and 4 (Top, Manning, 1985a, Q6-7) *and Type 2.3 awls from London (Below, AWL032 and AWL033).*

Type 2.3 awls have octagonal-sectioned handles with an integral suspension loop at the butt. This is an odd handle shape for an awl, which today have more ergonomic handles with bulbous wooden ends. However, these handles are very similar to those seen on Manning's (1985a) Type 2 and 4 knives. These knives are thought to have been scalpels or razors (Manning, 1985a, p. 110), whilst the awls were specialist stitching awls used in leatherwork (see p.387). These objects may indicate a relationship existing between leatherworkers and cutlers in London, and it seems likely that these two object types were made by the same people. A strong connection between these two trades would not be surprising, as leatherworkers would require good quality knives in order to carry out their work.

5.3.2.3 Other Shared Tool Styles

Other styles shared between different tool types demonstrate less surprising connections. Metalworking punches and cold chisels have a similar range of forms, having either an octagonal body or a continually tapering body the same shape as the tip. These were probably made by the same people; most likely the smiths themselves. Double-sided shaft-hole tools, such as hammers and picks, often have the same form of an expanded diamond-shaped casing around the eye. These objects were probably made with similar techniques, and a shared understanding of how to make robust shaft-hole tools. Hearth tools of all types (pokers, shovels and flesh hooks) are often made to a standard design, with a barley twist shaft. As such, it would be possible to have matching suites of hearth equipment.

5.3.3 Differential Execution

As well as examining different types of tools, it is possible to approach manufacturing practice based on the fact that some tools of the same 'type' appear to be better-made than others. Murphy (2017, pp. 107–13) highlights deviations from established typologies such as this as socially meaningful, interpreting them as evidence of the interplay between craftspeople, their desired outcomes, and the materials they work with. More straightforwardly, these tools may represent the work of smiths with different skill levels; a fact which may be related to their lifecourse or degree of craft specialisation (Costin, 1991, pp. 39–41).

This can be seen particularly clearly in the awls/bradawls from London. Two are extremely well made, although in different ways. AWL021 is notable for its decoration (Figure 13). Whilst the incised lines at the shoulder would have been simple to execute, the pointed langets which extend onto the blade would have required considerable skill to execute. The blade of the tool itself, which emerges from the shoulder on a different alignment to the handle, with crisp edges all round, before developing facets as it tapers to the point, is testament to the skill of the smith who made it.

Figure 13 Bradawl AWL021.

AWL037 is not decorated, but is nevertheless conspicuous for the skill with which it was executed (Figure 14). The handle and blade of this bradawl turns through a series of facets as it tapers. As such, the tool sits extremely comfortably in the hand.

Figure 14 Bradawl AWL037.

AWL028, AWL034, AWL039 and AWL041, meanwhile, are notable for their amorphous shapes and very obvious weld lines, which must have been visible when the objects were first made. However, the implications of these amorphous forms differ between the objects. AWL028 (Figure 15) and AWL034 (Figure 16) both closely resemble other tools that fit into defined types. We can therefore see these objects as amateurish, failed or unfinished attempts at making a tool of a recognised form.

Figure 15 AWL028 (below) with a more conventional Type 2.2 awl (above, AWL031).

Figure 16 AWL034 (below) with a more conventional Type 2.4 awl (above, AWL035 (Manning, 1985a, B78)*).*

In contrast, AWL039 (Figure 17) does not conform to a recognised type, and is only vaguely similar to another object, AWL040. Its construction methods are clear from weld lines on the surface; the object was made by bending a bar of iron around a separate core piece, welding the two ends together and refining them to an awl blade. Nevertheless, the object has still been somewhat carefully made, with the butt rounded and bevelled. This shows that the object was made with a clear function in mind, and shaped to accommodate it, but with less attention paid to aesthetics, and not following an established pattern.

Figure 17 Awl AWL039.

Finally, AWL041 is the most amorphous, having been made by folding a piece of iron and drawing it out to a point. It does not closely resemble any other awl form, and its shape may in part have been dictated by the shape of the piece of metal from which it was made. It is interesting that both of these awls have rounded butts, as this would have allowed them to be pushed comfortably with the palm of the hand as stitching awls. Can we infer from this a tradition of blacksmiths improvising leatherworking awls, perhaps for their own use? Or do these tools demonstrate the manufacture of leatherworking equipment by people outside of the main Roman toolmakers' technological frame?

Figure 18 Awl AWL041.

Differential execution can also be seen in other tools from London. Woodworking tools are generally well made, with adze-hammers, axes and chisels in particular often showing clean lines and purposeful shaping. However, some objects deviate from the expected forms. The gouge GOU10 has been decorated with lines and notches (Figure 63), but these overlie an obvious weld line extending from the blade to the handle. The use of decoration here may be an attempt to make a poorly executed tool, perhaps from a less accomplished smith, seem more appealing. The Type Dii-2 mortice chisel CHI35 has a less well defined shoulder and tip than other chisels of the same type. The shoulders on all Type 2 chisels are thinner than the iron at the blade, and therefore must have been made by drawing out a section of the material from the blade. The shoulders of CHI35 are wider and thinner in relation to the blade than on other chisels of this type, as well as being more sloped when they join the tang. They have therefore been drawn out further than would be usual for a chisel this wide. This may represent the work of a less experienced smith who was unable to find a more attractive solution to the problem of needing to form wide shoulders from a comparatively narrow-bladed tool. Perhaps this relates to the selection of an inappropriately narrow bar of iron as the starting material (Keller, 1994, pp. 67–8).

Figure 19 Type Dii-2 chisels. CHI35 (above) has a much less sharply defined shoulder and tip than CHI32 (below).

Amongst metalworking tools, the anvil ANV01 and cold chisel COL01 both have obvious weld lines indicating how they were made, whilst the hammer HAM12 has a very irregular form, the shape of which may have been dictated by the size and shape of the wooden piece used for the handle. It would not be unexpected for blacksmiths to manufacture their own tools with little regard towards aesthetics, although these tools are the only ones that stand out in this way.

5.3.4 Improvised and Modified Tools

As well as specialist manufacture, we can see evidence in London of 'improvised' or 'modified' tools. The best examples of the modification of objects into tools are Type 5 awls. Type 5 awls consist of an iron nail with leather washers threaded onto the stem to form a handle. They were probably leatherworking tools, and may have been manufactured by leatherworkers themselves. Nails would presumably have been available to purchase in London, and all of the nails used in Type 5 awls are of the most common type (Manning, 1985a, Type 1B).

Figure 20 Type 5 awl (AWL045), made from a modified iron nail with leather washers threaded to act as a handle.

However, only AWL049 consists of an unmodified square-sectioned nail. Other examples (AWL043-44, AWL046, AWL048) become round in section as they emerge from the leather handles. AWL045 and AWL050 are even more complex, changing again to become diamond-shaped in section at the tip. Importantly, all of these section changes can be achieved by reduction. Whilst this could have been achieved by forging, it would also have been possible to modify these nails by filing. This would not require the involvement of a blacksmith, and means that leatherworkers may have been manufacturing their own tools from commercially available nails.

Other tools may have been manufactured by modifying existing tools. The moulding plane PLA02 appears to have been made from a Type A-4S chisel. The punch PUN22 may have been made from a broken Type C drill bit. Two wax tablet spatulas (CIM02-03) appear to have been re-used as chisels, whilst a file (CIM01) may also have been modified into a small chisel. The blade from a pair of shears, SHE11, was re-used as a knife. A pair of tongs, TON03, appear to have been modified to suit a new task. The handles have been bent, possibly to facilitate its use in picking up crucibles rather than forging metal objects.

These objects demonstrate a different relationship between craftsmen and their tools to professionally manufactured objects. Murphy and Poblome (2012, p. 205) relate the use of improvised tools to the application of 'technical know-how' to the environment, contrasting this with the 'skill' required to purposefully manufacture tools. However, in London, the re-forging of a file into a chisel (CIM01), or re-shaping of tongs (TON03) would have required both 'know-how' and inventiveness and a degree of metalworking 'skill'. The recycling of objects can also be related to the economy. It is interesting that two of the improvised or modified tools from Bloomberg (the punch/drill bit PUN22 and chisel/file CIM01) come from the earliest phases of tool deposition at the site. This is possibly reflective of the nature of the economy of the middle Walbrook valley at the time of the Boudican fire, when it was peripheral to the main settlement and not engaging in the high levels of material consumption later demonstrated here by the deposition of metalwork in land-raising dumps (Chapter 7).

5.3.5 Composite Objects

When considering craft specialisation we need to critically consider to what extent objects were made from start to finish in the same workshop. The best way of approaching this through tools is by looking at composite objects. Whilst this thesis is primarily concerned with the metal portions of Roman tools, it is worth bearing in mind that many of these tools would have had substantial wooden components. Many objects would be hafted, whilst more complex machinery, such as ploughs, planes and crozes, would have required large wooden components, with the iron portions making up only a small part of the complete tool.

Unfortunately, the wooden components of tools rarely survive. Some information can nevertheless be obtained by examning the tang. Awls provide an interesting insight into the dynamics of producing composite objects. Today, awl blades are often sold separately from their handles. This requires both parts to be made in such a way that the blade can be easily inserted without specialist metal- or woodworking equipment. The double-ended and short-tanged awls from London may have been hafted using this model, although we cannot know this for certain. A different model is required for Type 7 awls, however. These awls have clenched tangs, which were presumably heated before bending. As such, their handles must have been fitted by a smith, presumably the toolmaker. It is therefore curious that the two awls from London with surviving wooden handles (the Type 7 AWL056 and the short-tanged bodkin AWL103) both have similar teardrop-shaped handles. This handle type can also be seen on another awl from Ilchester (Leach, 1982, fig. 126, 100). This may indicate that the handles had a similar source, perhaps professional handle makers, regardless of whether the involvement of a metal smith was strictly needed to fit them.

5.4 Discussion

The tools from London provide evidence of a group of tool makers who cannot be simply categorised as 'blacksmiths'. This group displays as much diversity in cultural background and social connections as any of the other communities envisioned to have lived in Roman London.

The tools display little obvious influence from local Iron Age communities. This stands in contrast to the structural evidence for 'native' ironworking in the city, including large numbers of 'native' style pit hearths in Southwark (Hammer, 2003). Partially this may be due to the lack of obvious distinction between some types of 'Roman' and 'Iron Age' tools, particularly metalworking tools. Alternatively, this picture may have been influenced by the different depositional practices of different communities (Chapter 7). Nevertheless, there is evidence in the tools from London for the specialist manufacture of 'Roman' tool types, potentially indicating the presence of immigrant smiths. There is also evidence for military tool types, and therefore possibly military smiths. However, it is far from clear that the majority of tools found in London were manufactured here, and a number of them were certainly imported to the city from Continental Europe.

Turning to the organisation of tool making, we can see evidence that the tools of different trades were made with different levels of specialisation; agricultural tools may have been made by a wide range of smiths, whilst woodworking tools were sometimes specialist products. Other tools (such as Type 5 awls) were made by the craftsmen themselves. The manufacture of tools was sometimes influenced by the degree of interaction between different groups of craftspeople, as seen in the interaction between leatherworkers and knife makers. Some tools may have been the product of manufacture by a number of individuals, with surviving wooden hafts indicating a market for pre-made wooden handles. Different tools were executed with different levels of skill, with a few exceptionally well made tools from London indicating a level of investment in high quality tools by woodworkers.

Chapter 6- Use

Activities, Industries and Practices

6.1 Introduction

> *'But of all his measures, the one most admired was his distribution of the people into groups according to their trades or arts… He distributed them, accordingly, by arts and trades, into musicians, goldsmiths, carpenters, dyers, leatherworkers, curriers, braziers, and potters. The remaining trades he grouped together, and made one body out of all who belonged to them.'*
>
> Plutarch (*Life of Numa*, 17, 1-2)

The identifications and possible functions of the London tools, alongside any evidence for the chronology and distribution of their types, are discussed in the typology section in Appendix 1.2. Drawing on this typological discussion, the following chapter will seek to explore what craft and agricultural activities were taking place in London during the Roman period. This chapter will synthesise the typological discussion of the tools with other evidence for craft in London, and evidence for the organisation of craft and agriculture in the Roman world more generally.

In Roman small finds studies a long-established convention, begun with Crummy's (1983) publication of the small finds from Colchester and continuing in numerous schemes today (Brand *et al.*, 2013), has been to divide objects into functional categories. As well as making small finds reports easier for non-specialists to navigate and use, this sought to advance small finds research by integrating some form of functional analysis into even the most basic publications. In Crummy's scheme, the tools discussed in this thesis would be split between Categories 10, 12, 15, 16, and 17 (Table 2). Whilst these categories do not encompass the full range of functions exhibited in the London tools assemblage (there is no category for stone-working equipment, for example), several similar functional breakdowns have been used in dedicated archaeological studies of tools (Champion, 1916; Jacobi, 1974; Manning, 1976b, 1985a; Duvauchelle, 1990; Tisserand, 2001; Hanemann, 2014). Although tailored to their respective assemblages, these works all divide their assemblages, as Crummy did, by the type of material that the tools were used to work.

No.	Description
1	Objects of **personal adornment or dress**
2	**Toilet, surgical or pharmaceutica**l instruments
3	Objects used in the **manufacture or working of textiles**
4	**Household utensils and furniture**
5	Objects used for **recreational** purposes
6	Objects employed in **weighing and measuring**
7	Objects used for or associated with **written communications**
8	Objects associated with **transport**
9	**Buildings and services**
10	**Other tools**
11	**Fasteners and fittings**
12	Objects associated with **agriculture, horticulture and animal husbandry**
13	**Military equipment**
14	Objects associated with **religious beliefs** and practices
15	Objects and waste material associated with **metal working**
16	Objects and waste material associated with **antler, horn, bone and tooth working**
17	Objects and waste material associated with the **manufacture of pottery vessels or pipeclay objects**
18	Objects the function or identification of which is **unknown or uncertain**

Table 2 Crummy's functional categorisation of Roman smallfinds (Crummy 1983, v).

This is clearly the most logical and straightforward way to organise a discussion of tools, and has been used by the author in the past in discussions of the contents of ironwork hoards (Humphreys, 2017a, p. 372). Categorisation of finds in this way provides a simple means of comparing assemblages, and demonstrates in broad terms the importance of different craft activities. Figure 21 shows a breakdown of the functions of London's tools, with each tool having been assigned its *most likely* function based on the interpretation given in the typology chapter

(Appendix 1.2). Objects related to domestic activity, writing, or to which no clear function could be assigned, have been excluded from this graph.

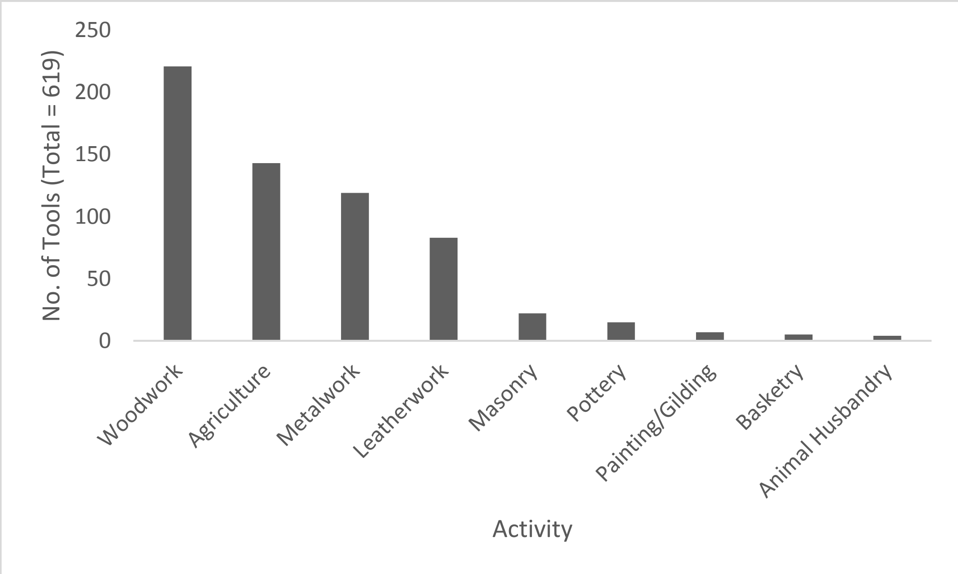


Figure 21 Functional breakdown of the identifiable craft and agricultural tools from London.

However, schemes of this sort are not unproblematic. They presuppose that it is always obvious from a tool's form what sort of material it was used on, and that a given tool type was only used on one material type. For this reason, the working of skeletal materials is not represented at all on this graph, as the tools used in this industry are indistinguishable from those used in woodwork (See p.263). At a more abstract level, this sort of categorisation encourages the supposition that 'woodworking' or 'metalworking' were emic categories of practice that would be recognised in the Roman period, rather than etic divisions designed for the convenience of researchers. I have no neat solution to this issue, and for ease of navigation will continue to structure discussion around a functional breakdown similar to that applied by the above authors. However, a key aim of this chapter will be to critically consider exactly what activities constituted 'professions' in Roman London.

This section is broken down into broad spheres of work based on material type, as given in Figure 21 (woodwork, metalwork, agriculture, etc.). These sections are ordered by the number of tools assignable to them, from highest to lowest. As such, the initial sections are the longest, as there is a greater amount of evidence to discuss. Each section begins with a discussion of the evidence for specialisation within this field, and for the social position of the various workers operating within these categories. For each section there is a discussion of the supply of raw materials to London, as well as a discussion of the evidence for sites specialising in this kind of work in the city. Here, the distribution of different tool types is compared to the distribution of waste and structural evidence for these crafts. In order to reduce the ‘noise’ created by the uncertainty around the function of some tools, these distribution maps have plotted only those tools which can be tied to a craft with near certainty (designated with an ‘- A’ suffix on the database). More detailed discussion of the issues with interpreting these distribution maps can be found in Chapter 7.

Finally, each section contains a discussion of craft ‘practice’. These discussions will synthesise the data from tools, waste and finished objects to discern what activities were taking place in London, how they were carried out technically, and which groups of people were involved. These discussions are not all-encompassing, and will focus on practices in which the tools from London were likely to have been used, and can therefore make a contribution to the discussion.

Previous chapters have highlighted how important it is to adopt a holistic approach, considering tools alongside other sources of evidence for ancient crafts. However, no previous synthesis of craft activity exists for Roman London. Instead, references to relevant activities are scattered amongst excavation reports (particularly Hammer, 2003; Seeley and Drummond-Murray, 2005; Wardle, 2015), and a number of short articles dedicated to particular activities (Hall, 2005; Bird, 2017a). An aim of this section will therefore be to bring these sources together in order to properly contextualise the London tools.

6.2 Woodwork

> *'we know how to govern sawyers and borers and planers and turners, as a class together; for is not that carpentry?'* Plato (*Theages*, 124b)

Woodworking tools are the best represented category of tools in London (Figure 21). Waterlogged conditions on the Thames waterfront, in the Walbrook valley, and in deep features elsewhere in the city, have also meant that a large number of timber objects and structural components have been recovered from London. This provides an excellent dataset against which the London woodworking tools can be contextualised. Together, these present a uniquely valuable insight into the world of ancient woodwork, which is usually invisible to us.

Woodworking is represented by as many as 219 tools, including axes and adzes, bradawls, augers and drill bits, chisels and gouges, croze and plane irons, drawknives, bench knives, saws, and rasps. Other tools identified with less certainty as woodworking tools include scrapers, hammers and wedges, whilst the broader suite of tools associated with woodworking will have included line irons, saw-setting hammers and files. This large suite of tools provides evidence of a wide range of tasks taking place under the general umbrella of carpentry, covering tasks from the initial felling and shaping of timber, to fine carving and finishing.

This section will first look at the evidence for the types of people working with wood in Roman towns, before moving on to a discussion of woodworking sites in London. Finally, the tools, tool marks, finished products and woodworking waste from London will be examined as evidence of woodworking practice in the city.

6.2.1 Woodworkers in the Roman World

Comparatively little work has been dedicated to Roman carpenters, probably because so few of their wooden products survive to us. Woodworkers are usually interpreted in the traditional classical mould as landless lower class *plebians*, freedmen, or slaves, looked down on by high society (Liversidge, 1976, p. 162; Ulrich, 2007, p. 7). This may not always have been the case, however. There is evidence from literary sources that woodworkers could be 'famous' for their skill and 'above reproach' in local standing (Pugsley, 2003, p. 140). The burial of an aristocratic woman at Turner's Hall Farm with woodworking tools shows that the wealthy could 'work wood', although this person is unlikely to have been a professional 'woodworker' (Chapter 7.7). Plane bodies from Cologne and Goodmanham show considerable investment in fine, decorative tools (Goodman, 1964, fig. 50; Long, Vere-Stevens and Steedman, 2002), whilst woodworking tools have also been found in elaborately decorated houses in Pompeii (Allison, 1997).

Relief carvings suggest that woodworkers worked together in workshops, which probably contained a mix of masters, apprentices and assistants (Ulrich, 2007, p. 9). Larger numbers of woodworkers will have worked together on civic projects, and in tasks such as shipbuilding (ibid). Like other craftsmen, woodworkers are presumed to have learned their trade through apprenticeships (Ulrich, 2007, p. 12), but may also have gained training through entering the military. Frere (1972, pp. 9–11) has suggested that a block of early timber buildings in Verulamium was built by soldiers loaned to city authorities by the state, although this has since been disputed (Millett, 1990, pp. 69–71). In London, some timbers appear to have been worked with a mattock (Goodburn, 2000, p. 7); a tool which is sometimes associated with the military (see p.516), potentially indicating woodworkers with a military background. The Gresham Street wells and Regis House Quay, both built c. 63 AD, are thought to have been civic infrastructure projects, possibly carried out by the Roman army as part of a post-Boudican rebuilding project (Blair *et al.*, 2006, pp. 10–11).

Several sources of evidence suggest that the umbrella term 'woodworking' masks a wide range of separate industries and professions in the Roman period. Like other trades, woodworkers had dedicated guilds. Inscriptions attest to a college of sawyers (*sectores materiarum*) in Aquileia (Meiggs, 1982, p. 355; Goodburn, 2000, p. 10; Ulrich, 2007, p. 9), and guilds for 'those who work with beams of wood' (*collegium fabrum tignuariorum*) in Rome (Ulrich, 2007, p. 9), Luna (Patterson, 1994, p. 235), and Arles (Tran, 2016, p. 256). Wagon builders (Liversidge, 1976, p. 163) and ship caulkers are attested in Ostia (Venticinque, 2009, p. 2), and ship builders in Arles (Tran, 2016, p. 256) and Portus (Liversidge, 1976, p. 163). There are, however, no known inscriptions by woodworking guilds in Britain.

A number of specialist woodworking trades are named on craftsmen's tombstones (Table 3). These inscriptions only ever give one specialisation, implying that these names represent dedicated professions, although it is possible that individual carpenters would be experienced in more than one area of woodwork (Ulrich, 2007, p. 9). Other trade names come from writing tablets. An example from Bloomberg, London, was addressed to a cooper (*cupario*) (Tomlin, 2016, p. 86, <WT14>), whilst another refers to shipbuilders (Merrifield, 1983, p. 99; Hall, 2005, p. 137). Diocletian's price edict also suggests specialisation, as it makes distinctions in the wages given to workers in different types of wood, and different types of shipbuilders (Liversidge, 1976, pp. 156, 165).

Latin name	Specialisation
arcularius	Chest maker
faber carpentarius	Two-wheeled cart (*carpentum*) builder
fabri citratii	Inlayer
faber intestinarius	Interior woodworker
faber lectarius	Bed and couch maker
faber pectinarius	Comb maker
faber plaustrarius	Wagon builder

Table 3 Latin names used for specialised woodworking professions (Ulrich 2007, 8-9).

Analysis of surviving woodwork also suggests specialisation. Roman machinery (water-lifting machines, mills, etc.) was often based on wood, indicating that some woodworkers must have been very technically knowledgeable. The excavators of a series of mechanical water lifting machines in London have suggested that the mechanical engineers who built them formed 'a distinctive and highly-specialised branch of woodworking, with its own set of tools and techniques intimately combining oak and iron' (Blair *et al.*, 2006, p. 49). It has also been argued that at least two different groups of structural carpenters operated in London; one producing Iron Age-type buildings, the other building Roman-style structures (Goodburn, 1995, p. 45, 2000, p. 7; Hall, 2005, p. 137).

Roman woodworkers can be seen in some images wearing short, single-sleeved tunics, similar to those worn by depictions of smiths and smith gods (Ulrich, 2007, fig. 2.3, 3.8, 3.17). Examples include those in furniture workshops on an altar (Ulrich, 2007, fig. 2.3) and sarcophagus (Ulrich, 2007, fig. 3.8) from Rome, and on a Pompeiian fresco depicting Icarus (Ulrich, 2007, fig. 3.17). Other images show woodworkers in a wider range of clothes, however (Ulrich, 2007, fig. 3.23), and it is unknown whether the short tunic formed part of a craft uniform for London's woodworkers. A separate class of *salutarii* (foresters and rangers who protected Imperial forests) were possibly distinguished by a special kind of narrow-bladed axe (*securis*), used as a symbol of office (Visser, 2010, pp. 15–6). There is no evidence for *salutarii* in Britain, however.

Unlike metalworkers, there has been no suggestion that woodworkers occupied a special position in ancient societies or cosmologies. That woodworking was associated more with skill and invention than magic is indicated by Apuleius' 2nd century *Apologia*, in which a woodcarver 'whose skill was famous among the town folk and whose character was above reproach' was summoned to prove that a carved figure of Mercury was his own work, and not made 'for the purpose of magic and by some secret process' (Pugsley, 2003, p. 140). Pliny (*The Natural History*, 7.57) associates the invention of woodwork, and many of the key tools used in carpentry, to the mythical craftsman Daedalus; the creator of the Labyrinth and father of Icarus. Other authors attribute these inventions to his nephew (Bostock and Riley, 1855, n. 38). The invention of other woodworking tools is attributed variously to Theodorus of Samos, or Pythagoras (Bostock and Riley, 1855, n. 40).

There is nevertheless some evidence that may support an interpretation of woodworking as ritually important in the ancient world. Woodworkers certainly participated collectively in worship through guilds. The guild of sawyers in Aquileia gave offerings to the forest-protector Silvanus, whilst the guild of carpenters in Rome set up an altar to Minerva (Ulrich, 2007, p. 9). That Silvanus was worshipped in London is shown by a statue base from Southwark dedicated to the god (Perring, 2015, p. 30). Superstition and folk knowledge may also have been important in woodwork. Pliny (*The Natural History*, 16.74-5) suggests that the felling of trees should be timed in regard to the phases of the moon, and there is evidence in Britain from Bronze Age and Iron Age structures that felling was timed to coincide with lunar eclipses (Chamberlain, 2003; Chamberlain and Parker Pearson, 2003).

There is also some evidence for an overlap in significance between metalworking and woodworking. Theodorus of Samos, to whom Pliny (*The Natural History*, 7.57) ascribes the invention of several woodworking tools, is also identified by Pausanius as the inventor of iron and copper forging (Bostock and Riley, 1855, VII, 57, note 40). The tree god Silvanus was sometimes associated with the Celtic smithing god Sucellus (e.g. in an inscription from Numidia, EDCS-16200905), and there is evidence for this connection in Colchester, where a plaque (*RIB* 194) was dedicated to Silvanus Callirius (possibly indicating syncretism with a local woodland god) by a copper smith, Cintumus (Breeze, 2004). Woodworking tools are also key components of many ironwork hoards, which are usually interpreted as having a ritual function, potentially related to metalworking cults (Manning, 1972a; Hingley, 2006; Humphreys, 2017a). A pit deposit from Auchendavy fort, not previously recognised as a hoard, contained two large iron 'mallets', possibly wood- or metalworking tools, and a number of altars (*RIB* 2174-8), including one dedicated to Silvanus (*RIB* 2178). Some of the items in these hoards may have originally been deposited in temples (Humphreys, 2017a, pp. 398–9); the *Greek Anthology* (6.103, 204-5) records Greek woodworkers dedicating their tools to Athena on their retirement (Humphreys, Oleson and Sherwood, 1998, pp. 323–4), whilst Appian (*The Civil Wars*, 1.11.97) records that Sulla dedicated an axe to Aphrodite following a dream (Kiernan, 2009, p. 144). A plaque from Cadenet records the dedication of an axe to Mars and Dexsiva (Kiernan, 2009, p. 144).

Key questions therefore emerge about the woodworkers of Roman London. Is there evidence of craft specialisation, and if so, what? Is there any evidence for the status of woodworkers in London? Can we identify technological change?

6.2.2 Timber Supply to London

Timber in London is represented by a number of different species, which are evidence of a variety of supply lines. Oak (*Quercus* sp.) is by far the best represented wood in London. It was used in construction for piles, planks, baseplates, structural beams and roofing materials (Goodburn, 1991, 1995, 2000; Brigham, Goodburn and Tyres, 1995), for waterfronts (Milne, 1985, p. 65), for well linings and bucket chains (Weeks, 1978, p. 104; Blair *et al.*, 2006, pp. 9, 14, 18), as well as for firewood (Blair *et al.*, 2006, p. 17), charcoal (Starley, 2003, p. 140), and for a range of domestic products, such as ladders (Weeks, 1978), doors, chests, and dishes (Goodburn, 2000, p. 14). Although different species of oak exist, these cannot be distinguished archaeologically (Brigham, Goodburn and Tyres, 1995, p. 33), limiting the degree to which this material can be provenanced. Oak is native to Britain, and is presumed to have been sourced locally rather than imported (Brigham, Goodburn and Tyres, 1995, p. 33), although other cities, such as Pompeii (Ferdinando De Simone, 2016, p. 46), must have imported substantial amounts of the most commonly used woods from outside of their direct hinterland. Woodland has been seen as 'the only sensible use' for the poor agricultural geology around the city (Bird, 2017b, p. 44), although the pollen evidence for this is weak (Sidell, 2008).

Analysis of the oak floor joists from a warehouse building in Southwark indicates that they came from 30-35 year old coppiced trees (Brigham, Goodburn and Tyres, 1995, pp. 34–8), as did some of the studs from 1 Poultry (ONE94, Goodburn, 2000, p. 7). Planks from the large wells at Gresham Street (GHT00), felled c. 63AD, also derived from managed woodland (Blair *et al.*, 2006, p. 9), whilst the timber for a base plate from Courage's Brewery, Southwark, came from an 85 year old tree from sparse or managed woodland (Brigham, Goodburn and Tyres, 1995, pp. 34–8). Coppicing involves cutting trees down to stumps so that fast, new growth is triggered, providing a reliable source of small timbers. Coppicing appears to have been widely practiced in the Roman period (Visser, 2010, pp. 17–9). Classical writers recommended that oak be coppiced every 7 years (Meiggs, 1982, pp. 267, 269; Brigham, Goodburn and Tyres, 1995, pp. 36–7), although the structural timbers from London were left much older (Brigham, Goodburn and Tyres, 1995, pp. 37–8). This indicates that the woodland resources around London were being managed to provide structural timbers from the start of the Roman period, if not earlier (Brigham, Goodburn and Tyres, 1995, pp. 36–8; Hammer, 2003, p. 167). However, wild woodland continued to be exploited; the crossbeams from the Gresham Street (GHT00) well came from 200 year old wild oaks (Blair *et al.*, 2006, p. 9), whilst piles from 20-28 Moorgate (MRG95) were c.130 years old (Goodburn, 2005, p. 193). Wild oak was also used at 1 Poultry (ONE94) (Goodburn, 2000, p. 7).

Other native woods were used in London, although much less frequently than in other Roman cities (Goodburn, 2000, p. 8; Goodburn, Goffin and Hill, 2011, p. 436) or in post-Roman London (Goodburn, 2005, p. 191). Hazel (*Corylus* sp.) was used in wattle (Goodburn, 2000, p. 6) and barrel hoops (Blair *et al.*, 2006, p. 11). Like oak, hazel was coppiced, with the hazel wattle from 1 Poultry (ONE94) coming from 2-3 year old coppiced plants (Goodburn, 2000, p. 6; Goodburn, Goffin and Hill, 2011, p. 436). Yew (*Taxus baccata*) was used in London for small stave-built vessels (Marshall and Wardle, forthcoming), potentially representing a continuation of Iron Age manufacturing traditions (Earwood, 1993, pp. 67–75; Pugsley, 2002). Box (*Buxus* sp.) was used for a range of small items in London, particularly combs and small wooden containers (*pyxides*), but also beads (Hill and Rowsome, 2011, fig. 268), spindlewhorls and utensils (Marshall and Wardle, forthcoming). Wild box may have been present in small quantities in pre-Roman Britain, but Lodwick (2017) has argued that an increase in box representation in the mid-late Roman period represents the movement of box plants from Europe to Britain (including London), primarily for ornamental purposes. Boxwood appears to have been valued for its appearance as 'poor man's ivory' (Pugsley, 2003, p. 138). A number of objects from Bloomberg (BZY10) provide further evidence of a wide range of woods being worked in smaller quantities (Marshall and Wardle, forthcoming). Late Roman turned vessels from Bloomberg (BZY10) were made of maple (*Acer* sp.), as were two wax writing tablets, although one of these may have been imported (Goodburn, 2016, p. 8). Maple wood was considered particularly attractive for its grain (Croom, 2007, p. 21). Ink writing tablets from the same site were made from alder (*Alnus* sp.) (Goodburn, 2016, p. 8), and spindlewhorls from elder and yew. Beech (*Fagus* sp.) was used for a bench top, ash (*Fraxinus* sp.) for shoe soles, and birch (*Betula* sp.) for a sill beam (Marshall and Wardle, forthcoming).

Whilst the involvement of the military in supplying timber to provincial towns is debated (Perring and Roskams, 1991, p. 107), there is evidence for this in London in the form of stamped inscriptions on timbers. Stamps on offcuts from timbers found at Regis House (KWS94) have been read as '...IRAECAVG...', and tentatively expanded to 'The [numeral] Augustan Cohort (or Ala) of Thracians' (Hassall and Tomlin, 1996, p. 449). These stamps show the involvement of the military in harvesting and supplying timber in London, in this case for the construction of a quay (Bird, 2000, p. 161), dendrochronologically dated to 63 AD and probably related to a period of post-Boudican regeneration. Another offcut, reused as a post pad in the Guildhall Amphitheatre, has multiple stamps reading 'ICLV' and 'MIBL' (Hassall and Tomlin, 1995, p. 382). Whilst it has been postulated that the 'CL' may refer to the *Classis Britannica* (Bateman, Cowan and Wroe-Brown, 2008, p. 126), it is by no means certain that these relate to official control of timber products.

Figure 22 Stamps on a timber offcut from the Guildhall Amphitheatre (Bateman, Cowan and Wroe-Brown, 2008, fig. 19).

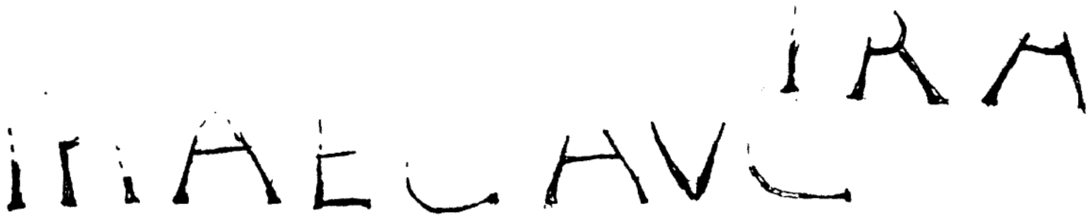


Figure 23 Stamp from a timber offcut excavated at Regis House (Hassall and Tomlin, 1996, fig. 8).

A large amount of the timbers recovered from London have been recycled from earlier structures (Goodburn, 2000, p. 5), and recycling seems to have been an especially important source of non-native wood types. 94% of the Bloomberg (BZY10) writing tablets were found to be made of silver fir (*Albies alba*), 5% of spruce (*Picea abies*) or larch (*Larix decidua*). All of these are non-native coniferous woods, with the silver fir coming from very large trees, some over 300 years old, possibly from wild Alpine forests (Goodburn, 2016, p. 8). Large numbers of silver fir barrel bungs from Bloomberg (BZY10, Goodburn, 2016, p. 9), and silver fir (Blair *et al.*, 2006, p. 11) and larch (Goodburn, 2000, p. 16) barrels from elsewhere in the city demonstrate that recycled barrels were the main source of these woods. All of the objects made of silver fir from London are the right size to have been made from old barrel staves (Goodburn, 2016, p. 9). Dumped barrel offcuts from Pudding Lane (Hall, 2005, p. 137), Centurion House (MNU11) and Bloomberg (BZY10, Goodburn, 2016, p. 9) are evidence of barrel re-working taking place, but the exact location of these workings is unknown (Goodburn, 2016, p. 9).

Whether other woods would have been specially imported for woodworking is unknown. Pugsley (2003, pp. 140–1) suggests that Apuleius' *Apologia* is evidence of 'craftsmen dealing, apparently exclusively, in costly woods'. A reference to *bruscas* (maple wood burrs) on one of the Vindolanda tablets (*Tab. Vindol*. II, 309.10) may indicate that the trade in desirable woods extended to Britain (Pugsley, 2003, p. 113).

The lack of primary processing waste from London may suggest that most timber was snedded (branches removed), bucked (cut to length), and hewn into baulks before entering London (Damian Goodburn pers. comm.). However, waste wood generated within the city could have been burnt as fuel rather than discarded (see p.249), obscuring our ability to identify its location.

Timber could be moved by land; a possible logging ring from Bloomberg (BZY10, Humphreys in Marshall and Wardle, forthcoming), and notches for ropes on timbers at Regis House (KWS94, Damian Goodburn pers. comm.) indicate that timbers were dragged with ropes, although the timbers from 1 Poultry (ONE94) do not appear to have been dragged (Goodburn, 2000, p. 8). Hanemann (2014, pp. 289–96) identifies chains which may have been used to drag logs, although none come from London. Logs can also be moved down rivers, although oak is sometimes too dense to float (Damian Goodburn pers. comm.). Hooks were not studied in detail for this project, but a large iron 'boat hook' from the Museum of London (MOL 13680, Figure 24) resembles the hooks used to guide floating logs on the Rhine in modern times (Kappesser, 2012, p. 82), whilst another (MOL 213) resembles modern 'log hooks' used in London's Docklands. Neither of these objects are certainly Roman, however.

Figure 24 Left, 'Flößer' with a hook for moving timbers down the river, c.1900 (Kappesser, 2012, Abb. 50)*. Right, Roman 'boat hook' from the Museum of London (MOL 13680).*

6.2.2.1 The Evidence of Tools

Tool handles also provide a source of archaeobotanical information. The spade SPA11 was made from oak. The wood for this tool may have been specially selected for its dense structure (Goodburn, 2011, p. 393). The handles of the miniature reaping hook SIC28 and awl AWL102 (which is possibly post-Roman) were made from box (*Buxus* sp.) (Manning, 1985a, pp. 41, 57), the use of which in tool handles is recommended by Pliny (*The Natural History*, 16.84). The adze-hammer ADZ03 had fragments of a rowan, whitebeam or service tree (*Sorbus* sp.) haft (Manning, 1985a, p. 18). Many of these woods are today used for tool handles, indicating that the wood was specially selected. The chisel CHI25 had a handle made of apple (*Malus* sp.) or pear (*Pyrus* sp.) wood (Manning, 1985a, p. 22). Many of these woods therefore appear to have been specifically selected as good materials for tool handles, echoing the advice of Pliny (*The Natural History*, 16.84), who gives lists suitable woods for different types of tool handles as well as recommendations for when they should be cut. Nevertheles, these woods may have been present in the urban environment primarily for their decorative effect, or as fruit-bearing plants.

6.2.3 Woodworking Sites in London

Buildings in which woodworking took place are extremely difficult to identify due to the lack of surviving waste products and the minimal structural requirements of carpentry. Possible furniture-making workshops have nevertheless been identified at Gloucester and South Shields on the basis of bone inlays (Crummy, 2001, pp. 97, 100, 2017, p. 261). Ulrich (2007, p. 9) presumes, on the basis of a building in Pompeii, that the majority of woodworkers would have worked from a room in their home. The *Casa del Fabbro* was identified as the home and workspace of a woodworker, perhaps a furniture maker, on the basis of the large number of tools found in the building, particularly in the covered porch by the enclosed garden (Ling, 1997, pp. 150–70; Ulrich, 2007, p. 11). This small courtyard building, decorated with crumbling wall paintings, may indicate the comparatively low position of carpenters in Pompeiian society (Ulrich, 2007, p. 11), although this identification is disputed. Agricultural implements, mason's tools and medical tools also found in the house challenge the idea that it was inhabited by a specialist craftsman (Ling, 1997, p. 162; Ulrich, 2007, p. 11).

However, woodwork in London would not have been restricted to workshops. Structural carpenters would have worked across London wherever buildings were being erected, although some amount of framework fabrication could have happened off-site. Fragments of timber in the linings of wells at Gresham Street and Arthur Street (Blair *et al.*, 2006, p. 31) and offcuts from fence panel manufacture at 1 Poultry (ONE94) and CID90 (Goodburn, 2000, p. 12) are evidence of on-site woodworking. Debris from the recycling of barrel timbers has been found on the Waterfront (at Pudding Lane (PDN81) and Monument House (MNU11)) and in the middle Walbrook valley at Bloomberg (BZY10), potentially indicating a localised industry related to waterfront trade, although some of this is dumped material (Goodburn, 2016, p. 9).

6.2.3.1 The Evidence of Tools

In London, no woodworking structures have been identified with certainty on the basis of waste products. Tools may therefore be an important resource in identifying the location of woodworking in Roman London. The distribution of firmly identified woodworking tools (Figure 25, Figure 27) shows that the majority were found in the Walbrook valley, although a number were also found elsewhere in the city. This pattern is typical for all tools in London, and probably represents disposal practices rather than craft organisation (Chapter 7). The majority of the tools in the Walbrook valley were deposited in dumps, and may not have been used there. This is supported by the fact that, when broken down by phase, the distribution of woodworking tools in the city closely follows the expansion of the city as a whole, even demonstrating a slight contraction in the Late Roman period (Figure 26). This can also be seen for all tools in London, suggesting that the pattern reflects the city's growth, and not specific craft practices (Chapter 7).

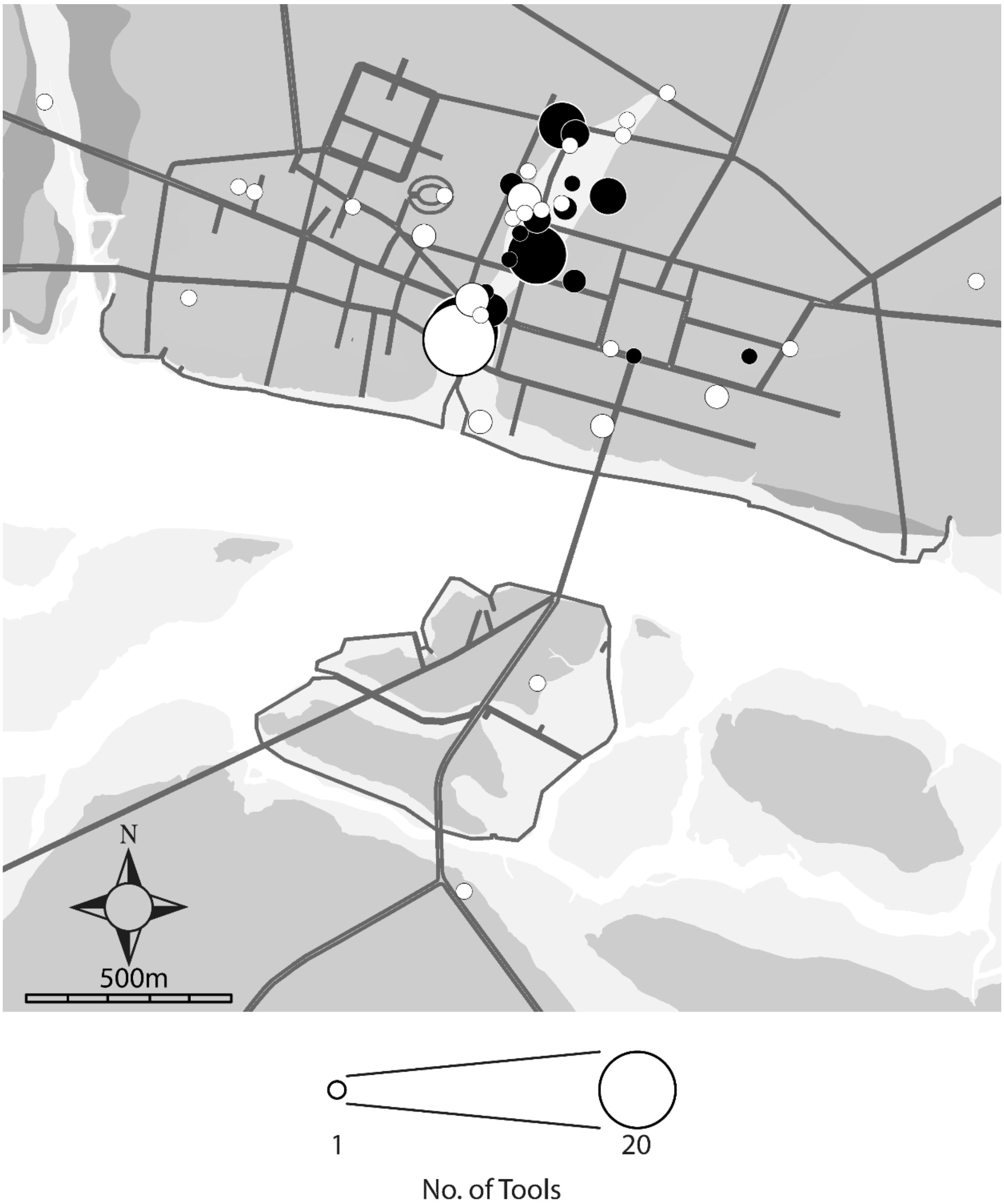


Figure 25 The distribution of woodworking tools in London (White dots = sitecodes. Black dots = street addresses, base map ©MOLA).

Figure 26 The distribution of phased woodworking tools in London (base map ©MOLA).

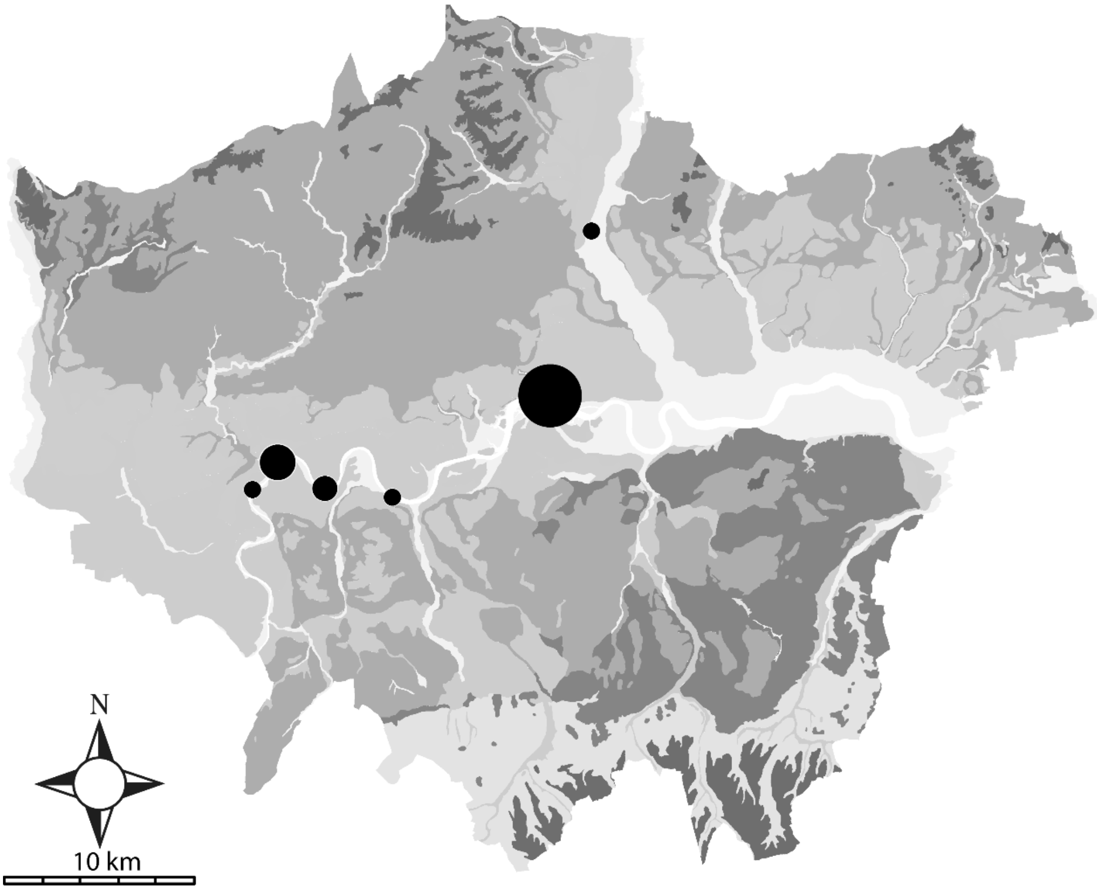


Figure 27 The distribution of woodworking tools in Greater London (base map ©MOLA).

Nevertheless, a small number of tools, all from the middle Walbrook valley, do come from possible occupation deposits. Four tools (BOR21, CHI42, GOU04 and SAW09), were found around two properties at Bloomberg London (BZY10). These may indicate that the structures, both timber strip buildings fronting onto the main east-west road through the city, were occupied by woodworkers (see p.298).

The spoon bit BOR52 comes from a pre-Boudican external working surface at 1 Poultry (ONE94). This area also produced evidence of lead and copper working, as well as a socketed spearhead, and was thought by Wallace (2014, p. 117) to represent the yard of 'a carpenter, metal-worker, and a veteran or soldier – who could conceivably have been the same person'. This interpretation is imaginative, however. The presence of a spearhead does not prove the presence of veterans. BOR52, a broken tip fragment, could conceivably have broken and been lost in use, but may have been lost during the construction or maintenance of nearby buildings, rather than in specialised craft work. The possible chisel CHI18 may nevertheless indicate woodworking taking place in an otherwise unused external space at 1 Poultry (ONE94) in the decades after the Boudican fire, although the function of this object is not clear. Another pre-

Boudican object interpreted by Wallace (2014, p. 117) as possible evidence of pre-Boudican woodworking in the Walbrook valley, CID90[892]<1231>, cannot be securely identified, and is unlikely to have been a woodworking tool.

6.2.4 Woodworking Practice in London

6.2.4.1 Timber Harvesting

The harvesting of timber in the London area is represented by a small number of tools. Off-cuts from 1 Poultry (ONE94) show that trees were felled with 80-90mm wide axes (Goodburn, 2000, p. 8). Although the majority of the axes from London show little evidence of specialisation, and are slightly narrower than the axe marks from 1 Poultry, a group of exceptionally large narrow-bladed axes (AXE01-02, AXE09-10, AXE16) conform to these dimensions, and may have been used as felling axes (Figure 28). There is no evidence for felling with saws in London (Goodburn, Goffin and Hill, 2011, p. 434). Smaller coppiced oak and hazel withies could have been harvested with axes, or the robust billhooks from London (Figure 77). Although dies of the type used to mark timbers (Figure 23) have been found in London (DIE02-03, Figure 48, Figure 119), these have shorter inscriptions and are likely to have been used in other industries.

Figure 28 Felling tools from London (Top-bottom: axes, AXE01, AXE10; wedge, WED01).

6.2.4.2 General Woodwork

The various tasks carried out by woodworkers in shaping, fitting and finishing wooden objects are represented by a huge variety of different tools. Many of these tools could have been used interchangeably in a wide variety of different tasks, and it is not clear from many of them how these may have related to the actual tasks carried out it London.

Figure 29 Wood-shaping tools from London (Top-bottom; adze-hammer, ADZ01; drawknife, DRW02; ?bench knife, BEN01).

Most of the tools from London reflect what could be considered 'standard' woodworking practice in the Roman world. Rough shaping could be carried out in a variety of ways. A large number of objects from London seem to have started as sawn or split planks which were then trimmed and shaped with axes (Goodburn, 2000, p. 14; Blair *et al.*, 2006, p. 49). Most of the axes from London are of similar shapes, all with wedge-shaped profiles and straight or slightly curved edges. This indicates that these tools fulfilled a variety of functions, and it would have been up to the user to select an appropriately sized tool for the task at hand. Objects could also be shaved to shape with drawknives or bench knives.

Although eight woodworking adzes come from London, there is little direct evidence of their use in the form of tool marks. This is possibly because they are being confused with axe marks, from which they may be difficult to distinguish (Earwood, 1993, p. 203). Alternatively, it may be that adzes were used in careful finishing rather than rough shaping, leaving fewer recognisable marks. Many have sharpening bevels on the underside of the blade only, making it possible to use the flat front face like a wide smoothing plane. No Roman axes have this 'side grind', indicating that both an axe and an adze would be required for producing neatly squared timbers, although Goodburn (pers. comm.) suggests that adzes are not suited for finishing, leaving a jagged finish. They may have been used to cut joints, although tool mark evidence suggests the use of wide chisels (see p.97). Pietsch (1983, p. 47) links the use of adzes rather than planes to a military style of woodworking, although both types of tools are found on both military and civilian sites. It is not possible to say whether the adzes from London indicate a 'military' woodworking style; although they outnumber plane irons in the archaeological record, we have more evidence from tool marks for the use of planes (see p.115).

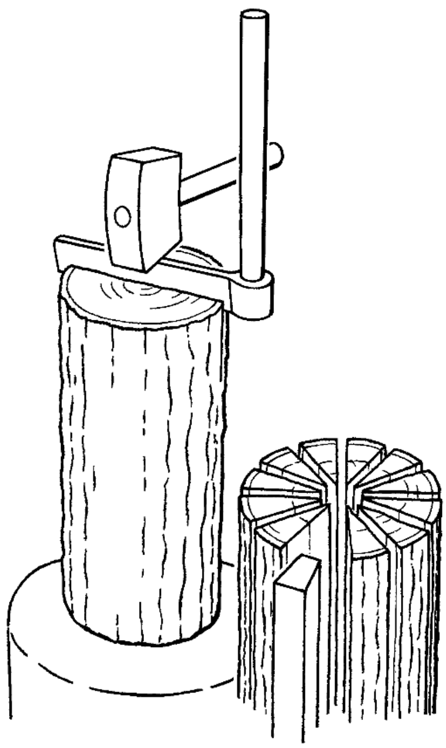


Figure 30 Splitting wood with a froe and mallet

(Hanemann, 2014).

Splitting was widely practiced in London. All of the writing tablets found at Bloomberg (BZY10) were found to have been radially cleft (Goodburn, 2016, p. 10). Fine cleft boards were used in the Gresham Street (GHT00) lifting buckets (Blair *et al.*, 2006, pp. 14, 23), where the excavators remarked that 'The use of oak timber converted by radial splitting, followed by trimming with axes, and finishing with planes to precise sizes and trueness, shows the quite deliberate selection of the most stable, readily available material for the water-boxes and box-buckets of the bucket-chains' (Blair *et al.*, 2006, p. 49). Smaller structural components could also be produced by splitting. Cleft oak roof shingles were found at the Courage Brewery (CO85-9) site, Southwark (Brigham, Goodburn and Tyres, 1995, p. 32), and cleft fence panels were found in the Walbrook valley at Bloomberg (BZY10, Goodburn, 2016, p. 10) and 1 Poultry (ONE94, Goodburn, 2000, pp. 12–3). The key tool used for splitting wood delicately today is the froe (Blair *et al.*, 2006, p. 14; Goodburn, 2016, p. 10), but no froes are known from London. Roman froes are found in the north-eastern provinces (Germania, Raetia, Noricum, Dalmatia, Pannonia), but no examples are known from Britain or Gaul (Hanemann, 2014, p. 368). This may suggest that other tool types were being used for this purpose in Britain, although it is not impossible that their absence indicates trends in survival rather than use.

As well as the large rip and cross-cut saws discussed below, a wide range of smaller saws were found in London. Feugère and Gilles (2017, p. 139) relate the use of saws to professional carpentry workshops, and the variation seen in saw blade form in London seems to imply that they had a range of specialised functions. Unfortunately, whilst modern saws are designed for a variety of specific functions, such as cutting joints, floorboards or veneers (Salaman, 1975, pp. 405–36), the functions of these Roman saws are obscure. One area in which specialised saws will certainly have been needed is comb manufacture (Pugsley, 2001, pp. 112–3). Roman combs can have as many as 25 teeth per 20mm (Pugsley, 2001, p. 113), meaning that the saws need to be much less than 1mm thick. Three saws from London, SAW02, SAW08, SAW10 and the possible saw SAW15 are under 1mm thick, although even these cannot be proven to have been used to make combs.

There are also ways in which the woodworking tools from London deviate from what may be expected from a Roman assemblage. Manning (1985a, p. 22) found that heavy mortice chisels were the most common type recovered from the Roman period, with few firmer chisels being found. This may suggest reliance on the heavier tool for general work (ibid). In London, however, this is not the case. Whilst a large number of mortice (Type D) chisels were found, the majority of the chisels from London were lighter Type A-C chisels, which would have fulfilled the functions of modern paring and firmer chisels.

Figure 31 Chisels from London (Top row, left-right; Type A, CHI10, CHI12; Type B, CHI25, CHI22. Middle row, left-right; Type C, CHI29, CHI31; Type D, CHI38, CHI33. Bottom row, left-right; Type E, CHI43, CHI44).

This may be the result of preservation bias; large mortice chisels may have survived in greater numbers outside of London due to their robust forms, or through being preferentially selected for deposition in ironwork hoards, in which they are more common than other chisel types. Fragile paring and firmer chisels may be better-represented in London than elsewhere due to the superior preservation in much of the city. However, it is also possible that this represents differences in practice. Structural carpentry, which requires heavy mortice chisels, would have been practiced all over the Roman world, wherever buildings were constructed. As well as structural carpentry, mortice chisels (and the more robust Type B chisels, such as CHI25) would have been used in a range of industries where joints were cut in heavy timbers. These would have included wheel and cart manufacture, shipbuilding, and furniture construction.

Finer work, however, may have been restricted to a smaller number of settlements, including London. The extremely slender Type A chisels (CHI01-16), the most common type in London, can only have been used as paring chisels, and are evidence of fine finishing work. The two Type A1 chisels, CHI01-02, have forms which can be seen in the Late Iron Age, and could indicate that fine woodworking traditions existed amongst indigenous woodworkers, although these tools continue to be used into the Roman period. Smooth finishing is also represented by plane irons (PLA01) and potentially by scrapers (SCR04). The function of many of the Type B and C chisels is obscure, as it is difficult to separate those used with a hammer and those pushed with the hand on formal grounds alone, but the wide range of forms and variation in blade shape suggests a wide variety of tasks. The Type C chisels are interesting for their unusual shape. Two of the three examples from London, CHI29 and CHI31, have makers' marks, which, combined with their unusual shapes, may indicate that they were tools from specialist workshops, perhaps designed for a particular, unknown purpose.

Diamond-tipped boring tools are also more common in London than elsewhere, although this is almost certainly due to preservation. Boring tools, such as drills and bradawls, have uses in multiple aspects of woodwork, but will have been especially necessary in London, where the majority of carpentry was in oak. Pilot holes are necessary in order to drive nails into oak timbers (Goodburn, 2000, p. 10), and pre-bored nailing holes can be seen on the oak buckets from Gresham Street (Blair *et al.*, 2006, p. 14) and the planking from 1 Poultry (ONE94, Goodburn, 2000, p. 10). There was, however, no evidence for the use of drills at 1 Poultry for cutting mortice joints (Goodburn, Goffin and Hill, 2011, p. 435). Larger spoon and taper bits are unlikely to have been used for these tasks, and indicate the boring and reaming of larger diameter holes in thicker timbers. These may have been to make holes for dowels or furniture legs. Some of these larger bore drills may have been used to hollow out turned wooden vessels (Pugsley, 2003, pp. 87–8, below), whilst the very large BOR49 may have been used for larger objects, such as wheel hubs.

Figure 32 Boring tools from London (Top left, BOR23. Bottom row, left-right; BOR43, BOR01, BOR30, BOR10, BOR49, BOR39).

Beyond these multi-use tools, several of the woodworking tools from London can be related with certainty to specific industries and processes, and can be contextualised within a broader body of evidence about these practices.

6.2.4.3 Structural Carpentry

Structural carpentry is an important aspect of the woodworking trades of London. Although masonry construction was introduced in the Roman period, the majority of buildings continued to be made of timber. Because of the waterlogged conditions in much of London, and the tendency for structural timbers to be re-used as piles, numerous timber structures and structural elements have survived to us, although the evidence from these timbers has not been brought together as it has for the medieval period (Milne, 1992).

Early Roman Technological Change

The use of timber buildings in Roman London should not be seen as a simple example of 'continuity' in carpentry traditions. Goodburn (1995, p. 43) has seen the Roman conquest as a time when 'radically new technologies' were introduced, including the introduction of squared beams (Goodburn, 2000, p. 7), new construction tools including measuring tools and cross-cut saws (Goodburn, 1995, p. 43, 2000, p. 7), and new joining techniques, including the 'tight mortice and tenon joint (where the tenon has a carefully cut shoulder), lap dovetails, complex scarf joints and the widespread use of iron nails as building fastenings' (Goodburn, 1995, p. 45).

However, neither should we see the Roman conquest as a time of total 'discontinuity'. Millett (1990, pp. 69–71) points out Late Iron Age structures that had begun to show elements of 'romanized' form, whilst there is evidence of continuing Iron Age building traditions in London. This is most obvious in the roundhouses built around the periphery of the early settlement (Perring and Roskams, 1991, p. 106; Watson, Brigham and Dyson, 2001, p. 13; Hill and Rowsome, 2011, pp. 439–40; Casson, Drummond-Murray and Francis, 2014). A trackway constructed at Drapers' Gardens (DGT06), built of split logs felled in 62 AD, was constructed in a style which 'would normally be attributed to native British workmanship', indicating that 'local craftsmen' were employed in its construction in the aftermath of the Boudican revolt (Pre-Construct Archaeology, 2009, p. 9). We can also see timber buildings exhibiting mixed techniques, including rectangular structures built with 'native style' earth-fast posts and wattle walls built in situ, rather than with 'Roman' prefabricated wooden frames (Perring and Roskams, 1991, p. 106; Wallace, 2010, p. 133). These techniques continued to be used into the later Roman period in the smith's workshops in Southwark, which also employed 'native' style pit hearths (Hammer, 2003).

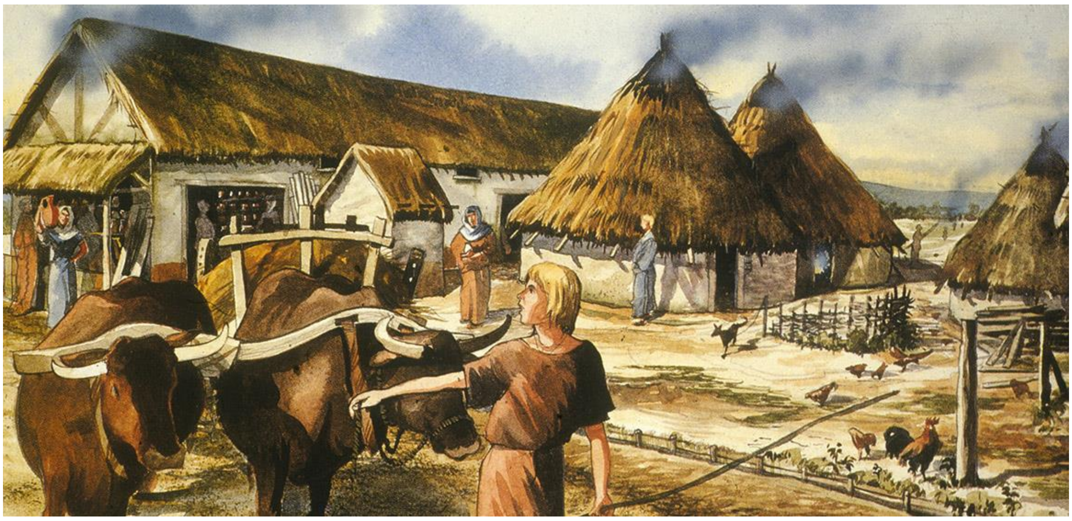


Figure 33 Roman and Native buildings at Newgate Street (GPO75), c AD 50-60. Reconstruction by John Pearson (Perring and Roskams, 1991, front cover).

This has led to the suggestion that ‘two groups of carpenters were working in London, one of local craftsmen and the other of foreign itinerant workmen introducing Mediterranean techniques in the first century’ (Hall, 2005, p. 137). Goodman (pers. comm.), however, prefers to see this as a distinction between ‘Classic Roman’ and ‘Rustic Roman’ styles, with the latter comprising ‘native’ traditions from both pre-Roman Britain and from other conquered territories. There is also debate about whether some of the new ‘Roman’ building styles should be seen as evidence of military carpentry traditions (Perring and Roskams, 1991, p. 106). We can therefore look to the tools from London for evidence of the dynamics of these groups.

Only three of the catalogued woodworking tools of the type needed for this kind of work have forms which indicate that they were manufactured in the Iron Age: ADZ01-02 and AXE05. Of these, only ADZ02 has any provenance associated with it, coming from the Thames at Mortlake. Tools therefore do not provide strong evidence for the existence of Iron Age carpentry traditions in London. It should be remembered, however, that ‘native’ techniques could be practiced with ‘Roman’ adzes and axes. The ‘native’ carpentry style will have used fewer tools, and those used will not have required specialised forms.

Equally, it is difficult to address the introduction of new ‘Roman’ joint styles from the London tools. The joints on the timbers from 1 Poultry (ONE94) and Cannon Street (LYD88) were made primarily with chisels, but also with axes, adzes, and saws, whilst drills were not used (Goodburn, 1991, pp. 198–200, 2000, p. 10). All of these tools could be found in Iron Age toolkits (see Darbyshire, 1995); the key new tools needed for these joints were measuring tools, which are not covered by this thesis. We can nevertheless make some observations about the cutting of joints based on a few measured chisel marks recorded at the Guildhall amphitheatre (Bateman, Cowan and Wroe-Brown, 2008, fig. 23) and Cannon Street (Goodburn, 1991, pp. 198–200). At both sites mortice joints were recorded with 25-30mm wide chisel marks inside them. This is considerably wider than the mortice chisel (Type Dii) blades from London, the widest of which, CHI38, is 21mm wide. This indicates that ‘mortice’ chisels alone were not used to cut ‘mortice’ joints; they must have been supplemented by robust Type Di firmer/mortice chisels (such as CHI32) or Type E chisels (such as CHI44), or finished with paring chisels (such as CHI12). A halving joint from Cannon Street had a mark from a rounded chisel *c*. 45-50mm wide. This again indicates the use of a Type E chisel, such as CHI43-44. This may be evidence that this unusual chisel type was specialised for use in cutting joints, and may indicate the introduction of new tools for this purpose.

Another way to examine the tools employed in new ‘Roman’ woodworking styles is through squaring techniques. Whilst Iron Age structural carpentry frequently made us of whole logs, Roman-type buildings relied on squared timbers and planks (Goodburn, Goffin and Hill, 2011, p. 433). There are three main ways of preparing squared timbers for use in construction: box hewing, splitting, and sawing, and these can be analysed with reference to the tools from London.

Box hewing

Large timbers can be hewn directly into beams by squaring them off around the heart wood with axes or adzes. Other timbers prepared by splitting or sawing may also have required trimming with axes. The marks left by axes in this process, collected by Goodburn in several excavation reports (Table 4), are an excellent resource which can be compared to the axes recovered from London. Similar work has been carried out on a much wider scale on prehistoric woodwork (Sands, 1997).

Modern ‘blocking axes’ designed for this work have exceptionally long blades (Salaman, 1975, fig. 55), allowing the entire width of the beam to be squared at once. However, visible ‘herringbone’ patterns of axe marks on some Roman timbers suggest that these were squared with shorter axes to a line halfway down their thickness before being flipped and worked from the other side (Goodburn, 2005, p. 195).

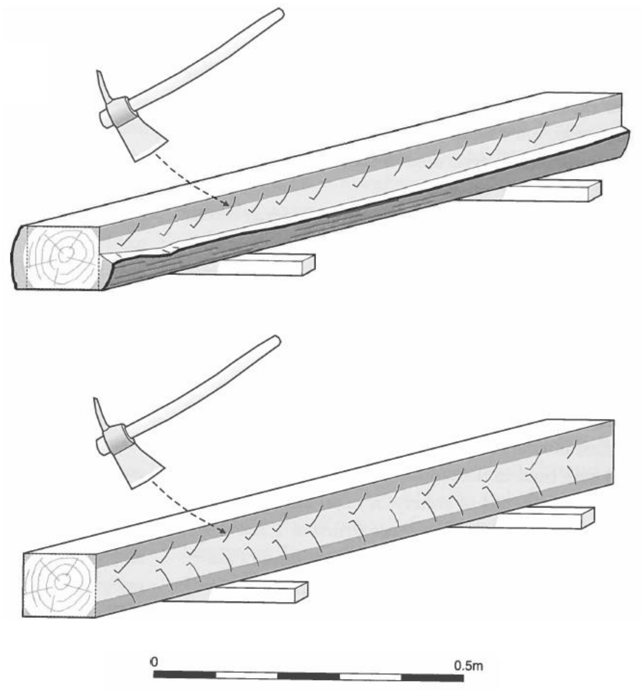


Figure 34 Squaring a round log with axes (Goodburn, 2005, fig. 186).

No.	Site	Feature	Date (AD)	Axe mark width (mm)	Description	Reference
1	Guildhall	Amphitheatre	70	70	-	(Goodburn, 2008, p. 146)
2	20-28 Moorgate	Posts	-	70+	Thin-bladed	(Goodburn, 2005, p. 195)
3	Cannon Street	Posts	75-200	75+	Rounded	(Goodburn, 1991, pp. 195–6)
4	Suffolk House	Waterfront 2	84	80	Thin-bladed	(Goodburn, 2001)
5	Suffolk House	Waterfront 3	90-121	90	Rounded	(Goodburn, 2001)
6	1 Poultry	Studs and baseplates	-	90-100	Thin-bladed	(Goodburn, 2000, p. 7)
7	Guildhall	Amphitheatre	70	100	-	(Goodburn, 2008, p. 146)
8	Suffolk House	Waterfront 2	84	110+	-	(Goodburn, 2001)
9	Guildhall	Amphitheatre	70	130-50	-	(Goodburn, 2008, p. 146)
10	Gresham Street	Well 3	104	140	Straight	(Blair *et al.*, 2006, p. 27)
11	Guildhall	Amphitheatre	70	200	Thin-bladed	(Goodburn, 2000, p. 16)

Table 4 Measured axe marks from London.

Only some of the axe marks found on these timbers can be accounted for by the known axes from London. The majority of the London axes have slightly curved blades varying from 46-79mm wide, although only four of these narrow-bladed axes (the small AXE05 and larger AXE09-10 and AXE16) have blades over 75mm wide. Axe marks 1-4 can therefore be considered 'normal' for London. Axes with these characteristics have a range of forms and overall dimensions, and probably did not have very specific functions (Figure 35). With no visual clues separating them along functional lines, it would have been the responsibility of the user to choose an axe of an appropriate size for a given task, from the pool of available axes used in everything from everyday tasks to industry.

Figure 35 Narrow-bladed axes (Left, AXE07. Right, top, AXE18; middle, AXE16) and mattock (Bottom right, MAT01) from London.

The other marks are not consistent with 'normal' axes from London. One narrow-bladed axe, AXE16, is wide enough to have made marks 5-8, but Goodburn (2000, p. 7) suggests that a mattock may have been used to make mark 6, where the tool is described as 'thin-bladed'. The blades of mattocks are notably thinner than those of the wedge-shaped axes from London. Both of the mattocks from London (MAT01-02) have blades of the appropriate width, and it is possible that these were also used to create marks 2 and 4. This again indicates the use of non-specialised tools from the pool of generally available objects.

The presence of marks 9-11 is less easy to explain. The only surviving axes from London with blades this wide are the bearded AXE25 and T-shaped axes AXE26-27 (Figure 43). These forms appear specifically tailored to the task of trimming large timbers, but appear to have been 3rd century introductions; much later than any of the preserved axe marks. This indicates that the builders of these structures had access to tool types which were not common in London at the time.

It may be significant that both of these structures are exceptional. The construction of the amphitheatre would have been a large civic project, and may have involved specialist craftsmen. The Gresham Street well contained a mechanical lifting mechanism, which may have been constructed by specialist engineers, and was intended to service a nearby bathhouse (Blair *et al.*, 2006). Both structures have been suggested to have been military constructions based on their position on Ludgate Hill (Bateman, Cowan and Wroe-Brown, 2008, pp. 124–7; Perring, 2015, p. 28) and, in the case of the amphitheatre, on its architecture (Ebbaston, 1988; Millett, 1994, p. 434), although the involvement of soldiers in their construction is not certain in either case. It may therefore be possible to see a distinction in London between carpenters making civilian buildings with unspecialised tools, and higher skilled engineers or military craftsmen working on civic projects with specialised tools. Whilst the excavators of the mechanical wells naturally focussed on the machine builders as 'a distinctive and highly-specialised branch of woodworking' (Blair *et al.*, 2006, p. 49), this suggests that the 'civil engineers' who built the well structures were also a group distinct from normal house builders. The range of tools employed in the construction of the amphitheatre may be evidence of multiple groups of craftsmen. Alternatively, the lack of hewing waste from central London may indicate that these tasks took place outside of the city (Goodburn pers. comm.). As such, the different sizes of tool marks may

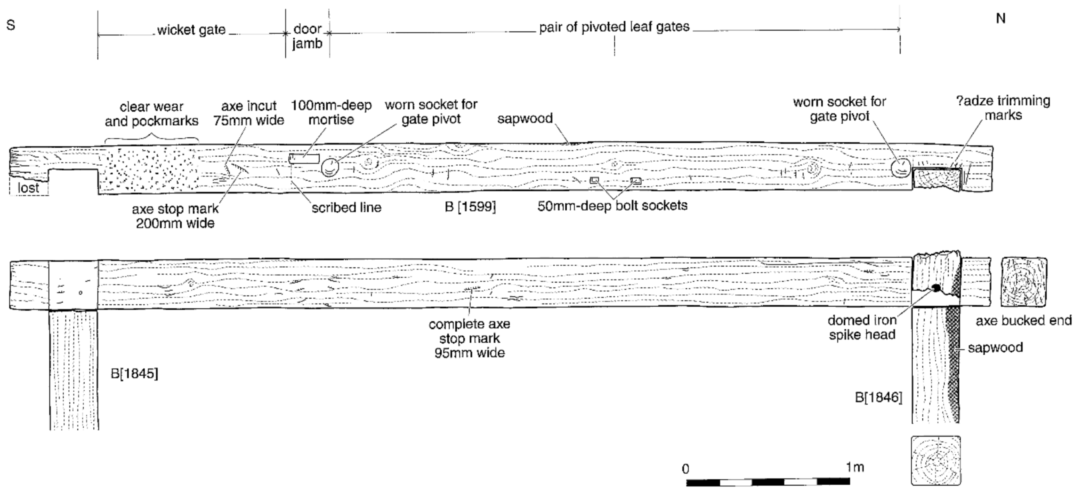


Figure 36 Detail of tool marks on a threshold beam from the Guildhall Amphitheatre, showing the wide axe mark No.11 on the upper side (Bateman, Cowan and Wroe-Brown, 2008, fig. 13).

relate to differences of timber supply between these groups, rather than on-site working practice.

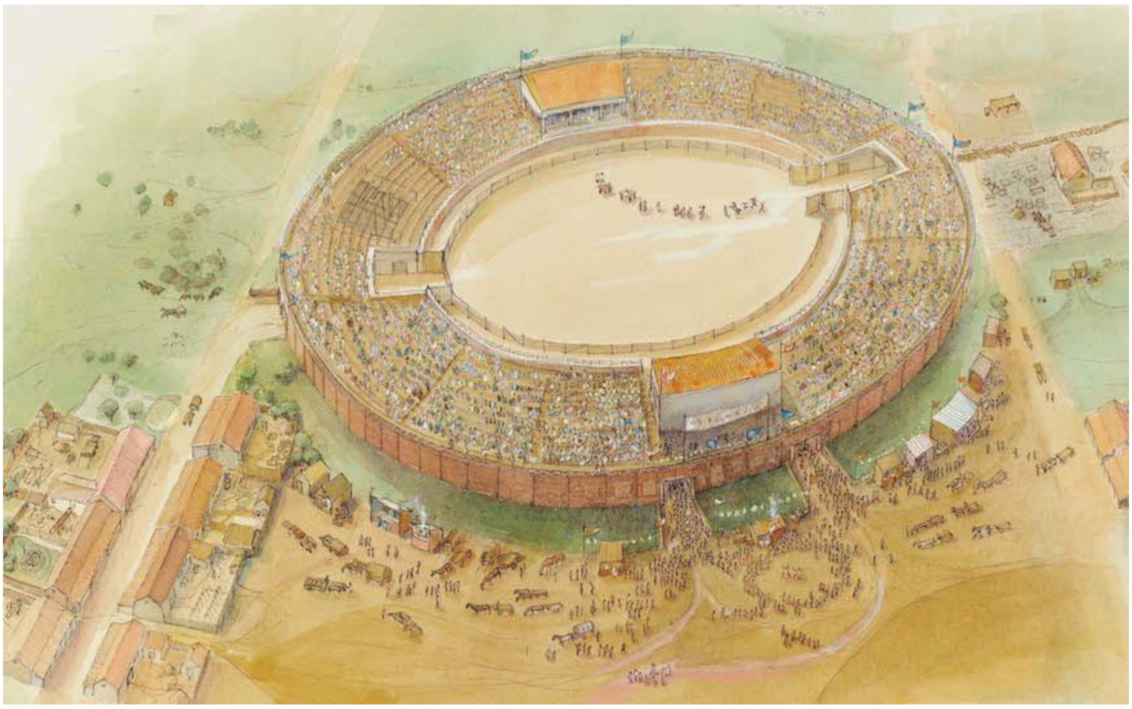


Figure 37 The Guildhall Amphitheatre c AD 130. Reconstruction by Judith Dobie (Bateman, Cowan and Wroe-Brown, 2008, fig. 113).

A note of caution about these findings is that tool marks on prehistoric timbers also indicated the use of axes larger than those found in contemporary Late Bronze Age and Early Iron Age assemblages (Sands, 1997, p. 86). This is not necessarily unexpected, as several tools that are known to have been used in London are not represented in the material record. It is possible that large, specialised tools were rarer, and hence discarded less often, or not selected for special deposition (a large number of the axes from London come from possible ritual deposits in the Thames, see p.324). However, as the same pattern has now been observed in the prehistoric and Roman periods, it is possible that there are methodological inaccuracies in the measurement of axe marks on timbers, which inflate the size of the tool marks.

Splitting

Splitting or cleaving involves driving a wedge-shaped object into the wood to break it along 'natural planes of weakness' (Goodburn, Goffin and Hill, 2011, p. 431). Splitting has been practiced in Britain since the Neolithic period (Goodburn, 2000, pp. 12–13), and must have been well understood in pre-Roman Britain. It may have been regarded as an archaic process in the Roman period, as Seneca remarked that 'Our early ancestors cleaved wood with wedges' (Meiggs, 1982, pp. 347–8), but it remained widely practiced. Splitting is less wasteful than sawing, which abrades part of the material into sawdust (Goodburn, 2016, p. 10), and produces timber which is more structurally stable (Blair *et al.*, 2006, p. 49; Goodburn, 2016, p. 10).

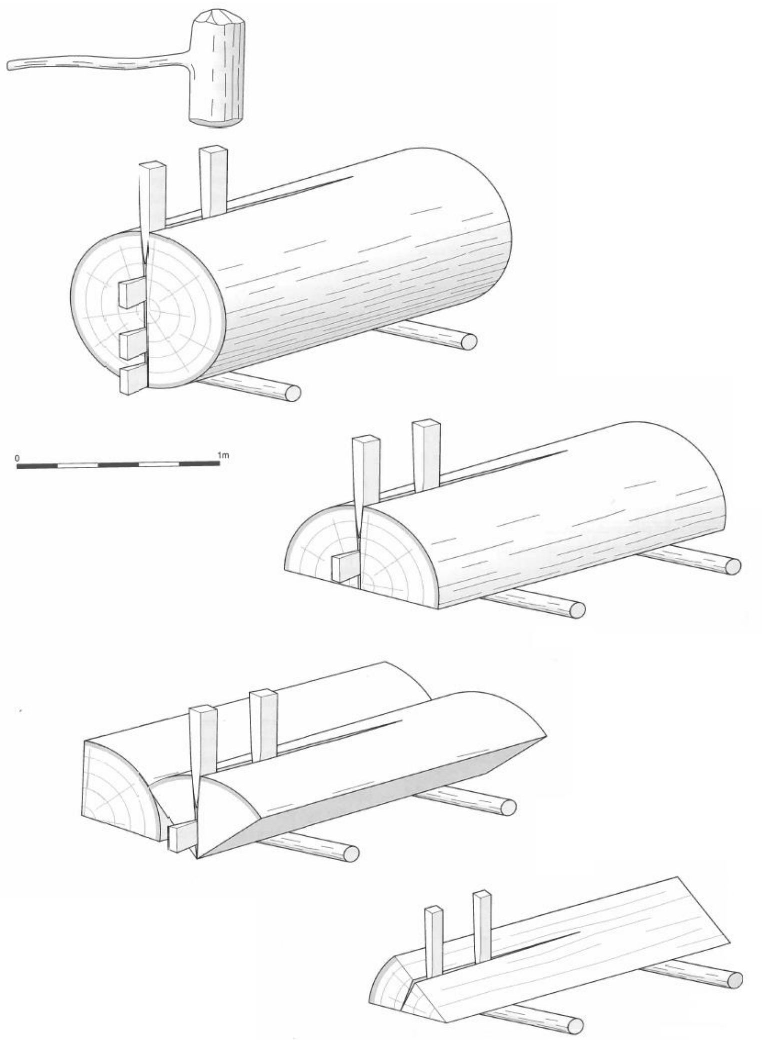


Figure 38 The process of splitting a log with wedges (Goodburn, 2005, fig. 185).

Splitting could be used in construction to quickly split up large logs to smaller timbers. A gravestone from Metz (Figure 40) shows two sawyers trimming a wedge-shaped piece of wood (Hanemann, 2014, Abb. 309), which could be a radially split log. Radially cleft logs were used in London for the crossbeams and buckets of the Gresham Street well (GHT00, Blair *et al.*, 2006, pp. 9, 14), to make wall studs at 1 Poultry (ONE94, Goodburn, 2000, pp. 6–7), and to make planks for waterfronts at Suffolk House (SUF94, Goodburn, 2001, p. 83).

The wedge WED01 and re-used adze-blade-fragment ADZ08 could have been used to split large timbers. As ADZ08 was found in the structural cut for a large timber tank (Hill and Rowsome, 2011, pp. 114–21), it is possible that it was employed in the construction of this structure. All of the axes from London also have wedge-shaped profiles and many have extended hammer-polls

(Figure 35), making them useful wedges for splitting large timbers. The absence of small splitting wedges probably indicates the use of wood rather than iron for these tools.

Sawing

Logs can also be prepared by sawing. Offcuts from 1 Poultry (ONE94) suggest that axe-felled trees were trimmed with cross-cut saws (Goodburn, 2000, p. 8). The extremely jagged SAW05 (Figure 39) may have been a deliberately formed cross-cut saw used in this way. The relief from Metz (Figure 40) shows the use of an unframed two man cross-cut saw to trim a split log, although saw marks on the timbers from 1 Poultry (ONE94), 20-28 Moorgate (MRG95), and the Guildhall amphitheatre suggest the use of framed saws (Goodburn, 2000, p. 8, 2005, p. 193, 2008, p. 148; Goodburn, Goffin and Hill, 2011, p. 430), such as those found in the Der Meern shipwreck (Jansma & Morel, 2007 Afb. 8.58-9).

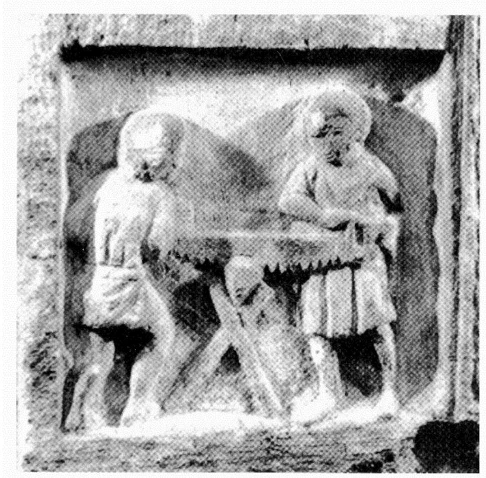


Figure 40 Relief from Metz showing two sawyers cutting a radially-cleft log with a cross-cut saw (Hanemann 2014, Abb. 309).

Figure 39 Possible cross-cut saw (Top, SAW05) and rip saw (Bottom, SAW04) from London.

Particularly important technologically are sawn planks. These were a Roman-period introduction, and were used extensively in Roman construction (Goodburn, 2000, pp. 9–10). Large numbers of sawn oak planks were used to cover the floor of a mid-2nd century warehouse floor at the Courage Brewery site (CO85-9, Brigham, Goodburn and Tyres, 1995), to line the massive 1st and 2nd century wells at Gresham Street and Arthur Street (GHT00, AUT01, Blair *et al.*, 2006, pp. 9, 19, 30), and to build cisterns, wells and drains at 1 Poultry (ONE94, Goodburn, 2000, pp. 9–11).

Sawn planks are made with rip saws, which cut along the grain. Saw marks from London indicate that large logs were sawn by propping them up on one (see-sawing) or two (double-trestle sawing) trestles (Figure 41) and sawing halfway, before flipping them and sawing from the other side (Brigham, Goodburn and Tyres, 1995, p. 45; Goodburn, 2000, p. 11, 2008, p. 146, 2011, fig. 361). The use of large, framed, two-man rip saws with trestles is shown in a fresco from Herculaneum (Figure 288), and a relief from Gaul (Meiggs, 1982, fig. 14), and it is likely that the large, coarse saw blade fragment SAW04 (Figure 39) was used in this way.

At 1 Poultry (ONE94, Goodburn, 2000, pp. 9–10; Goodburn, Goffin and Hill, 2011, pp. 434–5), Courage brewery (CO85-9, Brigham, Goodburn and Tyres, 1995, p. 43), and Drapers' Gardens (DGT06, Pre-Construct Archaeology, 2009, p. 27) the sawn planks were found to conform to standardised dimensions; c.45 cm wide and 40-50mm thick. Goodburn (2000, pp. 9–10) suggests that these were made by tangentially sawing a pre-prepared squared oak 'cubit' block, possibly to produce planks conforming to standard Roman measurements. This suggests a high degree of specialisation amongst the sawyers of London in the early 2nd century, based on an

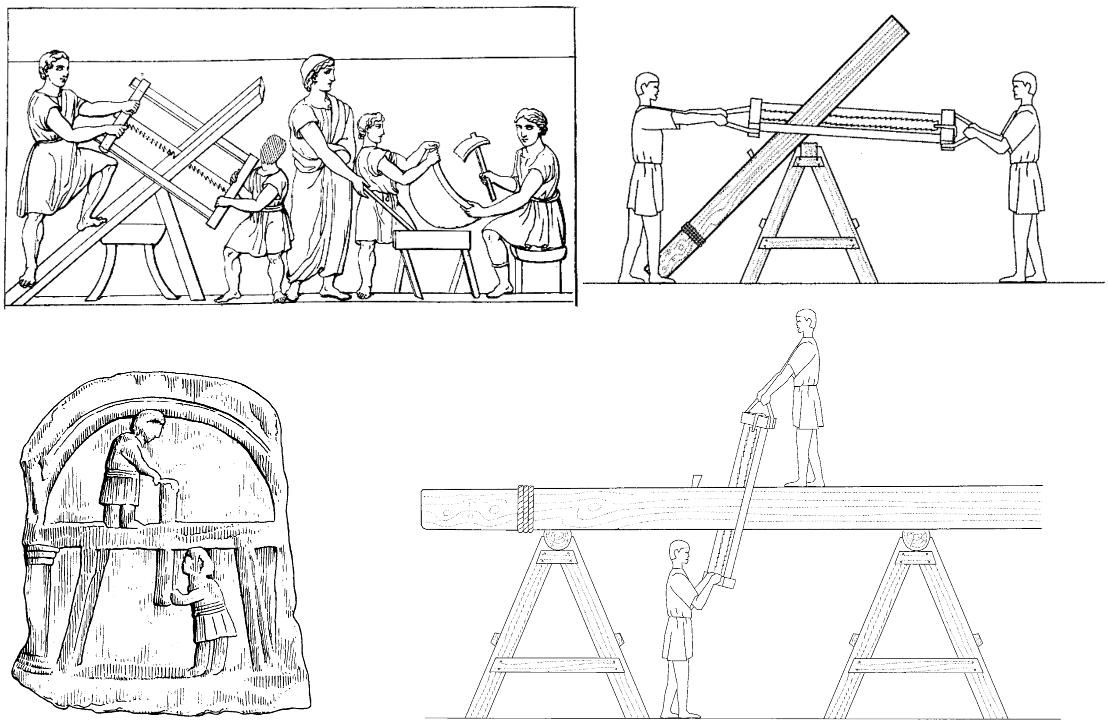


Figure 41 Sawing with trestles. Top; see-sawing with a rip saw and two trestles. Left, on a Roman or Etruscan monument (Goodman, 1964, fig. 122). Right; reconstruction (Goodburn, 2008, fig. 134). Bottom; double-trestle sawing with a rip saw and two trestles. Left, on a relief from Gaul (Meiggs 1982, fig. 14). Right, reconstruction (Hill and Rowsome 2011, fig. 361).

industry that was unknown in Britain before the conquest. Goodburn (2000, p. 10) relates this profession to organisations similar to the 'college of sawyers' (*sectores materiarum*) in Aquileia (Meiggs, 1982, p. 355; Goodburn, 2000, p. 10; Ulrich, 2007, p. 9). Whilst splitting can be carried out by a lone worker, moving and sawing planks in this way may have required a team of four to six people (Goodburn, 2008, p. 151). Planks made in this way were also used for non-structural purposes, for example in coffins (Watson, 2003, pp. 62–3).

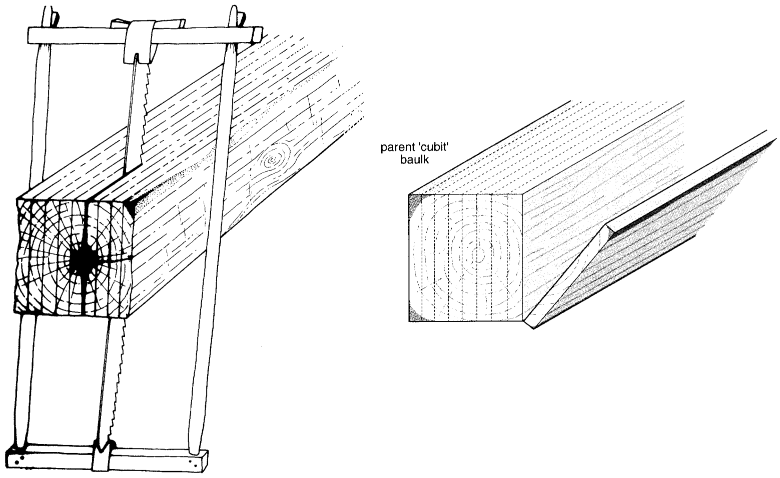


Figure 42 Sawing planks from a prepared block (left, Watson, 2003, fig. 86; right, Goodburn, 2008, fig. 131).

A Late Roman Technological Change?

The emergence of new axe types (Figure 43) in the 3rd century may signify a further technological change in carpentry practice in London. These broad-bladed axes, which are similar to those used in the middle ages (Goodall, 1980, fig. 6), would have allowed new styles of woodworking. Split planks, for example, could be smoothed more easily with broad axes. Techniques such as this are more laborious than sawing, but can be carried out by a lone woodworker with a less specialised toolkit (Goodburn, 2008, p. 148). It is therefore possible that the emergence of these tools indicates a change in the organisation of woodworking in London; away from groups of woodworkers making specialised products (such as planks), and towards lone workers who may have produced a wider variety of objects with a more versatile, less specialised toolkit. A shift in the Late Roman period towards 'autarchy' amongst woodworkers has also been inferred by Sagadin (2015, p. 74) based on the composition of ironwork hoards, which they saw as reflecting a wide range of woodworking practices being carried out by individuals or small rural workshops. However, the composition of these deposits may not necessarily reflect craft practice (Hingley, 2006; Humphreys, 2017a).

Figure 43 Late Roman bearded (top, AXE25) and T-shaped axes from London (middle, AXE26; bottom, AXE27).

6.2.4.4 Carving

A number of tools from London may have been used in freehand carving. These include the skew chisel CHI45 (Figure 59) and a number of gouges (Figure 44). GOU01 has a bent handle, and was certainly used in freehand carving. The solid-handled gouges GOU04-13, and any number of the smaller chisels from London, may also have been used in freehand carving, representing a wide range of tip shapes. Wood carving could have taken a number of forms in the Roman period. Carved domestic vessels are rare (Pugsley, 2003, p. 119), although carved oak dishes have recently been found at Bloomberg (BZY10, Marshall and Wardle, forthcoming) and 1 Poultry (ONE94, Goodburn, 2000, fig. 14). Unfortunately, no tool marks survive on these objects. A number of carved spoons (Pugsley, 2003, T061-2), scoops (Pugsley, 2003, T080) and spatulas (Pugsley, 2003, T085-90) are also known. These may have been shaped to some extent with drawknives or bench knives rather than chisels. One of these spatulas has a terminal carved in the form of a caricature of an African person (Pugsley, 2003, fig. 5.28).

Figure 44 Carving gouges from London (Top-bottom; Tanged gouges, GOU02, GOU0; Solid-handled gouges, Type 1, GOU05, Type 2, GOU07, Type 3, GOU13).

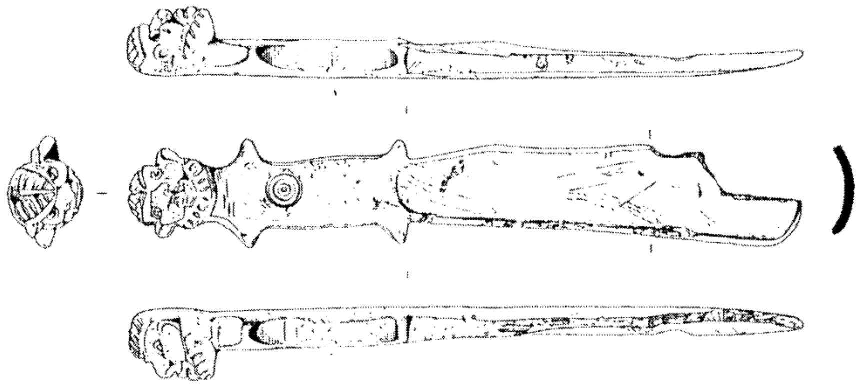


Figure 45 Carved spatula from London (Pugsley, 2003, fig. 5.28).

6.2.4.5 Cooperage

In a wide ranging study of barrels in the western Roman world, Marlière (2002, p. 183) considered there to be little direct evidence for cooperage, the making of stave-built vessels, in Britain. However, cooperage is now directly evidenced in London by both tools and documentary sources. Added to these are the vessels themselves. Whole barrels have been preserved when re-used as well-linings (Wilmott, 1982; Blair *et al.*, 2006, p. 11), with other surviving elements including bungs and offcuts from the re-fashioning of barrels into other items (Hall, 2005, p. 137; Goodburn, 2016, p. 9).

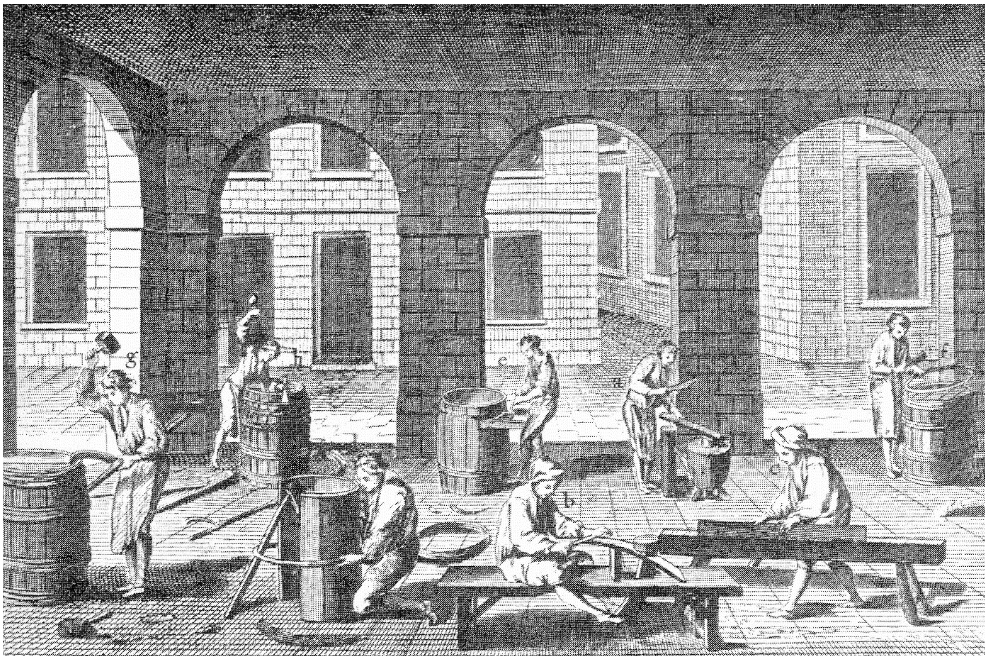


Figure 46 The stages of cooperage, from an 18th century engraving. Stages a-c, the staves are cut and shaped with planes and drawknives. Stages d-g, the barrel staves are assembled and hoops added (Marlière, 2002, fig. 18).

Roman barrels have been extensively studied (Marlière, 2002), and the processes involved in Roman cooperage have been discussed by Goodburn (2000, pp. 16–7, 2011, pp. 395–6) in relation to the barrel parts recovered from 1 Poultry (ONE94, Figure 47). The staves were made from radially split timbers, which were trimmed with broad axes, before being cut to length with saws, planed at the ends, and hollowed, probably with hollowing adzes. A croze was then cut with a croze iron, and the head was inserted. Roundwood oak bands were attached to hold the barrel together. The barrels were then sealed with hot pine resin (the production of which is described by Pliny (*The Natural History*, 16.22-3)), before bung holes were drilled and stamps applied. Cooperage in this manner therefore required a large suite of tools, including adzes, axes, crozes, dies, drawknives, drills, and saws.

Today, barrel-making requires both woodworking and ironworking skills, as hoops are usually made of iron (Salaman, 1975, pp. 155–7). However, Roman barrels, such as that excavated at Gresham Street (GHT00, Blair *et al.*, 2006, p. 11), have wooden hoops. Heat can also be used to make the staves of a barrel flexible when bending them to shape (Earwood, 1993, p. 181), although this also seems not to have been practiced on the London barrel staves (Goodburn, 2000, p. 17). With the exception of the application of hot pine resin (Blair *et al.*, 2006, p. 23), or hot branding iron marks (Marlière, 2002, p. 102), barrel-making in the Roman world seems to have been a cold industry, which only required woodworking skills.

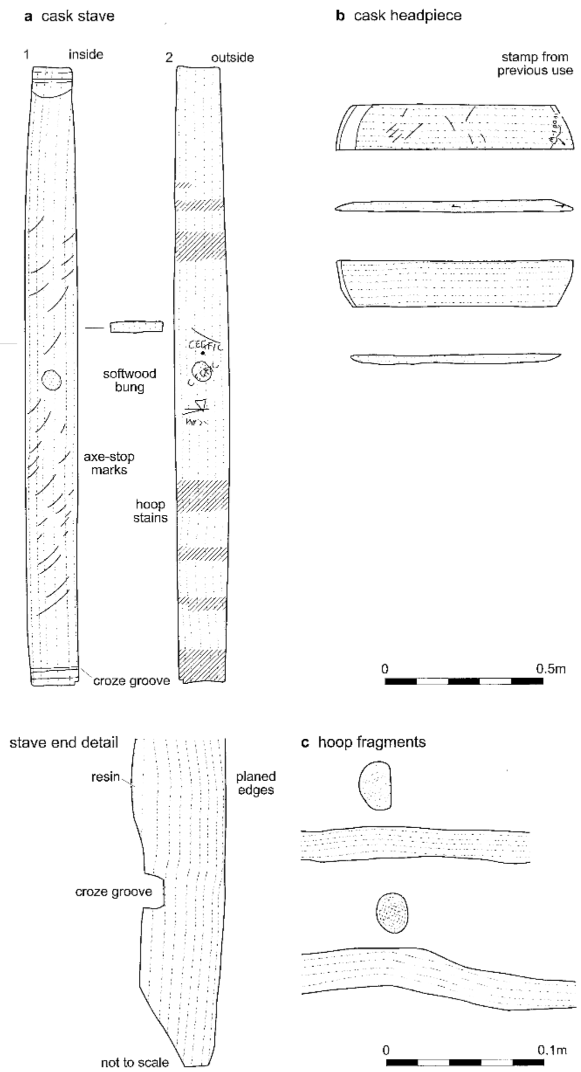


Figure 47 Tool marks on preserved barrel parts from 1 Poultry

(ONE94, Hill and Rowsome, 2011, fig. 338).

Whilst the majority of the tools needed for barrel making are represented in London, the axes and adzes required for these tasks are not. Broad-bladed axes are not known until the 3rd century, whilst barrels have been found in London from a much earlier date. Curved hollowing adzes are completely absent from the London collection. The majority of barrels and barrel pieces recovered from London are made of silver fir (Blair *et al.*, 2006, p. 11; Goodburn, 2011, p. 395, 2016, p. 9), with some larch examples (Goodburn, 2011, p. 395). These woods do not grow in Britain, indicating that the majority of these barrels were manufactured in Europe, and imported as wine containers.

Figure 48 Coopers' tools from London (Top, croze iron, CRO01. Bottom, die, DIE02).

The presence of the croze iron CRO01 in London, and the Bloomberg writing tablet addressed to ‘Junius the cooper’ (Tomlin, 2016, p. 86, <WT14>), nevertheless provide direct evidence that some form of cooperage was taking place here. The use of a croze suggests that casks were at least being cut down and fitted with new bases, which would also have required saws, planes and drawknives to re-shape the staves and cask heads. This may indicate that the coopers of London were primarily engaged in refurbishing rather than manufacturing barrels, and may explain the absence of key cooper’s tools. Truncated stamps on barrel timbers from 1 Poultry

(ONE94) demonstrate that barrels could be broken down and re-shaped after use (Goodburn, 2011, p. 396).

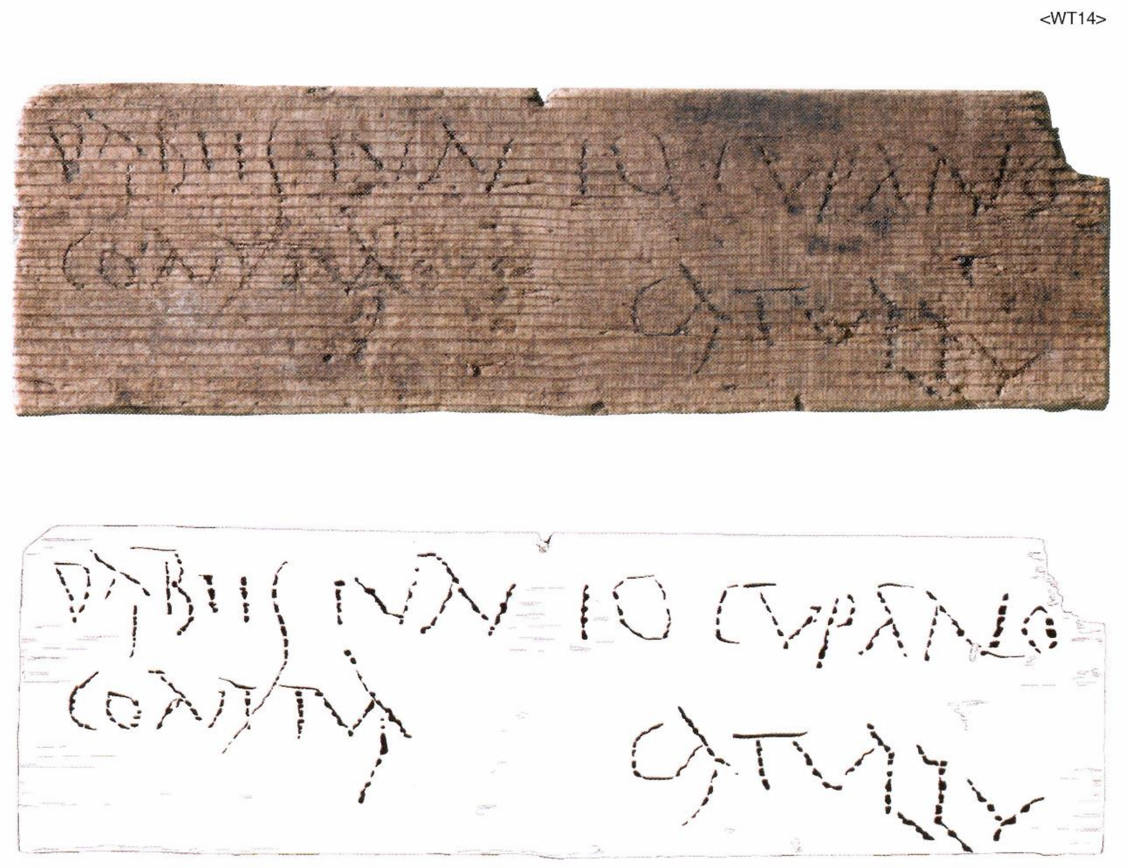


Figure 49 Writing tablet <WT14> from Bloomberg London, addressed to 'Iunio Cupario/Junius the Cooper' .

Another tool likely to have been associated with cooperage is DIE02. DIE02 could have been used cold to mark letters onto a barrel. Marlière (2002, p. 102) argued that cold-struck stamps such as this have a very limited distribution compared to hot branded marks, occurring only in the northern part of the Rhine, and going out of use in the 1st century. However, stamped marks, which are not recorded as having evidence of burning, were found on barrels at Gresham Street (GHT00, Blair *et al.*, 2006, fig. 9) an 1 Poultry (ONE94, Goodburn, 2011, fig. 339).

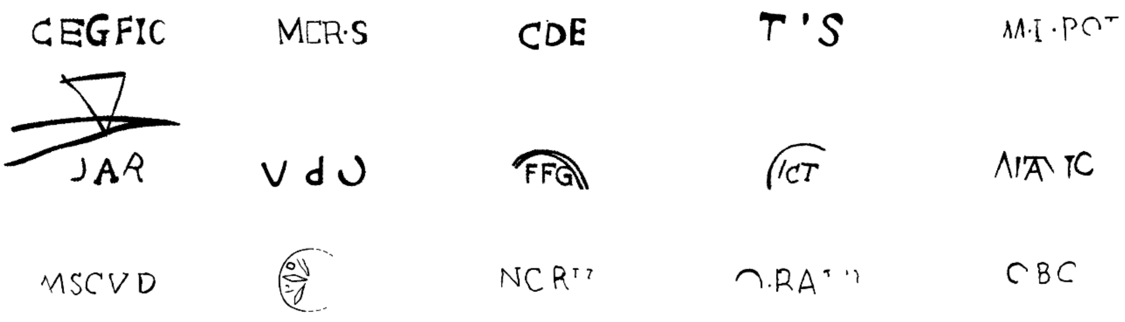


Figure 50 Stamps from barrel staves from 1 Poultry (Hill and Rowsome, 2011, fig. 339).

Numerous types of marks are found on barrel staves (Marlière, 2002, pp. 102, 112), which would have been added at various stages in the 'cycle of production, assembly, sale, transport and possibly customs processing' (Goodburn, 2000, p. 17) for the benefit of 'the vineyard owner, the customs officials, the shipper or the cooper' (Goodburn, 2011, p. 396). Letter stamps are sometimes found on the inside of barrels, which has been taken as evidence that these stamps may represent the names of master coopers or those who owned cooperage workshops (Marlière, 2002, p. 102). The three-letter stamp of DIE02 represents the initials of a *tria nomina*, the most common type of stamped mark (ibid, p. 112). The *tria nomina* is a sign of citizenship (Rhodes, 1987, p. 175; Baratta, 2007, p. 100), and demonstrates the involvement of Roman citizens to some degree in the craft of cooperage. However, these stamps are also found on the outside of barrels, including over bungs, indicating that they can also represent the names of those involved in trade (Marlière, 2002, p. 113).

Coopers do not only make barrels, however. In the modern period, coopers produced a wide range of stave-built vessel types (Salaman, 1975, p. 156). Most Roman stave-built containers are buckets (Earwood, 1993, p. 76), although serving vessels are also known (Earwood, 1993, p. 80). A decorated stave-built money chest from Dorchester is an at-present unique example of coopered furniture (Pugsley, 2002). The curvature of CRO01 may indicate that it was used to produce small vessels rather than large barrels, although the length of the tang suggests that this is not a reliable indicator of function (see p.468).

Buckets may have been made by separate specialists to those who made barrels. Unlike barrels, buckets are usually made of oak (Earwood, 1993, p. 78), although in London many appear to be

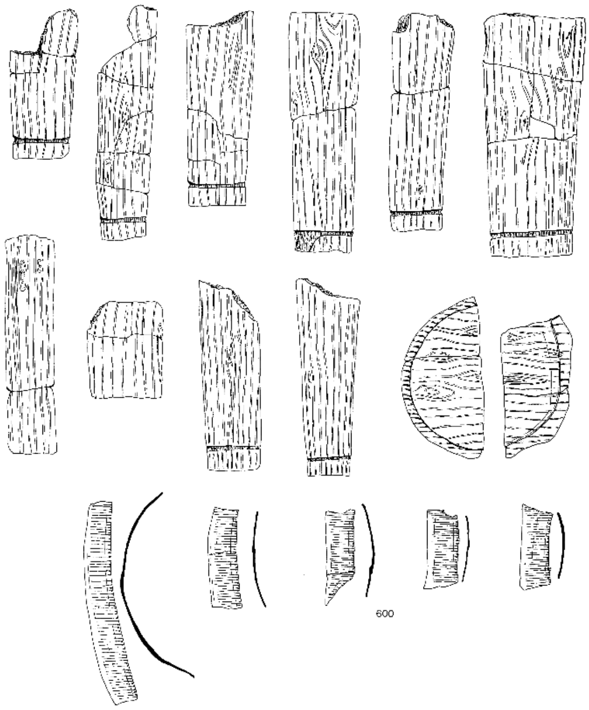


Figure 51 Wooden bucket from Bucklersbury House (Wilmott, 1991, fig. 112).

composite objects. Several from Bucklersbury House/Bloomberg (BZY10) have oak bases (Marshall and Wardle, forthcoming; Wilmott, 1991, p. 148, No. 600), but staves made of silver fir and yew are also known (Marshall and Wardle, forthcoming; Weeks and Rhodes, 1986, fig. 10.3-4; Goodburn, 2016, p. 9). Barrel hoops could be made of hazel (Blair *et al.*, 2006, p. 11) or oak (Goodburn, 2000, pp. 16–7), which were coppiced around London (Brigham, Goodburn and Tyres, 1995, pp. 26–8; Goodburn, 2000, p. 6), and bound with flax (Blair *et al.*, 2006, p. 12), seeds of which have been found in London (Willcox, 1977, p. 280), indicating that it was grown nearby. Pine resin, used to waterproof barrels and bucket chain buckets at Gresham Street (GHT00, Blair *et al.*, 2006, figs 12, 14, 23), needed to be imported from Europe, however. Buckets also have iron fittings, possibly indicating the presence of workshops in which both woodworking and ironworking were practiced. Other small stave-built vessels were made of yew, with copper alloy bindings (Earwood, 1993, p. 80), possibly indicating some continuity with Iron Age vessel manufacture (Earwood, 1993, pp. 67–75; Pugsley, 2002).

The large number of specialist tools required, and the fact that cooperage used materials from different sources to other woodworking trades, suggests that cooperage in London may have operated as one or more distinct professions. This is leant support by a writing tablet from the Bloomberg (BZY10) excavations, dated to 80-90/95 AD, which is addressed to *Iunio cupario*; 'Junius the cooper' (Tomlin, 2016, p. 86).

6.2.4.6 Joinery

Examples of joinery and furniture are rarely found in London (Goodburn, 2000, p. 13) when compared to more robust structural carpentry. However, recent excavations have produced several fragmentary examples, including doors (Marshall and Wardle, forthcoming; Goodburn, 2000, p. 13; Pre-Construct Archaeology, 2009, p. 11; Goodburn, Goffin and Hill, 2011, pp. 424–6), chests (Marshall and Wardle, forthcoming; Goodburn, 2000, p. 14, 2011, pp. 393–4), beds (Pre-Construct Archaeology, 2009, p. 33; Ranieri and Telfer, 2017, pp. 20–1), decorative mouldings (Blair *et al.*, 2006, p. 27; Pre-Construct Archaeology, 2009, p. 33), and machinery (Marshall and Wardle, forthcoming; Blair *et al.*, 2006).

Figure 52 Plane irons from London (Left-right; smoothing plane, PLA01; moulding plane, PLA02; plough plane, PLA03).

Many of the techniques used in joinery would have been familiar to other woodworkers, with the widespread use of split timbers, sawn planks, and axe trimming (Goodburn, 2000, pp. 13–4, 2011, p. 394; Blair *et al.*, 2006, p. 23). However, joinery in particular 'relies so heavily on the use of specialised planes and intricate joints not used in structural woodwork' (Goodburn, 2000, p. 13) that it can be seen as a separate specialisation. The small number of plane irons from London (Figure 52) are therefore an important resource for studying this craft.

Planes were used to smooth planks, and to chamfer their edges for joining. This can be seen on both the chest (Goodburn, 2011, pp. 393–4) and door (Goodburn, 2000, p. 13; Goodburn, Goffin and Hill, 2011, pp. 424–6) from 1 Poultry (ONE94). Planes with serrated blades were used to finish the boards used in the Gresham Street (GHT00) lifting buckets (Blair *et al.*, 2006, p. 23). The only 'smoothing plane' blade recovered from London, PLA01, is missing its tip, and could have been straight or serrated, although its size suggests that it was used for smoothing large timbers, such as those used in the London doors. This object dates from the decade after the Boudican revolt (AD 62-70), demonstrating the existence of joinery early in London's history.

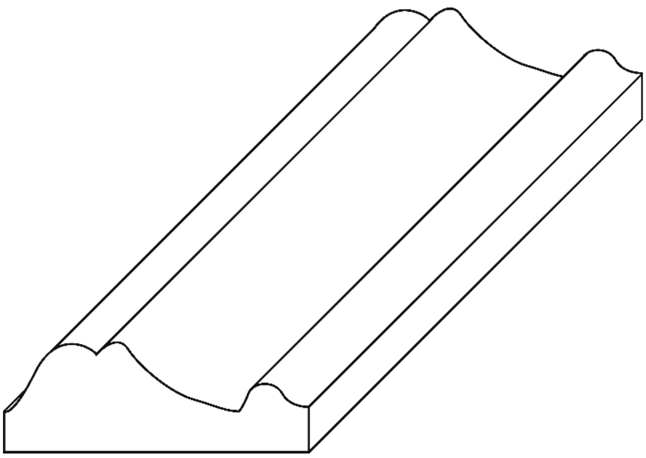


Figure 53 Reconstruction of the moulding produced by PLA02.

The moulding plane iron PLA02 indicates the production of decorative woodwork. Decorative mouldings were used on items of furniture such as doors (Liversidge, 1976, fig. 269) and beds (Pre-Construct Archaeology, 2009, p. 33). PLA02 would have produced a 'quirk ogee and bead' moulding (Salaman, 1975, fig. 505, h); a variant on a common classical design. A piece of moulded wood with an ogee design was found in the packing around Gresham Street Well 3 (GHT00, Blair *et al.*, 2006, fig. 27), and a similar design can be seen on a moulded end piece from a bed or couch from Drapers' Gardens (DGT06, Pre-Construct Archaeology, 2009, fig. 33). PLA02 is very narrow, however, indicating the production of smaller, delicately decorated wooden objects.

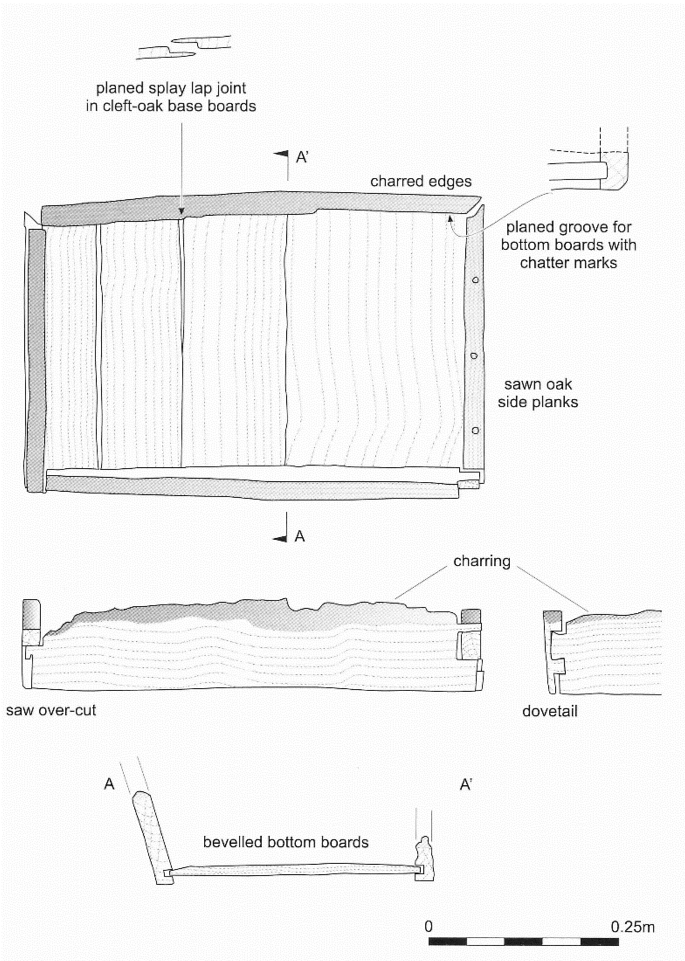


Figure 54 Base of a chest from 1 Poultry (ONE94), annotated to show the range of woodworking tools, particularly planes, used in its construction (Goodburn, 2011, fig. 336).

Grooved joints at the base of the 1 Poultry (ONE94) chest will have been made with a plough plane (Goodburn, 2011, fig. 336). However, plough planes may also have been used in the manufacture of some unidentified structural components from the same site (Goodburn, Goffin and Hill, 2011, pp. 433–4). If the use of plough planes was more widespread that just in joinery, this may explain why plough plane irons are the most common type recovered from London.

Not all joinery requires planes, however. The oak coffins from Atlantic House (ATC97) were constructed with professionally sawn planks and simply held together with nails (Watson, 2003, pp. 62–3). This would have required only a cross-cutting saw to trim the planks to length, and a hammer and bradawl to drive the nails in. This small toolkit and the lack of advanced woodworking techniques may indicate that these coffins were not made by the same specialist woodworkers who made chests and doors; perhaps instead by undertakers or the families of the deceased.

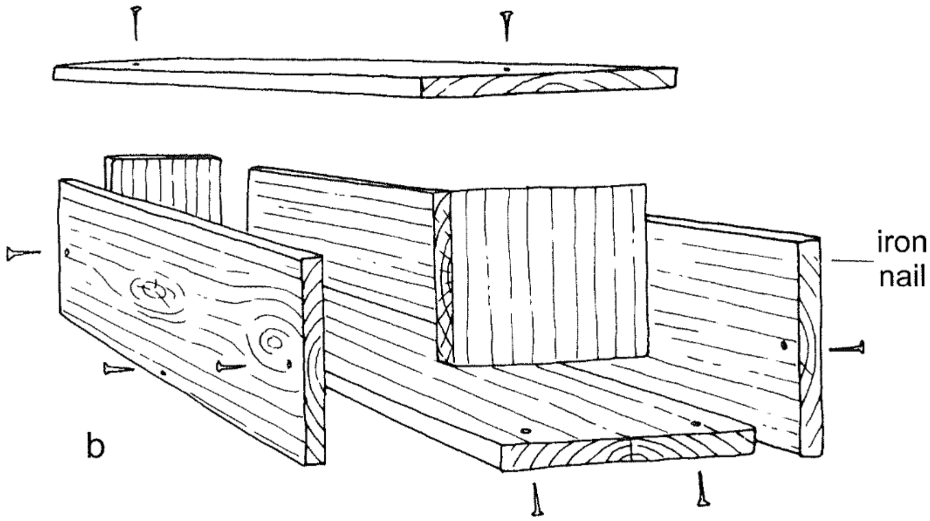


Figure 55 Construction of the wooden coffins from Atlantic House (ATC97, Watson 2003, fig. 86).

As well as special tools and techniques, joinery required different timbers to structural carpentry. The wood used in joinery needed to be seasoned, whereas that used in buildings did not (Hanson, 1978, pp. 295–7; Meiggs, 1982, p. 349; Goodburn, 2000, p. 13). The widespread use of oak in joinery means that timber used in joinery could be acquired from the same (presumably local) sources as the timber used elsewhere, but would need to be stored and looked after before it could be used.

6.2.4.7 Lathe Turning

Lathes are rotary machines which spin a workpiece on an axis, allowing it to be shaped with sharp tools. The origin of the lathe is a matter of debate (Simpson, 1999, p. 781), but they were certainly known in Britain by the pre-Roman Iron Age (Liversidge, 1976, p. 162; Earwood, 1993, pp. 184–5; Pugsley, 2003). The form of Roman lathes is not well understood, as no complete lathes are known from either archaeological or artistic sources (Liversidge, 1976, p. 162;

Pugsley, 2003, p. 133). The earliest identified lathe element in Britain is medieval (Pugsley, 2003, p. 133).

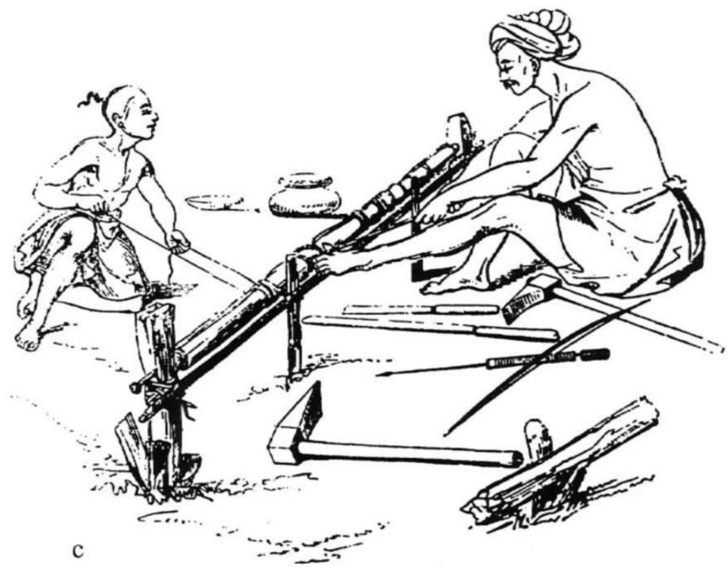


Figure 56 19th century illustration showing a ground-level horizontal lathe, driven with straps (Simpson 1999, Pl. CLXXIV, c).

A horizontal ground-level lathe driven by straps (Figure 56) is depicted in a 4th century BC carving from the tomb of Petosiris, Egypt (Simpson, 1999, p. 782). The same type of lathe could have been driven by a bow (ibid), which was widely employed to power drills in the Roman period, and may be depicted on a fragmentary carving of a lathe on a 1st century AD sarcophagus (Earwood, 1993, pp. 185–7). The use of a bow would allow a lathe to be operated by a single person (ibid). Lathes were also powered with treadles and poles from the medieval period onward, but it is unclear whether these were used earlier (Earwood, 1993, p. 193; Pugsley, 2003, pp. 134–5). These are all reciprocating technologies, in which the workpiece revolves in alternate directions as the straps/bow/treadle are pulled (Earwood, 1993, p. 193; Pugsley, 2003, p. 134). The material can only be cut as the object moves towards the operator (the cutting stroke), and not when it revolves away (the return stroke).

Some have argued that tool-marks on wooden, metal and stone objects indicate the introduction of continually rotating lathes in the Roman period (Mutz, 1972; Blagg, 1976, pp. 165–8; Cave, 1977; Earwood, 1993, p. 194; Pugsley, 2003, p. 134; Bessac, 2004, fig. 8; Böcking, Gérold and Petrovsky, 2004; Sitry, 2006, pp. xiii–xiv). These would have required more complex drive mechanisms, but with the exception of possible crank handles identified by Hanemann (2014, pp. 150–1), the direct evidence for these is slight.

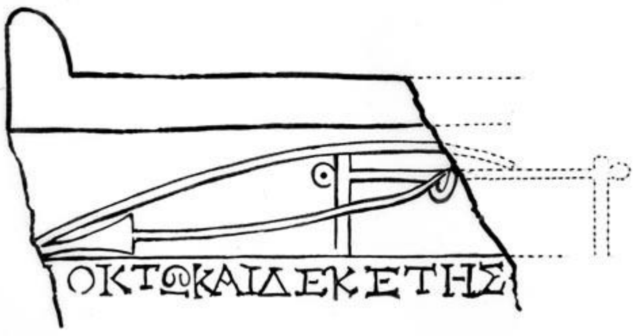


Figure 57 Fragmentary carving, possibly showing a bow-driven lathe (http://www.dartmouth.edu/~rogerulrich/tools/aa_tl_lathe_rmn.jpg).

Lathe working in the Roman period is different to that of the succeeding Medieval period both technologically and in the range of wares produced (Pugsley, 2003, p. 120). Whilst medieval woodwork was often carried out entirely on the lathe, Roman woodwork frequently used a mix of carving and lathe turning (Pugsley, 2003, p. 117). This can be seen on a number of serving implements from London (Pugsley, 2003, T0056-7). Carved blanks intended for future lathe-turning could be carved with axes and adzes (Earwood, 1993, p. 200), but none survive from the Roman period.

Pottery was seemingly preferred to wood for plates and bowls in the Roman period, which were not produced in wood with the same range of forms or on the same scale as in the Medieval period (Earwood, 1993, p. 90; Pugsley, 2003, pp. 101, 120, 143). When they were produced, some lathe-turned vessels appear to be conscious imitations of the forms of pottery, metal, stone or glass vessels (Pugsley, 2003, p. 108; Sitry, 2006 iv). Pugsley (2003, p. 108, fig. 5.12, 5.15) argues that this is the case for two wooden vessels from London (Figure 58). This may indicate that these objects were used in similar situations, had similar status, or indicate relationships between craftsmen working in different media (Pugsley, 2003, p. 108; Sitry, 2006, p. iv).

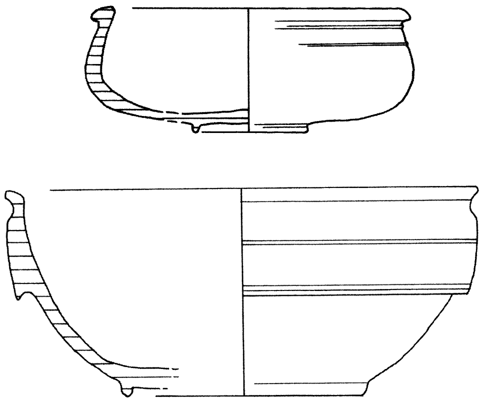


Figure 58 Turned wooden vessels from London. Top, imitating a glass bowl. Bottom, imitating a metal or pottery flanged bowl. Not to scale (Pugsley 2003, fig. 5.12, 5.15).

Apart from dining vessels, popular lathe-turned items included small boxwood containers (*pyxides*), needle cases and drinking cups (Pugsley, 2003, p. 138). Other lathe-turned wooden objects from London include the handles of CUR01 and AWL102 (although this is possibly post-Roman), other wooden handles from Bloomberg (BZY10, Marshall and Wardle, forthcoming), a number of dining and serving vessels (Pugsley, 2003, T001-9, 39, 42, 47), numerous small boxwood containers (Pugsley, 2003, P001-9, 25-6, 29, 35-8), furniture elements (Chapman, 1980, figs 73, 670; Weeks and Rhodes, 1986, fig. 10.6), and spindles (Chapman, 1980, figs 73, 671).

It is not clear how many of these objects were made in London, however. A hoard of boxwood objects found dumped in Southwark alongside samianware is thought to represent imported material (Pugsley, 2003, p. 141). There is no waste from London to provide direct evidence for the local manufacture of lathe-turned objects (Pugsley, 2003, p. 119). However, there is evidence of this in the London tools. CHI46 is a diamond-point scraper, and would have had few obvious functions outside of lathe work. This object alone indicates the existence of specialised lathe-working tools in London. The skew chisel CHI45

Figure 59 Lathe-turning chisels from London (Left, skew chisel, CHI45. Right, diamond-pointed scraper, CHI46).

and the tanged gouge GOU02 could also have been used in lathe work, although these tools could also have been used in carving. These tools are all related to the shaping of the outer surface of an object on a lathe.

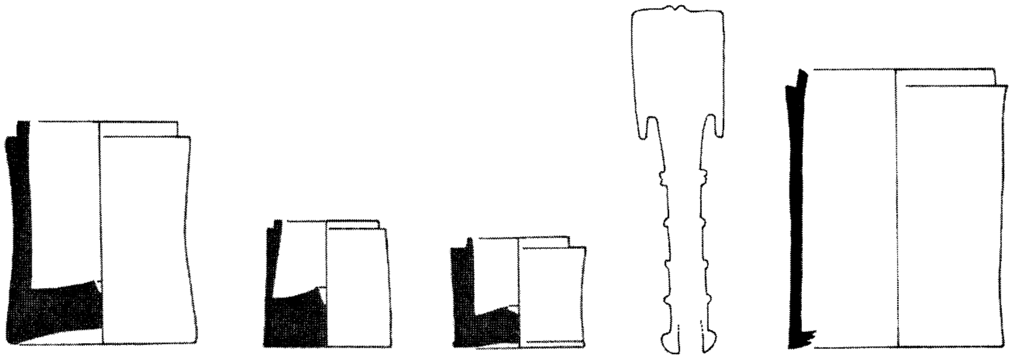


Figure 60 Lathe-turned objects from London (Pugsley, 2003, Pl. 4).

Lathe-turned vessels need to be hollowed out as well as shaped externally, indicating that a wider suite of tools may have been employed in lathe work. Roman craftsmen were able to hollow objects entirely with a lathe, although this was not practiced to the extent of the later Medieval period (Pugsley, 2003, pp. 86, 110). Some vessels were hollowed out by hand carving with chisels or gouges (Pugsley, 2003, p. 111), possibly preceded by boring (ibid, 86), although this was not common in the Western Empire (ibid). Another method used for narrow vessels was to drill out the interior with a spoon bit. This technique appears to have been short-lived, with no direct evidence for its practice after the early 2nd century (Pugsley, 2003, p. 90). Any of the spoon bits from London (Type 3, BOR07-18, 38-42, 52) could have been used to achieve this. Pugsley (2003, fig. 4.46, 17) posits the use of a long auger mounted in a wooden frame to drill these vessels accurately (Figure 61). The long-stemmed drill bit BOR09 could have been used in such a device.

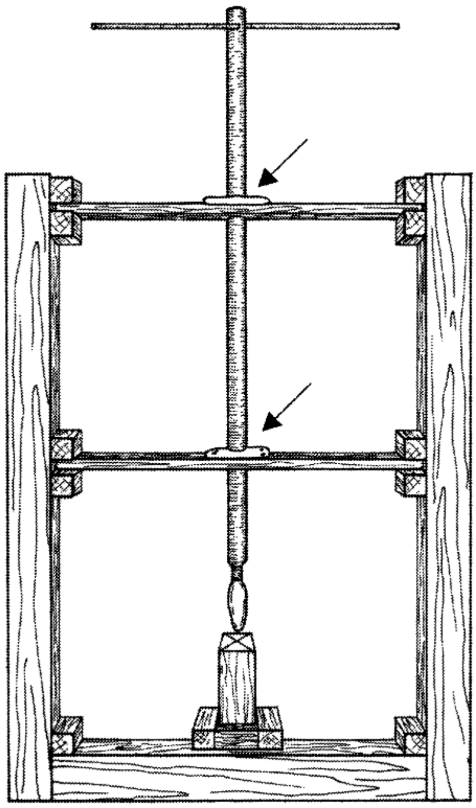


Figure 61 Experimental reconstruction of a frame-mounted auger for hollowing turned wooden vessels (Pugsley 2003, fig. 17).

A turned vessel made of box burr from the British Museum may have had a decorative metal overlay nailed to the rim (Pugsley, 2003, T042). This indicates collaboration between different craftsmen, or that lathe-workers may also have required the tools and skills of non-ferrous metalworkers.

6.2.4.8 Vehicle Manufacture

The manufacture of wheels and carts is not directly evidenced in London, but deserves brief consideration because of the range of specialisations needed. Wheels in the Iron Age and Roman periods were comprised of multiple parts, including lathe-turned hubs, spokes, bent wooden rims, and iron tyres (Ulrich, 2007, pp. 202–12). Wooden vehicles more generally employed a range of wood, iron and leather components. The manufacture of carts and wheels therefore required skills from multiple crafts (Scott, 2017, p. 313), which up until now have been treated in this thesis as separate phenomena. Cart makers and wheelmakers are attested as distinct professions on tombstones (Ulrich, 2007, fig. 10.1), but we do not know how the various skills needed to make these objects were organised within workshops. Were these objects made by a team of people each with a variety of skills, or were workshops comprised of multiple individuals, each trained in a specific aspect of wheel manufacture (heat-bending, lathe-turning, iron forging, etc.)?

Boatbuilding is another major woodwork specialisation which may have taken place in London. Two Roman vessels have been found in London, at Blackfriars and Guy's Channel, and are presumed to have been manufactured nearby (Marsden, 1994, pp. 33–104; Bird, 2000, p. 161). These are supported by fragmentary references to shipbuilding on writing tablets from London (Merrifield, 1983, p. 99). However, no dedicated shipbuilding tools have been identified in London. An object from an unknown location in the Thames, previously identified as a caulking iron (MOL A19645), must be regarded as unidentified. Other possible caulking irons have been identified as mason's chisels (MAS04) or hot cutting tools (HOT01-04). Whilst broad-bladed axes suitable for shipbuilding have been found in London (Figure 43), these appear to post-date the height of London as a port city.

6.2.4.9 Aspects of Ownership

Makers' Marks

Although a wide range of objects from the Roman period bear makers' marks, in London stamps appear almost exclusively on woodworking tools (see p.621). This indicates that several of the woodworking tools, particularly chisels, from London were the products of specialist workshops. Some may have been specially imported to London from the Continent.

Ownership Marks and Decoration

Ownership marks may provide insight into the nature of woodworking groups. Graffiti has been observed to be more common on pottery from communal settings (towns and military sites) than rural settlements (Evans, 1987). The need to mark tools could therefore be interpreted as a sign that these objects were kept in a communal environment, such as a workshop. Tools may also have been marked to signify ownership of objects that were frequently taken out of the workshop to a worksite elsewhere. None of the woodworking tools from London are inscribed with the names of people or institutions, but three have abstract marks incised on them which may constitute ownership marks (Figure 62). AXE19 has a star incised on the underside, GOU08 has four faint lines incised on the handle, whilst the bradawl AWL010 has notches cut into the corners of the handle. Whilst this number is small (representing 1.4% of the woodworking tools from London), these objects make up half of the six tools from London with obvious 'owner's' marks. As many of these tools will have had substantial wooden components it is likely that ownership marks would have been made on these, rather than on the surviving iron parts.

Decoration of tools may also have been a means of identifying them in a communal space. Moreover, the existence of decorated tools may indicate extra investment at the point of purchase, possibly showing that they were personal possessions. Four woodworking tools (AWL021, BOR39, CHI16, and GOU10) have decoration in the form of incised lines and notches (Figure 63). Two further woodworking tools from London (AWL037 and BOR23) are not strictly decorated, but show an elaboration of form that goes beyond the functional, and may be considered decorative. We can also presume that woodworkers may have customised the wooden elements of their tools to make them recognisable. A chisel from Aquileia has an elaborately turned handle (Ulrich, 2007, fig. 3.16).

Figure 62 Woodworking tools with ownership marks (Top-bottom; gouge, GOU08; bradawl, AWL010; axe, AXE19).

Figure 63 Decorated woodworking tools from London (Top-bottom; bradawl, AWL21; spoon bit, BOR39; chisel, CHI16; gouge, GOU10).

A rather different relationship with tools may be indicated by DIE02. Rather than being personal possessions, modern marking hammers are owned by institutions and 'kept locked up' when not in use (Salaman, 1975, p. 229), as their markings carry official authority. We may imagine that the dies used in London were similarly controlled.

Tool Maintenance

Many of these tools would have required maintenance, which brings a wider suite of objects into the sphere of woodworking tools. Three woodworking tools, CHI42, CHI45, and PLA03 are well-preserved enough for evidence of re-sharpening to survive. Re-sharpening could have been achieved with files or whetstones. The majority of the whetstones used in London seem to have come from a single source, although this has yet to be located (Green in Marshall and Wardle, forthcoming). Theories as to its origin include various sites in the Weald (Allen, 2014), although Green (in Marshall and Wardle, forthcoming) suggests that a Continental origin is possible. In either case, this suggests that the desire for good maintenance equipment was sufficient for them to be imported from great distances.

Saws require a particular form of maintenance. Four saws from London display a set; the bending of the teeth in alternate directions to improve the efficiency of the cut. With use, the teeth will be bent back into line, so the set needs to be maintained. Saws also require periodic re-sharpening. The file FIL14 appears to be a fragment of a saw-setting and sharpening file, complete examples of which often have a notch for setting saw teeth. Two hammers, HAM09-10, may also have been used for saw-setting, although this identification is less certain.

We can therefore see how having a wide suite of specialised tools created the need for yet more practices and tools. This even raises the possibility of further craft specialisations existing in the Roman period. In the modern period, saw sharpening and setting could be carried out by professional 'saw doctors', although their services were only used by cabinet makers and joiners, with other craftsmen carrying it out themselves (Salaman, 1975, pp. 436–7).

6.2.4.10 Workshop Furniture and Embodiment

As well as introducing new tool types and professions, the Roman period may have seen changes in the ways that craftsmen held themselves whilst working. Whilst we have observed that there are few 'Iron Age type' tools in London, the functioning of many 'Roman' tools would have been familiar to 'native' craftsmen. However, more fundamental changes to the embodied practices of woodwork can be seen in some changing tool forms from the Iron Age to Roman periods. Pietsch (1983, p. 29), for example, highlights how the increasingly steep angles of adze blades from the Iron Age to Roman periods would have necessitated the woodworker holding their workpiece differently. There may also have been a change from sitting to standing whilst working wood, as has been observed in metalwork (see p.171), although the positive evidence that Iron Age woodworkers sat is limited. The introduction of saws which cut on the push stroke has been linked to the introduction of a standing posture, allowing more upper body strength to be applied compared with the sitting posture which pull strokes may favour (Sitry, 2006, p. xiii). Other changes of embodiment involving saws include the use of trestles and the introduction of two-man saw teams (see p.105). The use of a standing posture is also implied by the introduction of the plane, which may be linked to the introduction of the carpenter's workbench, an example of which has been found at Saalburg (Goodman, 1964, pp. 183–4), although a Pompeiian fresco of Icarus shows the woodworker seated at a bench (Ulrich, 2007, fig. 3.17). Other woodworking crafts will have involved specialist furniture, such as the 'clam' used in comb-making (Pugsley, 2001), although it is not clear that these did not exist in the Iron Age.

6.2.5 Discussion

This analysis has shown that identifying 'woodworking' in the Roman period is not a sufficiently detailed descriptor of the types of roles that 'woodworkers' would have occupied. Numerous sources have been used to suggest that woodworking was highly specialised, and divided into a number of distinct professions. Whilst the main sources for this (epigraphy and iconography) are not found in Britain, the tools from London support this supposition, providing evidence in the form of specialised tools for distinct styles of structural carpentry, joinery, cooperage, etc.

This variety of tool form has previously been seen as a marker of the introduction of a 'Romanised' way of life, with the tools corresponding to an increase in the range of objects carpenters needed to be able to make (Tisserand, 2011, p. 889; Scott, 2017, pp. 308–9). However, this analysis has suggested that this 'Romanised' style of craft did not last throughout the entire Roman period, with new axe types giving the possibility of significant changes occurring in woodwork in London from the 3rd century. After this time, woodworkers may have become less specialised.

The woodworking tools from London are not only highly specialised; some are also decorated, imported, or made to an extremely high standard. These factors indicate that some of London's woodworkers took considerable pride in their identity as specialists, and invested in tools as personal possessions. However, specialisation of form may not always indicate an increased status. Some of these tools reduced tasks previously carried out by skilled individuals to mechanical operations involving teams.

A prime example of this is the introduction of two-man saws and the widespread availability of planks in Roman London. Although specialised, sawing planks may not have been a highly skilled operation. If sawyers only needed a small number of specialised tools and equipment (saws, axes and trestles) and were required by the nature of the technology to work in teams, they may have enjoyed less personal status and monetary reward than other woodworkers. Joiners, for example, would have required a large number of highly specialised tools, locking out those of lower means from entering the profession.

6.3 Agriculture, Horticulture and Gardening

143 tools from London are potentially associated with the growing of plants. These include billhooks, a coulter, forks and pitchforks, hoes, ploughshares, rake tines, sickles and reaping hooks, spades and spuds. This is the second largest category of tools from the city, and the presence of so many agricultural tools in an urban context may be surprising. Whilst not all of these tools need to be seen as directly associated with agriculture and horticulture, these objects nevertheless provide an opportunity to discuss when, where and how plants were grown and harvested in a major urban centre.

At the heart of this is an attempt to understand who grew plants in London and why. These groups are very difficult to pin down, and very little work has been dedicated to farmers and horticulturalists living in ancient urban settlements. However, the study of modern urban farming and horticulture reveals the potential social significance of these acts (Meller, 2016). Green spaces can be set up by official mandate, by private individuals, or by community groups, on both public land and private property. Urban green spaces may include gardens, allotments, urban farms and parks. Far from being simple plots of land, urban green spaces can have political significance (Meller, 2016). Vegetable plots can be a key source of food for the urban poor, the supply or denial of which can be used to further political agendas. Groups and individuals can 'reclaim' land in towns for growing plants as an act of defiance. Authorities can use the creation of gardens as a means to control space. Gardens will have become especially important in times of war or hardship; in WWII, allotment gardens provided around 50% of Britain's vegetables (Meller, 2016). The use of green spaces in towns and cities can also reflect changing social concerns. Over the 20th century, gardens have gone from being practical spaces for washing and growing food, to being leisure spaces (Meller, 2016).

This section will first look at the evidence for the types of people working with plants in Roman towns, before moving on to a discussion of agricultural and horticultural sites in London. Finally, the tools will be examined as evidence of agricultural and horticultural practice in the city.

6.3.1 Growing Plants in Roman Towns

6.3.1.1 Gardens and Gardeners

The most obvious venue for growing plants in towns is the garden, and Roman gardens have been the subject of an extensive body of literature (Jashemski, 1979, 1994; MacDougall, 1987; Zeepvat, 1991; Cima and La Rocca, 1998; Farrar, 1998, 2016; Carroll, 2003; Cowan and Hinton, 2008). This literature has focussed on the more spectacular formal gardens of the classical world, with the excavated gardens of the Vesuvian region being particularly important. c.450 gardens have been identified in Pompeii, with most houses of all sizes having at least one (Jashemski, 1979, p. 25; Cowan and Hinton, 2008, p. 75). Gardens in the Roman period could also be associated with public buildings, cemeteries, temple precincts, the properties of guilds and corporations and private enterprises such as restaurants and inns (Jashemski, 1979, pp. 141–66, 183–200; Farrar, 1998, pp. 176–86, 2016, pp. 143–4, 149, 151–2; Cowan and Hinton, 2008, p. 78).

The majority of excavated classical gardens from Britain are from rural villas, the most spectacular are which was excavated at Fishbourne, where bedding trenches revealed the layout of decorative hedges (Zeepvat, 1991, p. 53; Dickson, 1994, p. 49; Cowan and Hinton, 2008, p. 75). There is a perhaps surprising dearth of evidence for formal gardens from urban sites in Britain. This is perhaps due to issues of preservation, with urban sites in particular suffering from heavy truncation and keyhole excavation (Zeepvat, 1991, p. 53). Nevertheless 'garden porches' have been identified in some Roman town houses, which may have overlooked gardens or courtyards (Perring, 2002, pp. 151–4; Cowan and Hinton, 2008, p. 75).

Roman gardens were mostly based around evergreen hedges and trees, with few flowers (Jashemski, 1979, p. 54, 1994, p. 16; Dickson, 1994, pp. 57–8; Cowan and Hinton, 2008, p. 75). Larger formal gardens were constructed with geometric patterns of hedges and paths, often enclosed by painted walls which echoed the garden itself (Jashemski, 1979, pp. 55–88; Farrar, 2016, pp. 148–9, 153–5). Water features could include borders, pools and fountains (Jashemski, 1979, pp. 32–4, 41–8; Farrar, 1998, pp. 64–96, 2016, pp. 159–65). These gardens were used for a range of functions, including dining, practicing crafts, and worshipping (Jashemski, 1979, p. 113). Many contained statues of mythological creatures or gods (Jashemski, 1979, pp. 35–41; Farrar, 1998, pp. 97–129, 2016, p. 157), and some contained altars, or plants associated with particular deities (Farrar, 2016, p. 143). Venus was particularly strongly associated with gardens (Jashemski, 1979, pp. 124–31; Farrar, 2016, p. 140).

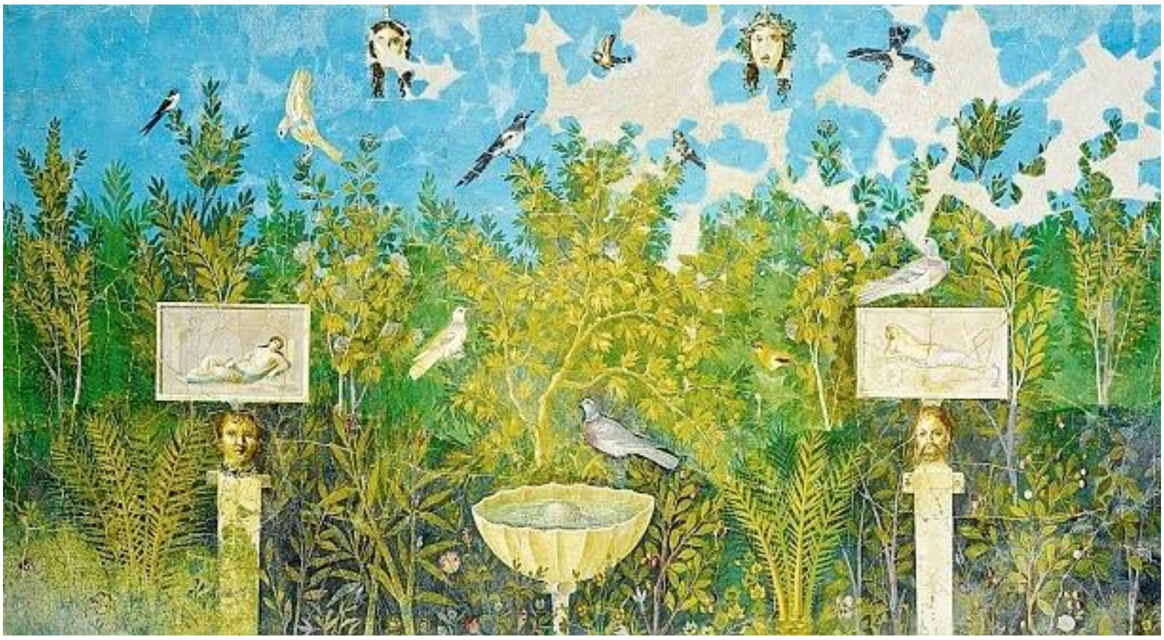


Figure 64 Fresco depicting a garden scene from Pompeii (http://www.dailymail.co.uk/home/gardening/article-2301045/Pompeii-Exquisite-frescoes-reveal-just-enchanting-Roman-gardens-were.html).

As well as formal decorative gardens, cities in the Roman period could contain productive market gardens, orchards and horticultural plots. In Pompeii, large areas within the city were given over for use as vineyards (Jashemski, 1979, pp. 201–32) and orchards (Jashemski, 1979, pp. 251–65; Cowan and Hinton, 2008, p. 75). Flowers, which did not have a major role in decorative gardens, but which were used for ceremonial garlands (Jashemski, 1979, p. 267; Farrar, 1998, p. 176; Cowan and Hinton, 2008, p. 75) and perfume production (Stewart, 2007, pp. 12–3), were also grown commercially in Pompeii (Farrar, 2016, p. 151).

In Britain, the Roman period sees the introduction of small horticultural plots to both urban and rural landscapes (van der Veen, 2008, pp. 102–3). These small plots were particularly suitable for growing perishable crops which needed to be used soon after harvesting, and may have been used for growing new crops introduced after the Roman conquest (van der Veen, 2008, p. 103). Evidence of these plots in towns includes linear plots, perhaps allotments or market gardens, from Colchester (Crummy, 1984, pp. 138–40) and Wroxeter (Zeepvat, 1991, p. 59; van der Veen, 2008, p. 103). Plant macrofossils from waterlogged pits and wells also suggest the presence of garden plots in Silchester, Caerwent and York (Dickson, 1994, pp. 49–50; Cowan and Hinton, 2008, p. 75). Garden plants and possible garden plots have also been identified at forts in Britain (Dickson, 1994, pp. 50, 54; Cowan and Hinton, 2008, p. 78; van der Veen, 2008, p. 103).

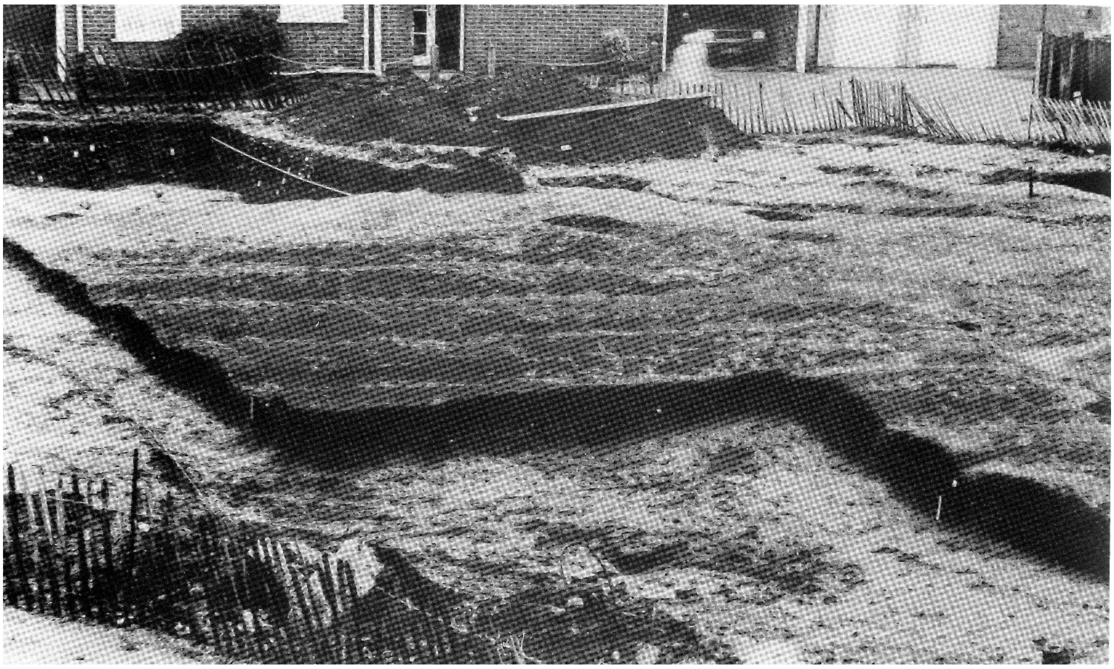


Figure 65 Garden beds excavated at Colchester (Crummy, 1984, fig. 129).

Of the people involved in growing plants in Roman towns, gardeners are the only group to have been studied in any detail (Farrar, 1998, pp. 160–1, 2016, p. 168; Carroll, 2003, pp. 80–95). A number of funerary inscriptions indicate the existence of professional gardeners in the Roman world, although none are known from Britain. These inscriptions indicate that larger classical gardens may have had multiple dedicated workers under the control of a *villicus* and *subvillicus*. These workers may have been divided into those who tended to vines (*vinitor*), trees (*arborator*), vegetables (*olitor*/*holitor*), or who watered plants (*aquarius*) (Farrar, 1998, pp. 160–1, 2016, p. 168). Those who operated market gardens may have been referred to by the term *hortulanus* (Farrar, 1998, p. 161). Others may have had more general roles. A contract from the 3rd century AD in Egypt requires a gardener to manufacture baskets, chase away birds, maintain irrigation channels and water plants (Carroll, 2003, p. 83).

Very little is known about the status of these people. Like other Roman craftsmen, professional gardeners may have been freedmen (Farrar, 1996, p. 50). Several Roman funerary inscriptions are dedicated to *topiarii* (specialist hedge trimmers or landscape gardeners), indicating that they had some status as craftsmen (Farrar, 1998, p. 161, 2016, p. 168). The dedication of one by a pupil indicates a form of apprenticeship (Farrar, 1998, p. 161). They layout of the box hedges at Fishbourne has been attributed to the presence of a professional *topiarius* in Britain (Carroll, 2003, p. 86).

The introduction of new agricultural technologies, and the possible use of horticultural plots to grow crop types introduced to Britain in the Roman period, may suggest the presence of immigrant horticulturalists. Veterans may have been on part of this group, as agricultural skills could have been learned at the horticultural plots established around forts. Smaller plots may have been operated by any of the residents of an ancient city at a household level, although larger commercial enterprises may have employed multiple people.

6.3.1.2 Fields and Farmers

A city is by definition a settlement in which agriculture did not form the primary component of the economy, and urban settlements are typically seen only as the consumers of agricultural produce. However, agricultural land could exist only meters away from the edges of a major settlement, and we can presume that some of the people cultivating this land may have lived in nearby towns (Merrifield, 1983, p. 100). Farmers in Roman towns have received no detailed study, however, and are the least well understood of the groups discussed here. Lodwick (2014, p. 210) has given some consideration to the farmers who may have lived in Late Iron Age Silchester. Here they are envisioned as a community operating at a level of cohesion beyond the household unit. Although living in a town, they observed the same seasonal pattern of agricultural production as those living in the contemporary countryside. Lodwick postulates a decline in the importance of farming to the urban economy in the Roman period; a time of social bonds breaking, as the people involved turn to craft industries, which can be carried out individually. A key part of this section will therefore be to look for evidence of farmers living in Roman London.

6.3.1.3 Ritual and Social Aspects of Urban Agriculture

Beyond its practical importance in providing food, agriculture and agricultural tools feature prominently in aspects of Roman religion. A large number of Roman deities are associated with fertility and agriculture, with Venus in particular being associated with gardens (Jashemski, 1979, pp. 124–31; Farrar, 2016, p. 140). Other gods are associated with agricultural and horticultural tools. Saturn was known as 'the sower', and was sometimes depicted holding a sickle or scythe (Farrar, 2016, p. 139). Pomona was associated with the cultivation, pruning, grafting and harvesting of fruit, and was depicted with fruit and a pruning hook (Farrar, 2016, p. 141), as are some cupids (*RIB* 1131, 2198). The fertility god Priapus also has a pruning hook as an attribute (Farrar, 2016, p. 141).

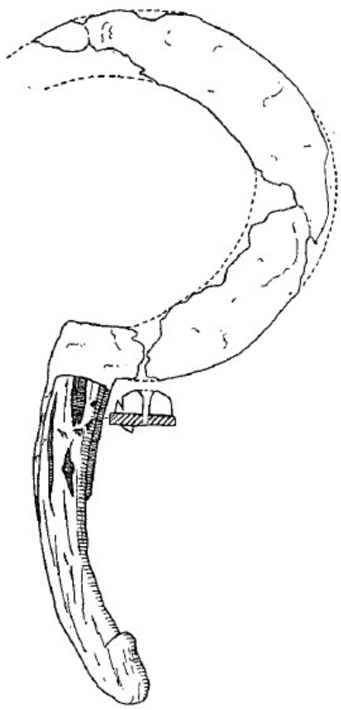


Figure 66 Sickle from the Blackburn Mill hoard, with a wooden handle in the form of a phallus (Piggott, 1952, fig. 12, B34).

Agricultural tools were also used for specific rituals in an urban context. Rituals accompanying the foundation and laying out of a town could include drawing a plough along the boundaries of the settlement (Manning, 1971, p. 134; Woodward and Woodward, 2004, p. 68). Agricultural tools are the most common tools in Roman ironwork hoards, which are commonly thought to have been deposited for ritual purposes (Piggott, 1952; Manning, 1972a; Hingley, 2006; Humphreys, 2017b). Agricultural tools may have been deposited in hoards as fertility symbols, continuing a practice started in the Iron Age (Haselgrove and Hingley, 2006), or for more complex reasons referencing their association with ironworking (Hingley, 1997, p. 14; Giles, 2007) or civic identity (Woodward and Woodward, 2004; Humphreys, 2017a, p. 401). A ritual function for some of these tools is hinted at by a sickle from Blackburn Mill, the wooden handle of which is in the shape of a phallus, potentially a reference to Priapus (Piggott, 1952, fig. 12, B34), although this possibly references the protection or good luck of phallic symbolism more generally (Johns, 1989; Parker, 2017). The *Greek Anthology* (6.36, 41, 95, 104) records several instances of the dedication of agricultural tools to the gods.

6.3.2 Agricultural and Horticultural Sites in London

6.3.2.1 Ornamental Gardens

Of all the urban settlements in Britain, London has been seen as the most likely location for formal gardens to have been built, and the physical evidence for gardens has recently been brought together by Cowan and Hinton (2008). The strongest candidate for a formal garden in London is a possible garden identified around a public building at the Winchester Palace site in Southwark (Cowan and Hinton, 2008, p. 77). Gullies and pits in Open Area 9 were thought to indicate the position of bedding trenches and trees (Yule, 2005, p. 74) in an area of dark earth, possibly formed through garden cultivation (Macphail, 2005, p. 90). Painted wall plaster from the gullies featured the only known depictions of gardens from London (Cowan and Hinton, 2008, p. 77), and echoes the use of wall paintings around gardens in Pompeii (Goffin, 2005, p. 134). There was, however, no obvious formal arrangement to these plots (Yule, 2005, p. 74).

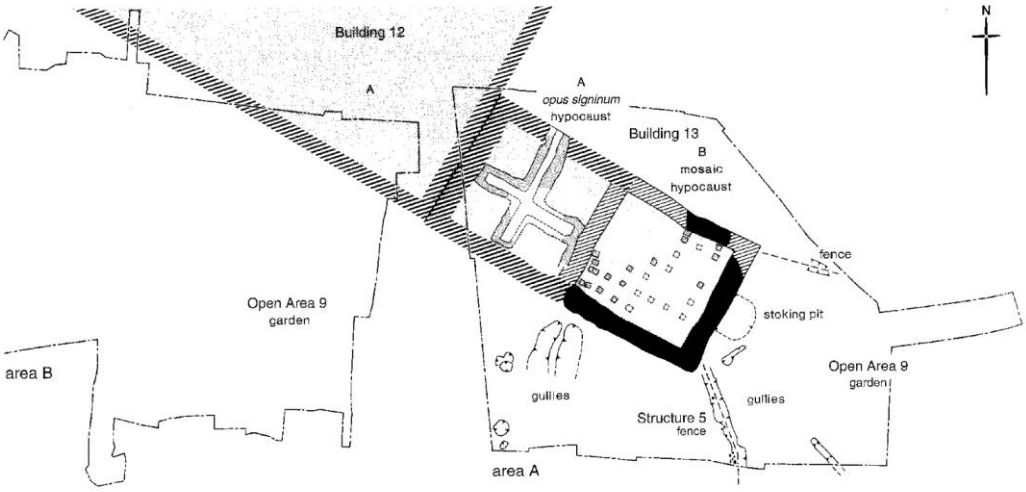


Figure 67 Gullies and fences excavated in the possible garden at Winchester Palace (Yule 2005, fig. 40).

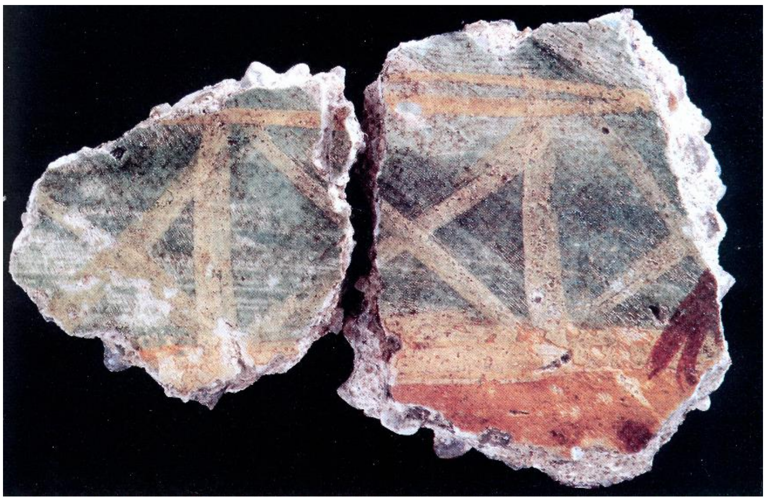


Figure 68 Painted wall plaster from Winchester Palace depicting a fence, possibly part of a garden scene (Cowan & Hinton 2005, fig. 2.3.3).

A line of possible spade marks aligned with a wall at Warwick Square may represent the edge of a small plot or hedge line. This feature is not well dated, but is possibly 2nd century or later (Marsden, 1969, p. 7; Perring, 1991, p. 79; Cowan and Hinton, 2008, p. 76).

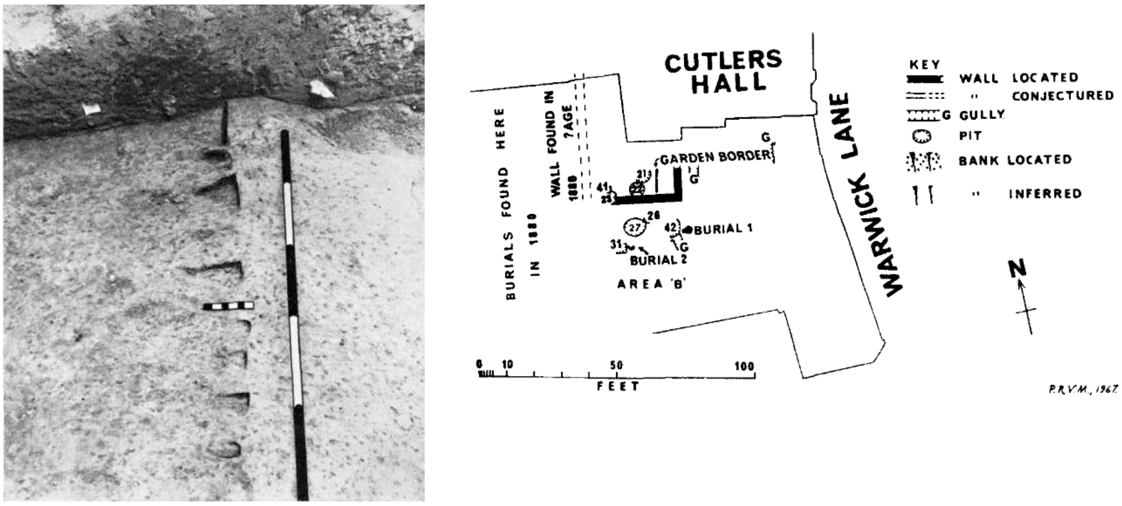


Figure 69 Spade marks excavated at Warwick Avenue (left, Marsden 1969, Pl. 2) and the position of the bed within a ?walled garden (right, Marsden 1969, fig. 2).

At 1 Poultry, an expanded 3rd century building was set within a large plot, possibly a garden, with box leaves and conifer needles (possibly juniper or Norway spruce) indicating hedges along the nearby road (Cowan and Hinton, 2008, pp. 76–7; Davis, 2011a, p. 400; Lodwick, 2017). Box leaves from a late 1st century ditch at Drapers' Gardens may indicate the presence of box hedges in London from an early date (Lodwick, 2017). Other evidence for box plants in London comes from waterlogged sites along the Walbrook stream and the Thames waterfront (Cowan and Hinton, 2008, p. 78; Lodwick, 2017). Holly (Cowan and Hinton, 2008, p. 78) and stone pine (Lodwick, 2017) are also known to have been grown in London. Pine (possibly stone pine) branches in a ditch near the Guildhall Amphitheatre may indicate the pruning of nearby decorative trees (Lodwick, 2017).

There is a small body of evidence for the presence of flowers in London. Rose was found at 1 Poultry (ONE94), with marigold coming from a well at Blossom's Inn (Cowan and Hinton, 2008, p. 78). 'Flower pots' found at 179 Borough High Street (179BHS89, Figure 70) are of a type found at Eccles and in the formal gardens at Fishbourne, as well as on various Continental sites. These are thought to have been used in transplanting trees, and may indicate the cultivation of non-native decorative or fruit-bearing trees in London (Farrar, 1996, p. 50, 2016, p. 170; Carroll, 2003, pp. 90–1; Cowan and Hinton, 2008, pp. 78–9; van der Veen, 2008, p. 104).

There is no strong evidence of decorative water features from London. A 'great pool' associated with the 'Governor's Palace' may have been part of a garden water feature (Marsden, 1969, p. 14; Zeepvat, 1991, p. 58; Cowan and Hinton, 2008, p. 76), but the identification of this building is highly disputed (Milne, 1996), and no associated plots were found (Cowan and Hinton, 2008, p. 76). There is also no evidence of gardens around any of the London cemeteries or at the fort (Cowan and Hinton, 2008, p. 78). Whilst the land around the cemeteries must have been maintained in some way, this is thought to have been achieved through animal grazing rather than gardening (Harward, Powers and Watson, 2015, p. 83), although evidence of elder and willow trees has been found around the perimeter of a cemetery in the Upper Walbrok (Ranieri and Telfer, 2017). A garden may have existed near the bath house of the extra-mural villa at Beddington (BSF81-87, Howell, 2005, p. 27).

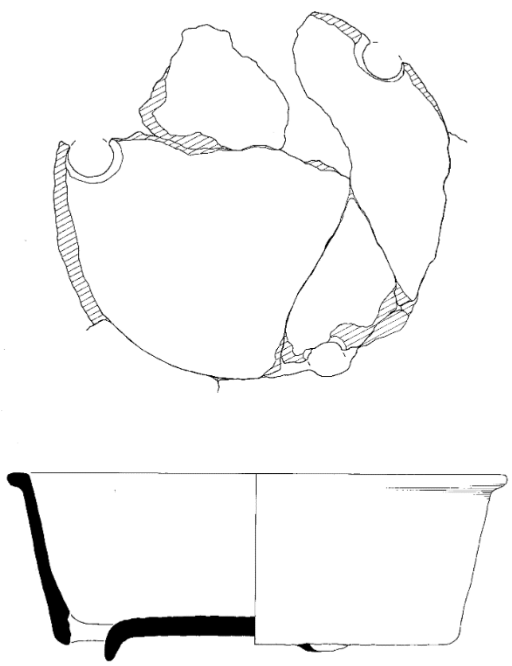


Figure 70 Plant pot from 179 Borough High Street

(Cowan and Hinton, 2008, fig. 2.3.4).

6.3.2.2 Market Gardens, Orchards and Small Plots

Whilst a series of stake holes and pits associated with rooting may indicate some form of horticulture at Newgate Street (GPO75), on the far western edge of Ludgate Hill c AD 60-75 (Perring and Roskams, 1991, p. 101), much of the evidence for market gardens and horticultural plots in London comes from pollen and plant macrofossils. This evidence is highly ambiguous, as it is not clear from these alone which plants were cultivated in London, what was growing wild, or what was only consumed here (Cowan and Hinton, 2008, p. 78). Species represented include almond, apple, beet, *Brassica*/*Sinapis* (cabbage, swede and rape), carrot, cherry, coriander, dill, fennel, fig, lentil, mulberry, olive, parsnip, pea, pine nut, pomegranate, plum, prune, strawberry, summer savory, and walnut (Dickson, 1994, pp. 50, 55; Cowan and Hinton, 2008, p. 78; Davis, 2011a, p. 400, 2011b, p. 403).

Many of these foods were new introductions to Britain in the Roman period. London displays by far the most diversity of food types consumed in the Roman period (van der Veen, 2014, p. 10), and was unique amongst British towns in being able to continue importing food throughout the Roman period (van der Veen, 2008, p. 105). The presence of these exotics has been linked predominantly to London's place as a trading hub (Livarda and Orengo, 2015, p. 251).

Nevertheless, some imported plants may have been cultivated here. Mulberry must be picked when ripe, and so is likely to have been grown locally (Dickson, 1994, p. 55; Davis, 2011b, p. 404). Grape pollen from 1 Poultry has been used to suggest that viticulture may have taken place in the Walbrook valley (Scaife, 2000, 7.c; Cowan and Hinton, 2008, p. 78). It is also notable that amphorae of Dressel 2-4 type were produced in VRW fabric in the London area (see p.249) from the 1st century (University of Southampton, 2014). Whilst their contents are unknown, it is not impossible that they were used to transport wine grown nearby. However, whilst Roman viticulture has been identified in Britain (Brown *et al.*, 2001), the evidence of pollen alone is not sufficient to identify viticulture in London, as pollen can be recovered from imported dried fruit (Scaife, 2000, 7.c; Davis, 2011b, p. 404).

A number of semi-wild products may also have been collected around London, including timber, wattle, and reeds. Some food plants evidenced in London, such as hazelnut, sloe, and blackberry (Dickson, 1994, p. 48; Cowan and Hinton, 2008, p. 78; Davis, 2011a, p. 400) are also likely to have been harvested from the wild rather than cultivated. Exploitation of wild foods increases in the Roman period compared with the Late Iron Age, perhaps overturning a pre-existing cultural taboo (van der Veen, 2008, p. 102).

6.3.2.3 Fields and Farms

Although some evidence exists for the importation of grain from the Continent (Bird, 2000, p. 163) it is presumed that the majority of the food consumed in Roman London was grown nearby. This presumption must be contrasted against the lack of good evidence for rural settlement around London, however. The expected ring of rural settlements and elite villas has not to be found around London; there is instead a large gap in the rural settlement of London's hinterland (Figure 71). This may be partly explained by geology. The land around London is not well suited to agriculture, with London clay being especially difficult to work (Bird, 2000, p. 156, 2017b, p. 41). Villas are more likely to be located in areas of mixed geology, and this may explain their absence around London (Bird, 2000, pp. 156–77, 2017b, p. 41), although others have suggested that social factors, such as the lack of an earlier tribal centre, are more important (Millett, 1996, pp. 34–5). Regardless, the land around London is not so poor that it cannot be farmed. London was able to sustain itself from largely local sources in the medieval and early modern periods (Bird, 2000, p. 163), whilst pollen and plant macrofossils have provided evidence for open, cultivated land in London's hinterland in the Iron Age and Roman periods, growing barley, oats, wheat and einkorn (Sidell, 2008).

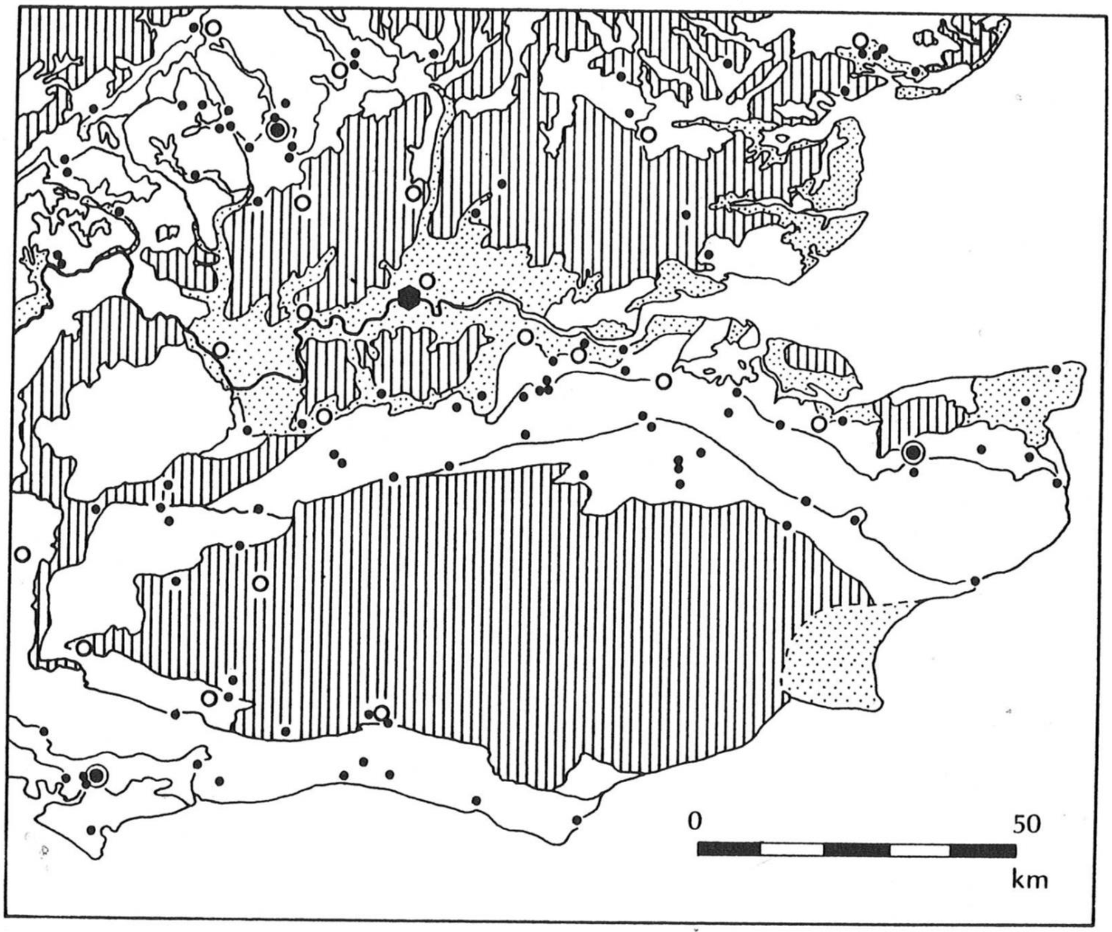


Figure 71 The distribution of villas (black dots) and major towns (white circles) around London (central hexagon). Vertical lines = clay soils. Stippling = alluvium, sands and gravels (Bird, 2000, fig. 9.3).

This section will concern itself only with the evidence for agriculture in the near vicinity of the Roman city and Southwark. We therefore need to ask how close the fields around London came to the city. Modern allotments need to be within a car journey or bicycle ride of people's homes (Meller, 2016). If the fields around Roman London were worked by city dwellers, they needed to be within walking distance. Whilst the land immediately outside the city walls was largely given over to cemeteries in the later Roman period, there is some evidence in the form of ditches and banks at 1-12 Rangoon Street (RAG82), 7-12 Aldersgate (ALG84), and 28-32 Bishopsgate (BIS82) to indicate that earlier field systems and stock enclosures extended to the immediate area around the city, some within the later city walls (Museum of London, 2000, p. 145; Cowan and Hinton, 2008, p. 78). None of these sites has been fully published, however. Possible 2nd century plough marks were identified immediately to the north of the later city wall in the upper Walbrook valley at Moor House (MRL98), although the excavators were not convinced of this identification (Butler, 2006, pp. 12, 36). Ditches have also been found on the mainland to the south of the Thames, possibly indicating agriculture close by to the settlement on the Southwark eyots (Cowan *et al.*, 2009, pp. 117–8).

There is also a limited amount of evidence for the cultivation of fields closer to the core of the settlement. A number of waterlogged sites in London have produced evidence of hay, which was used for flooring, as well as for bedding and fodder for animals (Lodwick, 2014, p. 187; Campbell, 2017, p. 145). Pollen from 1 Poultry (ONE94) suggests that hay may have been grown in water meadows on the Walbrook valley floor (Davis, 2011a, p. 400). A cluster of sites indicates dispersed occupation and agriculture on Cornhill, around the site of the later forum, in the late 1st century. A small late 1st century field or market garden was excavated at 1-7 Whittington Avenue (WIV88). The c.9 x 3.5m rectangular plot contained irregular linear grooves, thought to have been made with ploughs or spades, with micromorphs showing evidence of manuring (Brown and Pye, 1992; Museum of London, 2000, p. 145; Cowan and Hinton, 2008, pp. 77–8). This plot may have been associated with contemporary buildings at the adjoining Leadenhall Court (LCT84) site, where two phases of buildings may have been associated with agriculture from c. AD 65-75 (Milne and Wardle, 1993, pp. 30–3). This 'farm' existed at a time when the area was at the periphery of the city, with strip buildings later taking over as the city expanded. Ard marks are also reported from 9-19 Throgmorton Avenue (TRM86), although no further information is available (Museum of London, 2000, p. 145). Plough marks and evidence of manuring found at 60-63 Fenchurch Street (FNE01) probably represent Iron Age rather than early Roman activity (Birbeck and Schuster, 2009, pp. 11–12; Macphail and Crowther, 2009, p. 118).

It has been suggested that 'dark earth' layers indicate that agricultural cultivation was also taking place within the city walls in the Late Roman period (Yule, 1990, p. 621; Watson, 1998b, p. 103; Hill and Rowsome, 2011, p. 359). 'Dark earth' is a term originally coined in London (Perring and Roskams, 1991, p. 64) to describe the thick layers of unstratified material with a dark colour and soil-like consistency found overlying the latest Roman layers (Yule, 1990; Perring, 1991, pp. 78–81; Perring and Roskams, 1991, pp. 64–5; Watson, 1998b). The term has since been used to describe similar deposits in many Roman towns in Britain and on the Continent (Faulkner, 1994, pp. 103–5; Watson, 1998b, p. 101; Macphail, Galiené and Verhaeghe, 2003; Borderie *et al.*, 2015). In London, tip lines and soil composition have been taken as evidence that 'dark earth' comprised deliberately deposited agricultural soils, which were used to create market gardens and 'farms within the walls' (Sheldon, 1978, p. 40; Yule, 1990, p. 621; Perring and Roskams, 1991, p. 65; Watson, 1998b, p. 102).

However, Yule (1990, p. 625) suggests that the uniform 'truncation' of archaeological layers by 'dark earth' indicates that much of it must have been formed by the in-situ transformation of Late Roman layers into anthropogenic soils. This is supported by soil thin sections indicating that the ‘dark earth’ from St Thomas Street, 15-23 Southwark Street (15SKS80) and 1-12 Rangoon Street (RAG82) was mainly composed of reworked building materials from timber and clay buildings (Macphail, 1980, pp. 7–9). Micromorphological studies suggest that dark earth was created by the in-situ biological reworking of stratified layers, principally by maggot-like *Enchytraeidae* worms, then by roots and earthworms (Yule, 1990, pp. 625–6; Watson, 1998b, p. 103). Cultivation by ploughing is no longer seen as a plausible means by which these layers can have become mixed, as dark earth deposits at Milk Street and 15-23 Southwark Street (15SKS80) sealed well-preserved mosaic and mortar floors, which ploughing would have damaged (Yule, 1990, p. 625).

6.3.2.4 Hoes in Different Area Codes: The Distribution of Agricultural Tools

The distribution of agricultural tools (Figure 73, Figure 72) is unique amongst London’s tools, as the number recovered from within the city is not significantly greater than that recovered from outside it. This may imply, unsurprisingly, that agriculture was more important outside the city itself than within it. A caveat to interpreting this pattern as a reflection of practice is that it is possible that many of the tools from Greater London were deposited as part of votive assemblages, either in major rivers or in hoards (Chapter 7.6).

Very few obvious agricultural tools have good contextual information associating them with local occupation. The majority are unstratified objects found in the Walbrook valley; a fact which probably reflects disposal practice, although a number were found in the Walbrook stream itself, and were possibly votive deposits (Chapter 7.3.5). A possible exception is HOE02, found in an early Roman quarry pit on Cornhill (GWS89). It is possible that this tool was used in cultivation in the area around this feature, which was at the periphery of London at the time. However, we cannot discount the possibility that this object was used in gravel extraction, or was buried here as a votive deposit.

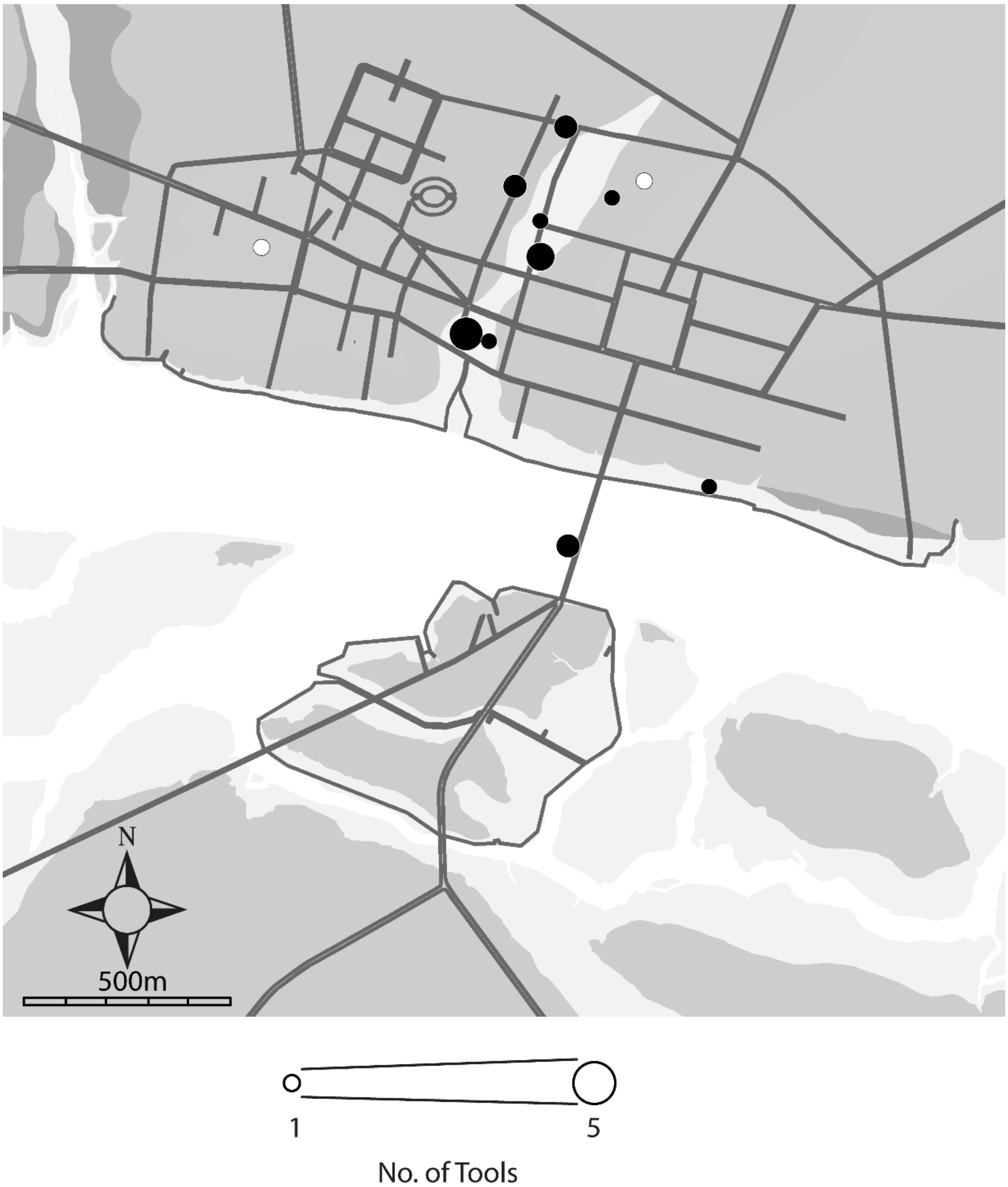


Figure 72 The distribution of agricultural tools in the city of London and Southwark (White dots = sitecodes. Black dots = street addresses, base map ©MOLA).

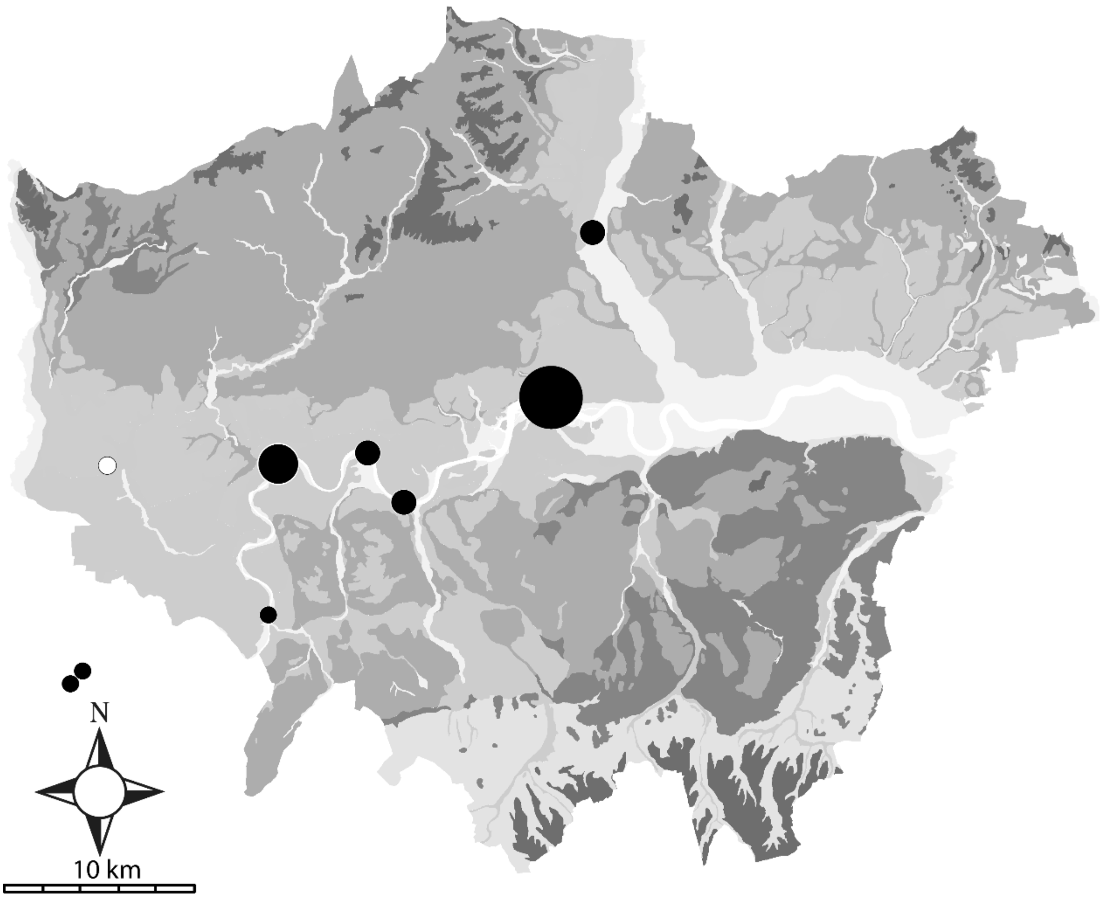


Figure 73 The distribution of agricultural tools in Greater London (base map ©MOLA).

6.3.3 Agricultural and Horticultural Practice in London

6.3.3.1 Cultivation

Small Plot Cultivation

Despite the lack of strong evidence for small plot cultivation in London, a large number of manual cultivation tools have been found. Fifteen spade irons (SPA01-15, Figure 74) come from London. Whilst spades have a variety of uses other than agriculture, the existence of 'spade marks' from fields in the city means that some may have been used in this way. The spades vary in width from 90-225mm, although most complete spade irons are around 200mm wide. This is considerably wider than the majority of the spade marks from Warwick Square. Whilst many of these marks are incomplete, this may suggest that some of these marks were made with spuds or hoes rather than spades.

Figure 74 Spade irons from London (Left, SPA11; right, top-bottom, SPA01, SPA03, SPA05, SPA12).

Thirteen hoes (HOE01-13, Figure 75) were found in London, indicating their widespread use in cultivation. Despite this, no hoe marks have been recorded from London. This may be because hoe marks are less diagnostic than those of spades or ploughs, but it is also possible that some of the features interpreted as being cultivated with spades were in fact cultivated with Type 2 or 5 hoes, as their blades have very similar shapes (Figure 74, Figure 75).

Figure 75 Hoes from London (Top row, left-right; Type 1, HOE01; Type 2, HOE03, HOE02; Type 3, HOE04; Type 4, HOE05, HOE06. Bottom row, left-right; Type 5 (entrenching tool), HOE07; Type 6 (bidens), HOE09, HOE08; Type 7 (antler hoe), HOE17).

All of these hoe types are Roman introductions to Britain, but their uptake varied across the country. Two-tined hoes (Type 6) were used in small towns and 'native' sites, but not military ones (Rees, 1979, p. 311), whilst Type 4 hoes were used on military sites and in towns, but not on 'native' sites or villas (Rees, 1979, p. 310). Type 2 hoes are almost absent from Britain, but two come from London. London is therefore interesting in containing all of these hoe types together. The variety of hoe types found in London may reflect the range of different activities taking place here. Type 6 (two-tined or *bidens*) hoes (HOE08-11) are frequently shown being used by horticulturalists in ancient art (Farrar, 2016, p. 170). Whilst they are usually interpreted as cultivation tools, similar modern tools are used to spread manure, and tools such as this may have been used to manure the small field at Whittington Avenue. Type 4 (*ascia rastrum*) hoes (HOE05 and HOE06) were probably used for weeding and aerating soil (Rees, 1979, p. 310). The fact that they are found in towns and military sites but not villas may suggest their use in cultivating small horticultural plots rather than formal gardens or large fields. Type 2 hoes (HOE02 and HOE03), which have wide spade-like blades, may have been used for the cultivation of larger plots, although it is also possible that they were used for mixing plaster (See p.235).

These tools are also evidence of the range of different groups who influenced the technological landscape of the city. The Type 5 military entrenching tool (HOE07) may indicate the presence of veterans in the city, although we cannot know whether this tool was used for agriculture or not. Type 2 hoes are especially interesting as they are so rare in Britain. They may represent the attempted introduction of Continental agricultural practices to London which did not become popular in the rest of the country. One of these, HOE02, is potentially pre-Boudican in date, although this could not be established with certainty. If small garden plots were used to grow food types introduced in the Roman period, these Continental-type tools may indicate the conscious use of Continental horticultural practices to manage them from an early stage in the city's development.

Field Cultivation

A number of tools from London suggest the cultivation of fields rather than small garden plots. Five pieces of plough furniture were found in the London collections; four ploughshares (PLO01-04) and one coulter (PLO05, Figure 76). Other tools potentially associated with cultivation include 'rake tines' (RAK01-48), which may have been part of harrows rather than rakes. This is considered especially likely for the double-sided type, represented in London by five objects (RAK44-48), but cannot be established with certainty. 'Ox goads' have been taken as evidence of ploughing in the past, but will not be discussed here as their identification is uncertain (Rees, 2011, p. 96).

As we have seen in Chapter 3, the plough has been the subject of immense debate as an ancient technology. The movement from 'scratch ard' to 'heavy' coultered plough has been seen as a key technical achievement of the Roman period, allowing the cultivation of larger fields on a wider range of soil types, without the need for cross-ploughing (Rees, 2011, pp. 90–6). The tools from London support this picture, demonstrating a movement from smaller ploughshares which protect and extend the reach of a wooden share beam in the Iron Age (PLO01-02), to heavier, symmetrical all-iron shares (PLO03-04) in the Roman period, and the introduction of coulters (PLO05), and possibly mouldboards, in the Late Roman period. The increasing size of ploughshares in London (Figure 76) also demonstrates the increased amounts of iron used in agricultural tools in the Roman period (Fowler, 2002, p. 163).

Figure 76 Plough equipment from London (Left, coulter, PLO05; top right, ?Iron Age ploughshare PLO02; bottom right, Roman ploughshare PLO04).

Both PLO01 and PLO02 come from outside the city, and may date to the Iron Age rather than the Roman period. Both PLO03 and PLO04 were found in the Walbrook valley, although neither comes from a stratified context. I would hesitate to use these objects as evidence for the cultivation of fields within the city, however. Ploughing is a seasonal activity, and tools may have been stored away from the farm when not in use. Hoes excavated from the Boscoreale villa were thought to represent out of season tools stored at the main villa complex at the time of the Vesuvian eruption (Harvey, 2010, p. 709). PLO04 is interesting as it appears to be unworn, although the original surface has been lost to corrosion, removing any traces of light wear. This object may indicate that ploughshares, or ploughs themselves, were being manufactured or repaired in London. However, as the forms of PLO03 and PLO04 are unusual in Britain, it is also possible that they were imported to London from the Continent. These tools could also have entered the city for ritual rather than agricultural purposes (see p.135). Whatever their interpretation, these tools do not provide strong evidence for the cultivation of fields within Roman London.

6.3.3.2 Harvesting

Harvesting is represented by 34 sickles and reaping hooks, nine billhooks, seventeen pitchforks and 48 rake tines. The sickles and reaping hooks display a particularly wide range of forms, which may be evidence of a wide variety of practices.

Figure 77 Harvesting tools from London (Top row, left-right; billhooks, BIL01, BIL08, BIL03; sickles, SIC01, SIC05. Bottom row, left-right; reaping hooks, SIC21, SIC17, SIC13, SIC09, SIC20, SIC18; miniature hooks, SIC26, SIC27, SIC29).

The balanced sickles SIC01-05 (Types 1-2) are well suited for cutting and gathering field crops, such as cereals. The large, complete sickle SIC01, from Southwark, could conceivably have been used to harvest crops grown nearby on the mainland south of the Thames. The heavily curved reaping hooks SIC06-20 (Types 3-7) could also have been used for harvesting field crops, although they would have been used with a two-handed gathering method (Rees, 2011, pp.

102–3). Many of the reaping hooks from London seem too small to have been effective reaping tools, however.

Some of these smaller reaping hooks, especially those with forms less specialised for reaping (Types 5-7), may have been used for harvesting vegetables, fruit or flowers, either from cultivated plots or from the wild. This also seems to be the most likely function for the miniature reaping hooks (SIC27-34). No reaping hooks of the *falx vinitoria* type, often sought as an indicator of viticulture (Brown *et al.*, 2001, p. 753), come from London, although unusual Continental types are present (SIC18, SIC24, BEN01). The miniature hook SIC24 and the possible bench knife or reaping knife BEN01 have been tentatively identified elsewhere as vine knives (Hanemann, 2014, pp. 207–8). Whilst it would not be appropriate to attempt to infer the care of any specific crop from these tools alone, it is possible that these likely imported tools represent the importation of Continental plants and harvesting practices.

No scythes were found in London. Scythes would be required for crops which need to be harvested quickly, such as hay, and their absence from London may indicate that these activites were not carried out here. Alternatively, this may represent the recycling of exceptionally large tools in the city. Pitchforks and rakes will also have been used to harvest crops, such as hay, within and around the city, although they have other uses in moving these products for use as thatch or animal bedding. A number of rake tines (Figure 78) from Copthall Court in the upper Walbrook valley may have formed a tool which was wider than, and with more slender teeth than, a normal Roman rake. Such a tool may have been used as a hay rake, although it was also possibly a harrow. Hay harvesting has particularly strong time constraints, and is usually only practiced in a two-day window in mid-summer. Lodwick (2014, p. 211) therefore sees hay harvesting as a key annual activity to bring dispersed social groups, perhaps kin groups, together. However, in London it is probable that the setting aside and maintenance of land within the city necessitated a degree of official involvement.

Figure 78 Rake tines from Copthall Court (RAK23-34, 36-9).

The billhooks from London may represent a wide variety of activities, including pruning trees, cutting coppiced wood, or woodland crafts. None of these tools come from the city of London itself, however. A number of spuds may have been used in cutting bark, and may also belong to this suite of woodland harvesting tools.

6.3.3.3 Garden Maintenance

A number of tools from London could have been used in the maintenance of formal gardens, although none of these tools are exclusive to that task. No excavated plant trimmings have been closely studied for evidence of how they were cut (Lodwick, 2017), but this is presumed to have been primarily carried out with shears. The larger shears from London (e.g. SHE01-02) could have been used to trim hedges, as could many of the pruning hooks. These small hooks may also have been used to graft and prune tress as part of their cultivation and propagation (Brown *et al.*, 2001, p. 753). The serrated knives from London (SAW16-SAW23), often referred to as pruning saws, could have been used to tend to small trees and plants, although a more general domestic interpretation is favoured here (see p.563). None of the other saws from London are obviously designed for use in pruning trees, although many could have been used in this way.

Iron-tined rakes may have been used to keep gravel surfaces and pathways neat (Duvauchelle, 1990, p. 45); a suggestion supported by the fact that RAK39 was found in a 3rd century gravel surface, which was possibly part of a large public precinct. Spuds may also have been used to neaten the edges of cultivated garden plots, or to weed small areas, as might the small spade shoe SPA01. The spud SPU01 is considerably earlier than other examples of this type in Britain, and may indicate a form of gardening taking place in London in the late 1st century, although it was found in a dumped context.

6.3.4 Discussion

The agricultural tools from London are challenging to interpret. Very few can be unambiguously tied to agriculture, rather than other urban tasks such as gathering thatch or clearing straw from house floors. Nevertheless, the sizeable number of agricultural tools, coupled with other evidence from the city, shows that plants were being grown in London for a variety of reasons.

There is very little evidence for professionally-maintained formal gardens in London, although elements of these gardens, such as gravelled paths, box hedges and stone pines, may have been present. Cultivation for food production was therefore perhaps more important. From the earliest days of the city, farms were set up in areas so close to London that they were later subsumed by it.

A wide variety of cultivation tools were used, including ploughs, hoes and spades of different types. As well as indicating agriculture at a range of scales, these may indicate the presence of a wide range of social groups in London, as these tools are not often found on the same settlement types. It is also noticeable that a number of Continental tool types, which are rare elsewhere in Britain, are found in London. These will have allowed new agricultural technologies to be practiced, such as cultivation with broad-bladed hoes. The small size of most of the harvesting tools from London suggests that fruits, vegetables and flowers may have been more important crops than cereals. These may have been grown in newly-introduced horticultural plots, and could have included newly imported species. In these ways, urban agriculture in London may have been a key way of maintaining a new way of life through modified foodways.

The agricultural tools from London are distributed more widely than other craft tool types, although disposal practices obscure the degree to which these can be related to practice. It is nevertheless the case that a number come from central London. Merrifield (1983, p. 100) suggests that some of these tools were used 'by men who may have lived in Londinium but gained their livelihood from the countryside, a form of commuting still familiar in Italy'. The existence of fields in the near vicinity of London means that this is likely to have been the case for some of these tools. However, others may have been manufactured here, or entered the city as trade items, rather than used here. Involvement in farming by Londoners will have extended beyond physically working in the fields, and several writing tablets show that Londoners had business interests in farmland (Bird, 2000, p. 157). One from Bloomberg London (BZY10, <WT50>), dated to AD 64, details the collection of payments, possibly of rent, from a farm in an unknown location by the slave of a Roman citizen (Tomlin, 2016, p. 168). Another, from 19 Throgmorton Avenue (TRM86), dated to the 14th of March 118 AD, relates to the ownership of a piece of woodland in Kent (Hassall and Tomlin, 1994, p. 302). Perhaps some of these rural holdings were stocked with tools purchased in or distributed from London. The range of tools available in London certainly seems to have been more diverse than elsewhere in Britain.

6.4 Metalwork

> '*The hammer from the fire, with the pliers and tongs, is consecrated to thee, Hephaestus, the gift of Polycrates, with which often beating on his anvil he gained substance for his children, driving away doleful poverty*.' (*Greek Anthology*, 6.117)

Metalworking in London is evidenced by 119 tools, the third largest group from the city. This includes anvils, hot and cold chisels and punches, dies, engraving tools, chasing and repoussé punches, files, hammers, hearth management tools, soldering irons, scribers and tongs. These tools are evidence of a range of metalworking practices. This section will examine whether it is possible to identify different working practices and professions based on the activities indicated by these tools.

6.4.1 Metals in the Roman World

A wide variety of metals were worked in the Roman period. The most important were iron, copper, lead, tin, silver, gold, and their alloys. Giving names to these alloys is a tricky subject. Today, the proportions of different metals in an alloy can be established with certainty using scientific methods, but there is a growing appreciation that ancient societies experienced metal alloys in a different way, informed by experience and practice rather than empirical measurement (Welton, 2016). Copper can be alloyed with lead, zinc and tin to produce a range of alloys (Figure 79), mostly known as brass or bronze, although it is now common practice to refer to these collectively as 'copper alloys' due to the variable contents of Roman metalwork (Bayley, 2017, p. 336). Mixtures of tin and lead are usually referred to as pewter, although this covers a wide range of metal compositions ranging from pure tin to mostly lead, and sometimes including small amounts of copper (Beagrie, 1989, pp. 169–70). Alloys of gold and silver, which may be naturally occurring or man-made, are referred to as electrum (Strong, 1966, p. 1).

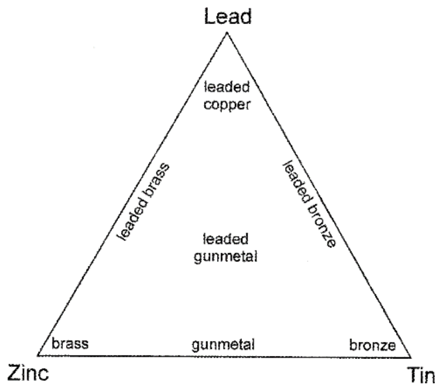


Figure 79 The names conventionally used for different copper alloys (Bayley, 2017, fig. 15.3).

Although usually containing a number of other trace elements, iron is generally categorised based on its carbon content, and is not alloyed with other metals. 'Wrought iron' has a low (< 0.05%) carbon content, and is the most malleable. Iron with a higher carbon content (0.05 - 1.7%), known as steel, is harder than iron, but more brittle, and can be created in a number of different ways. Iron with a higher carbon content (> 2%), known as 'cast iron', was only accidentally produced in small quantities in the Roman period (Tylecote, 1976, pp. 53–8; France-Lanord, 1980, pp. 46–50).

The expansion of the consumption of metalwork is one of the key changes brought about in Britain after the Roman conquest. Although the major tools and technologies of metalworking had been long established, and were little changed by the conquest, the Roman period saw a significant increase in the scale of the production of metal objects of all types (Manning, 1976b, p. 1; Bayley, 2017, p. 337; Scott, 2017, p. 315). The period saw the introduction of new metal artefacts (Scott, 2017, p. 315), moving away from the previously restricted suite of prestige items produced in the Iron Age (Manning, 1976b, p. 1). Suggested reasons for this include demand stimulated by the army, or consumer demands fuelled by new tastes from Gaul (Scott, 2017, p. 321). Whatever the cause, this expansion of metalworking industries will have meant that the metalworkers of Roman London inhabited a very different social and economic landscape to any of their British predecessors.

6.4.2 Metalworkers in Roman Britain

Professional metalworkers (smiths) have long been a figure of interest to those studying metal objects. However, 'metalworking' covers a wide variety of potential tasks, and it is worth considering the extent to which these craftsmen constituted a homogenous group. Some professions may have been defined by the working of particular metals. An inscription from Malton, North Yorkshire (*RIB* 712), refers to a goldsmith's shop (*tabernam aureficinam*) (Johns, 1996, p. 188; Henig, 2012, p. 124), whilst plaques from Colchester (*RIB* 194) and Foss Dike (*RIB* 274) record coppersmiths (*aerarius*). However, although ironworkers (blacksmiths) and non-ferrous metalworkers are often separated in archaeological literature, the evidence from London suggests that iron and copper alloy were usually worked by the same people (Merrifield, 1983, p. 102, see below). The variable quality of Roman metalwork, and the wide range of objects produced, suggests that 'metalworkers' were a broad group, ranging from professional smiths to DIY amateurs (Bayley, 2017, p. 343; Scott, 2017, pp. 320–1). In addition to these groups would have been slaves, whose skills and working conditions could have varied wildly (Strong, 1966, pp. 15–6; Hammer, 2003, p. 15). Smithing waste from rural settlements in south-eastern Britain (below), suggests that in the countryside, small-scale, possibly part-time smiths may have manufactured and repaired objects purely to satisfy local demand. Stamped objects indicate the existence of specialised workshops, probably in towns, which could have made only one item type for a wide market (Scott, 2017, p. 316). These specialists could have included European immigrants (Scott, 2017, pp. 320–1). On the Continent, inscriptions attest to the existence of extremely specialised professions, including silver polishers (*tritor argentarius*, *CIL* iv, 9950), casters (*flaturarius*, *CIL* vi, 9418) and leaf gilders (*brattiarii inauratores*, *CIL* vi, 95) (Strong, 1966, pp. 15–6).

Little is known about the training of civilian smiths in Britain, although it is presumed to have been based upon a form of apprenticeship (Sim and Ridge, 2002, p. 53). A contract from Egypt gives the terms of an apprentice nail smith, whose labour was taken as payment for the cost of teaching, and to cover the interest on a loan given by the master smith (Westermann, 1914, p. 300). Apprenticeships may have started at an early age; a tombstone in Rome (*CIL* 9437) commemorates a slave named *Pagus*, a skilled goldworker and gem setter who died at 'twelve years, nine months, thirteen days and eight hours' old (Johns, 1996, p. 188). Smiths may also have been part of dedicated craft guilds (*collegia*). We know of guilds of blacksmiths (*CIL*, vi 1892), silversmiths, and leaf gilders (Strong, 1966, p. 16). A guild of blacksmiths in Rome had a high magistrate amongst its members (Sim and Ridge, 2002, p. 53). A smith's guild is perhaps evidenced in Britain by an inscription from Chichester (*RIB* 91) erected by a *collegium fabrorum*, although the interpretation of this inscription is disputed (Scott, 2017, p. 315). Another from Bath (*RIB* 156) records a member of a guild of armourers (*collegio fabricensium*).

Military smiths may have constituted a separate group. Military *fabricae* were presumably mostly staffed by regular soldiers working under the direction of *immunes* (soldiers with craft training who were immune from some regular duties) (Sim and Ridge, 2002, p. 64; Bishop and Coulston, 2006, p. 236), but workforces could potentially be extremely diverse. Military *fabricae* could be quite large, with a tablet from Vindolanda (Tab. Vindol. 1, 155) recording 343 men working on one day (Bishop, 1985, p. 3; Bishop and Coulston, 2006, p. 236). A 2nd or 3rd century papyrus document from Egypt, detailing the activities over two days in a legionary *fabrica*, records a workforce which included '*immunes*, *cohortales* (presumably auxiliary soldiers), *galliarii* (camp servants), and even civilians (with guards)' (Bishop, 1985, p. 3; Bishop and Coulston, 2006, p. 236). The extent to which military and civilian craft traditions overlapped is unknown. Some soldiers may have been assigned duties based on craft education they had received in their civilian lives. It is also widely presumed that retired military smiths would have set up workshops in civilian settlements (Scott, 2017, p. 322).

Permanent metalworking workshops have been excavated in Roman towns and cities (Hammer, 2003, p. 15; Bayley, 2017, pp. 341–2; Scott, 2017, p. 320), and metalworking evidence has also been found on villas and in larger rural settlements (Bayley, 2017, p. 342; Scott, 2017, pp. 319–20). Other types of metalwork, such as iron- and lead-working related to construction, are presumed to have taken place alongside building work, although the direct evidence for this is slight (Bayley, 2001, p. 76). Jewellers and statuette makers are thought to have been itinerant, travelling to fulfil commissions or to garner new work (Henig, 2012, pp. 123–4).

Some workshops may have employed multiple smiths. An inscription from Rome (*CIL* vi, 9391) records a workshop with five freedmen silversmiths working for a man named *Junius* (Strong, 1966, p. 15). A relief from Rome shows the smith god Hephaestus seated, guiding the work of assistants with sledgehammers (Sim and Ridge, 2002, fig. 11), as does a fresco from the Casa delle Quadrighe (Naples Museum No. 9531, Figure 80). Graffiti from the Catacomb of Domitilla, Rome (Manning, 1976b, fig. 4), and a relief from Aquileia (Sim and Ridge, 2002, fig. 9) both show a smith working at an anvil with an assistant working the bellows of a forge. Lower-skilled assistants could manage fires, work on simple objects, or work under the supervision of a smith, allowing the smith to have multiple artefacts produced at once (Sim and Ridge, 2002, figs 55-6). Statuettes, however, are always signed by only one person, possibly indicating that those who made them worked alone (Henig, 2012, p. 123).

Figure 80 Fresco from the Cassa delle Quadrighe, showing the smith god Hephaestus assisted by two strikers (http://images.fineartamerica.com/images-medium-large/forge-of-hephaistos-roman-fresco-

6.4.2.3 Ritual and Social Aspects of Metalworking

A number of depictions of smiths are known from Britain (Figure 81, Figure 99). A tombstone showing a smith comes from York (Scott, 2017, p. 315). Boots and tools on a stone screen from London may be from a depiction of Vulcan (Henig, 2002, p. 116). Smith gods are also depicted on pottery (Leach, 1962), on gold and silver plaques (Henig, 2002, p. 116), and in five bronze figurines of Vulcan and one of Sucellus known from Britain (Durham, 2010, Pl. 164, 166-70). These depictions are universally formulaic, showing a bearded man, often wearing a pointed *pileus* cap and a short sleeveless tunic covering one shoulder only (Manning, 1976b, p. 6; Sim and Ridge, 2002, pp. 54–5; Durham, 2010, p. 58). This is the costume worn by most smiths in Roman period depictions (Sim and Ridge, 2002, pp. 54–5). The Vulcan figurine from Richborough is unusual in being nude except for the cap (Durham, 2010, Pl. 170). Where the attributes survive, these figures are usually shown holding a hammer and tongs over a block anvil.

Figure 81 Images of smiths and smith gods from Britain. Top left, pottery applique from Corbridge (Leach, 1962, fig. 1). *Top right, tombstone from York (https://www.yorkmuseumstrust.org.uk/collections/search/item/?id=1084&search_query=bGltaXQ9MTYmRk49JTJBJkdnPVJvbWFuJnBhZ2U9OA%3D%3D). Bottom left, Silver plaque from Barkway (https://romaninscriptionsofbritain.org/inscriptions/220). Bottom right, figurine from Catterick* (Henig, 2002, Pl. 97).

How much these depictions say about working people in Britain is uncertain, however, as the majority depict smith gods rather than mortal smiths. The costume shown in these depictions

Figure 82 Statuette, possibly of Sucellus, from Southbroom (http://www.britishmuseum.org/research/collection_online/collection_object_details/collection_image_gallery.aspx?partid=1&assetid=19386001&objectid=1364349).

has been suggested to be the attire of both smith gods and mortal smiths (Manning, 1976b, p. 6; Sim and Ridge, 2002, pp. 54–5). An obvious drawback of this tunic would be that it left the user vulnerable to burns from sparks, although Sim (Sim and Ridge, 2002, p. 55) more optimistically remarked that it could be considered 'a cool style of dress in what must have been a hot environment', whilst also observing that 'being burnt is just part of the job!' A different type of tunic is seen on images of the Gallic hammer god Sucellus, which possibly includes a protective leather jacket (Durham, 2010, p. 343). This could be considered a more appropriate garment for smithing in, although only one depiction of Sucellus is known from Britain (Durham, 2010, Pl. 164). A uniform such as this may have served to mark professional identity, and could have been an important way to express craft skill or masculine gender identity. Nevertheless, the formulaic nature of these depictions means that it cannot be known whether the costume is a true representation of the attire of a smith, or simply a well-established artistic convention.

This is not to diminish the potential role of social rules and beliefs in restricting participation in, and informing perceptions of, metalworking industries. Recent archaeological studies of prehistoric and medieval metalworking (Budd and Taylor, 1995; Hingley, 1997; Aldhouse-Green, 2002; Bergstøl, 2002; Schrüfer-Kolb, 2004, p. 110; Haaland, 2006; Giles, 2007) have been strongly influenced by ethnographic studies of African metalworking traditions (Njoku, 1991; Herbert, 1993; Bekaert, 1998), which highlight the ritualised and social aspects of craft. Njoku (1991, p. 198), for example, has highlighted the need for ritual purity in smelting in pre-colonial Igboland, Southern Nigeria. Participants must not have spilt blood or had sex the previous night, whilst some operations could only be carried out by virgin children. The tools involved must have been purified in a shrine beforehand. Every stage of the smelt was accompanied by rituals (meals, sacrifices, dances), and the whole operation was linked with community fertility; participating women increased their own fertility, whilst a failed smelt was treated like the death of a child, and was potentially the cause for community disaster. Whilst Hammer (2003, pp. 14–3) saw the Iron Age-Roman transition as a time which changed 'the role of smiths, from being the mediators of material and mystical strength to being merely utilitarian craftsmen', the ample evidence for religion and superstition based around metalworking in the Roman period makes this position untenable (e.g. Halkon, 2014).

Ironmaking and ironworking have been seen as particularly strongly associated with ritual and mysticism (Scott, 2017, p. 301), although there is no direct evidence for traditions similar to those observed in Africa in Roman Britain (Schrüfer-Kolb, 2004, pp. 110–2). Iron may have been perceived as manifesting the dual properties of creation and destruction. Iron was used to make weapons, and had to be avoided when gathering certain herbs (Hingley, 1997, p. 14; Aldhouse-Green, 2002, pp. 9–10; Giles, 2007, pp. 403–5). However, iron was also used to make agricultural tools, and iron objects form essential parts of some Roman healing rituals (Hingley, 1997, p. 14, 2006, pp. 216–8). This association between iron and healing may have had a long life, continuing in the early modern belief in the healing properties of quenching water (Merrifield, 1987, p. 29; Hammer, 2003, p. 16). Metals could also gain importance based on their provenance. There is evidence that some objects in hoards were selected based on whether they were smelted by Roman or native smiths (Hutcheson, 1997, p. 71).

The Classical gods most closely associated with smithing include Vulcan, 'the ancient Italians' god of fire', and Hephaistos, 'the Olympian god of fire and smithing… son of Zeus and Aphrodite' (Hammer, 2003, p. 14). An Iron Age god, Sucellus, known as the striker or mallet god (Dennis, 1978, p. 306; Hammer, 2003, p. 14), also seems to have been known in Britain (Durham, 2010, pp. 57–8), whilst the classical Mercury, Minerva, Mars and Mithras may have been associated with ironworking through their associations with trade and warfare (Schrüfer-Kolb, 2004, p. 111). Jupiter may also have been associated with metalworking or craft in some way, as evidenced by the appearance of statuary in hoards of ironwork from Seltz (Schaeffer, 1927) and Mauer an der Url (Noll, 1976), and the appearance of wheels (a symbol of Jupiter/Taranis) on smith pots (Leach, 1962, p. 42), sceptre bindings (Green, 1986, p. 54) and in ironwork hoards (Humphreys, 2017a, p. 400). Pliny (*The Natural History*, 7.57) considered ironworking to have been invented by the Cyclopes.

Some of this importance appears to have been attached to specific metalworking tools. Hammers, anvils and tongs appear on unusual pottery vessels (Leach, 1962; Braithwaite, 1984; Didsbury, 1984; Halkon, 1992), and a on ritual binding from Farley Heath temple (Green, 1986, p. 54; Scott, 2017, p. 302), where they may be stand-ins for depictions of smith gods. Pliny (*The Natural History*, 7.57) records these tools as having been invented by Cinyra, the son of Agriopas, who also invented tiles and discovered copper mines on Cyprus. Metalworking tools

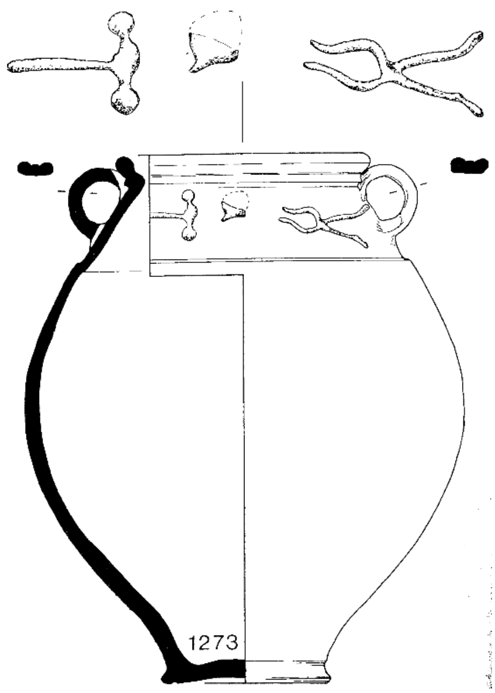


Figure 83 Pot decorated with smith's hammer, anvil and tongs, from Southwark (G. Dennis, 1978, fig. 166, 1273).

are also found in ironwork hoards (Humphreys, 2017a), whilst the *Greek Anthology* (6.92, 117) records the dedication of a smiths' tools to Hermes and Hephaestus.

Religious rituals invoking the symbolism of metalworking certainly took place in London. A pot with piped smith's tools on the neck was deposited in a late 2nd century well (F30), along with dog skeletons and other pottery vessels, at St Thomas Street, Southwark (Figure 83). This object is thought to have been part of a ritual deposit associated with a smith god, perhaps Sucellus (Dennis, 1978, pp. 303, 306), and may be related to the contemporary ironworking industry in Southwark. A similar deposit, involving a 'smith pot' buried with a dog, comes from a foundation deposit under a tower at Chester-le-Street (Braithwaite, 1984, p. 125). Another ritual deposit from London potentially related to metalworking was found at Bucklersbury House in 1956 (Figure 84). Here, a face pot (a type of vessel closely related to smith pots (Braithwaite, 1984; Halkon, 1992)) was found 'surrounded by lumps of flint and iron rust' over a burnt wooden screen (Wilmott, 1991, pp. 28–30).

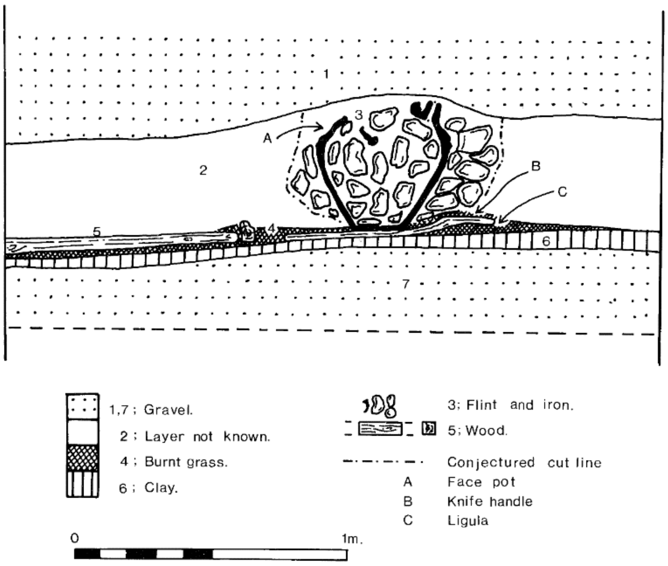


Figure 84 Section of burnt feature containing a face pot at Bucklersbury House (Wilmott, 1991, fig. 16).

6.4.3 Metal Supply to London

6.4.3.1 Metal Sources

London is not rich in metal ores, and only iron ore is found in quantity in the southeast of Britain (Bayley, 2017, p. 330). The metals worked in London will therefore have come from a variety of external sources. The most abundantly used metal, copper, was mined in Cornwall, north Wales, Cheshire, and perhaps the Lake District and Shropshire (Hammer, 2003, p. 167). Tin is abundant in Cornwall and Devon (Hammer, 2003, p. 167; Bayley, 2017, pp. 330–1). Lead and silver occur together in the same ore, galena (Strong, 1966, pp. 3–4), although the silver content of British lead ores is low (Sherlock, 1978, p. 12). Galena was exploited in the Mendips, Welsh Borders, Derbyshire and the north Pennines (Bayley, 2017, pp. 330–1), with the lead ingots from Regis House (KWS94) probably deriving from the area around the excavated mines at Charterhouse on Mendip (Hammer, 2003, p. 167; Todd, 2007). Zinc may also have been mined in the Mendips (Todd, 2007, p. 66), although it is still widely thought that zinc was not used in a pure form in antiquity (Brown, 1976, p. 26; Bayley, 2017, p. 338). Only one Roman gold mine is known from Britain, at Dolaucothi, Carmarthenshire, where a series of shafts and open cast mines have been excavated (Burnham, 1997; Dennis and Ward, 2001, p. 117; Burnham and Burnham, 2004).

Iron ores occur across most of Britain, although the degree to which they were exploited is not known for certain. Most iron appears to have been produced in industrial areas in the Weald (Cleere, 1976, p. 127; Cleere and Crossley, 1985; Clough, 1992; Hodgkinson, 2009, 2017), Forest of Dean, the Midlands (Condron, 1997; Schrüfer-Kolb, 2004), and Exeter (Bray, 2006). Most of London's iron is thought to have been supplied from the Weald (Cleere and Crossley, 1985, pp. 82–3; Hodgkinson, 2009, p. 34, 2017, p. 296). Iron production here goes back potentially as far as the 6th century BC, but increased in scale after the conquest (Hodgkinson, 2017, pp. 282–3). Whilst earlier models saw the Roman conquest as a period of rapid change in smelting technology (Manning, 1976b, p. 1), it is now accepted that there was significant continuity and development of smelting technologies already practiced in the Weald in the late Iron Age (Clough, 1992, p. 184; Paynter, 2007; Hodgkinson, 2009, p. 30, 2017, p. 284). The level of production at different sites in the Weald varied considerably, with the largest sites producing 3,000 times more than the smallest. These are likely to have been seasonal satellite operations around larger sites where the majority of iron was produced (Cleere, 1976, pp. 139–40; Hodgkinson, 2009, pp. 30–2). Ironmaking appears to have been disrupted in the 3rd century, with many Wealden sites ceasing production (Cleere and Crossley, 1985, p. 84; Scott, 2017, p. 322), although Southwark appears to have continued to be well supplied with blooms into the 4th century (Hodgkinson, 2017, p. 297). Production after this point may have shifted from dedicated industrial sites to villas and rural settlements (Hammer, 2003, p. 166; Scott, 2017, p. 322).

6.4.3.2 Metal Production and Trade

Most metals are mined as ores; that is rocks containing significant quantities of desirable minerals. Ores must pass through several stages of processing, including extraction, preparation (roasting and cleaning), smelting, and bloomsmithing or casting, before a useable material is produced (Sim and Ridge, 2002, p. 19). In the Roman period, iron ore was smelted using low-temperature furnaces (Manning, 1976b, p. 1). These produced iron 'blooms'; spongy masses of iron and slag which have to be consolidated by hammering together into wrought iron billets (Manning, 1976b, p. 1), or occasionally directly into finished items (Bray, 2006, p. 182). Cast iron, which runs from the furnace as a liquid, was not produced until the middle ages (Cleere, 1976, p. 129). Non-ferrous metals could be cast, however. Gold is rather different from the other metals, as it can be extracted as nuggets or flakes without the need for ore smelting. 'Native' gold often exists as an alloy of gold and silver, with lower quantities of copper and iron (Strong, 1966, p. 1).

There is no evidence of iron smelting having taken place in London (Keys, 2002, p. 241; Starley, 2003, p. 140; Hodgkinson, 2009, p. 34). Instead, semi-finished iron blooms are thought to have been brought in by road or river from the closest major smelting area, the Weald. Non-ferrous metals were also traded as ingots rather than as unprocessed ore (Bayley, 2017, pp. 331–2). Ingots from London include a number of copper alloy bars and a lead ingot from 60-63 Fenchurch Street (Andrews and Schuster, 2009, p. 87), three 1st century lead ingots with stamps of Vespasian found under the floor of a warehouse at Regis House (Hassall and Tomlin, 1996, pp. 446–8; Wardle, 1998, p. 87; Hammer, 2003, p. 167), 4th century pewter ingots found on the Thames foreshore at Battersea (Hall, 2014a; Bayley, 2017, p. 332), and a 4th century silver ingot from the Tower of London (Hall and Merrifield, 1986, fig. 37). A hoard containing a number of late 4th century gold bars was discovered under a mosaic at the Bank of England, with stamps indicating that they originated in *Sirmium*, modern Serbia (Bank fo England Museum).

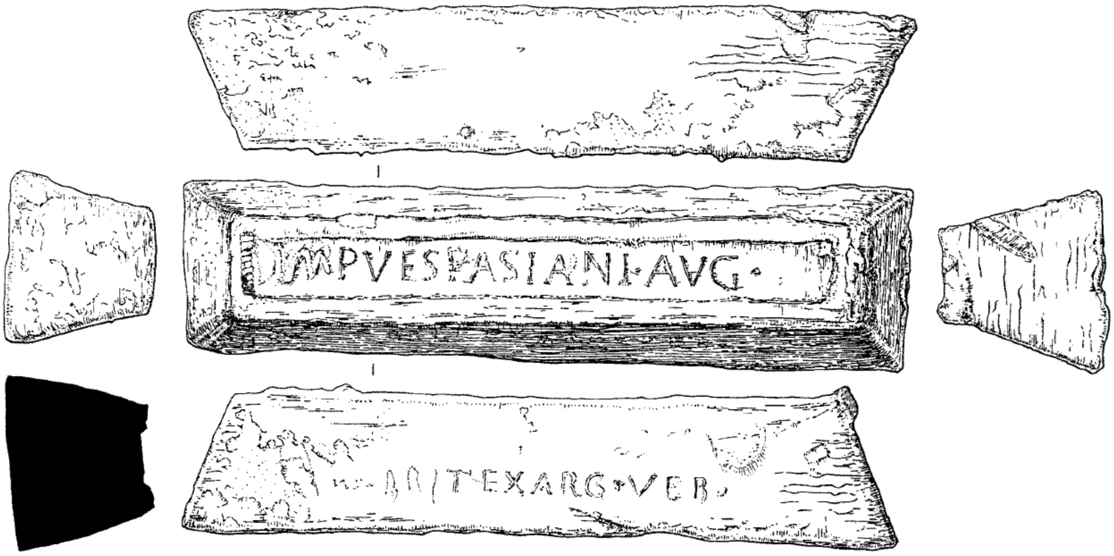


Figure 85 Lead ingot from Regis House, London. The text on the top reads 'IMP VESPASIANI AVG' – '(Property) of the Emperor Vespasian'. The secondary stamp on the side reads 'BRIT EX ARG VEB' – 'British lead from lead from the Veb(…) lead-silver works' (Hassall and Tomlin, 1996, fig. 5).

There is little evidence for the mixing of alloys in London, suggesting that ingots of particular alloys were manufactured at source (Hammer, 2003, p. 167), although the evidence for this is sometimes ambiguous. Litharge cakes from areas of lead extraction suggest that silver and lead were being separated at source (Bayley, 2001, p. 76), but Roman lead ingots from Britain have very variable levels of lead and silver. It is unclear whether those with a high percentage of silver represent mixed metals awaiting separation, poorly refined lead, or deliberate mixes of metals. A lid from a brass-making crucible found in Paternoster Square indicates that some degree of alloying did take place here (Bayley, 2006, 2017, p. 338).

Metals would therefore have to move great distances in order to be used in London. Whilst this is suggested to have been by river and sea rather than over land (Hammer, 2003, p. 167), the siting of the Charterhouse mine and the presence of ingots in inland towns suggests that metals were also moved by road. The discovery of pairs of ingots possibly indicates that they were moved by pack mule (Todd, 2007, pp. 67–8), although the ingots from the waterfront warehouse at Regis House are better explained as objects transported by river (Hassall and Tomlin, 1996, pp. 446–8; Wardle, 1998, p. 87; Hammer, 2003, p. 167). Iron may have entered London by road through the metalworking areas of Southwark (Cleere and Crossley, 1985, pp. 82–3; Hodgkinson, 2009, p. 34, 2017, p. 296). The act of acquiring metals in London would have created and maintained links between London's traders and metalworkers and the imperial administration, the military, civilian smelters, traders, and *collegia*. The cross-channel operations of the *Classis Britannica* would allow these connections to have unusually long reach. The act of acquiring metals can therefore be seen as a key mechanism for the movement of ideas and objects across southern Britain and into Continental Europe.

Not all metal used in metalwork was newly smelted, however. Recycling became increasingly common throughout the Roman period, with old objects becoming a key source of copper alloy (Hammer, 2003, p. 167) and perhaps iron (Hammer, 2003, p. 166; Scott, 2017, p. 322). The cupelation vessels found at Governors House may suggest that old gold was being refined in London (Dennis and Ward, 2001, p. 119). Another major source of metal, especially precious metal, would be coinage. Classical texts suggest that it was common for people commissioning gold jewellery to supply the correct weight of gold in the form of coins (Ogden, 1991).

6.4.3.3 Metal Producers

The extraction of metals in Britain seems to have involved a greater degree of official control than is evidenced in other industries. Newly minted precious metals may only have been available through official channels (Hobbs, 2016, p. 265), and this may sometimes have also been the case for base metals. However, there is evidence for change in the groups involved in producing metals in Britain throughout the Roman period.

Gold is thought to have only been extracted under official control (Dennis and Ward, 2001, p. 119). The gold mine at Dolaucothi was associated with a fort in its early stages (Burnham and Burnham, 2004). Extraction here used hydraulic mining techniques also employed in Spain, suggesting the involvement of soldiers brought in from that region (Todd, 2007, p. 78), although it is supposed that slaves or convicts were also used (Wacher, 1978, p. 92). However, mining here was short lived. The decline of these gold mines at the same time as mines were opened in Dacia suggests that the mines were operated under direct Imperial control, and closed as a matter of imperial policy (Todd, 2007, p. 78). Although worked in the pre-Roman Iron Age, the construction of a small 'fortlet' near the Charterhouse lead-silver and zinc mine in c.49 AD (Todd, 2007, pp. 65–6) indicates that this mine also came under official control at an early date in the Roman period. This 'fortlet' appears to have been used as a processing area rather than a garrison, with animal bones and pottery indicating a well-fed military workforce (Todd, 2007, pp. 65–6). The fort was abandoned in the late Flavian period, perhaps indicating that the state lost interest when the high silver-content surface ore had been mined (Todd, 2007, pp. 77–8).

Whilst there is generally little evidence of direct state or military control of iron production in Britain (Manning, 1976b, p. 6; Schrüfer-Kolb, 2004, p. 103; although see Young, 2014), the Weald is a notable exception. Stamped tiles indicate military control of production in the eastern Weald by the *Classis Britannica* (Cleere and Crossley, 1985, p. 65; Hodgkinson, 2017, p.

290). The closing of sites in the eastern Weald in the early 3rd century, when the *Classis Britannica* disappears from records (Cleere and Crossley, 1985, p. 84), also suggests direct working by the military (Cleere and Crossley, 1985, pp. 67–8). It has also been argued that the entire area was an Imperial Estate (Cleere and Crossley, 1985, pp. 67–8; Hodgkinson, 2017, p. 298), either inherited as an organised entity from pre-Roman rulers or created after the conquest. Other ironmaking areas may also have been under direct military or state control, but this is disputed (Schrüfer-Kolb, 2004, pp. 104–5). Recently, a 3rd century iron ingot was found at Vindolanda (Figure 86), possibly inscribed with the name of a Centurion, suggesting military involvement in some aspect of production. Several copper bun ingots with official stamps have been found in north Wales (Hammer, 2003, p. 167), again indicating a degree of official control.


Figure 86 Iron ingot from Vindolanda. The inscription possibly reads ƆIVLIS/ EVRIA (century of Julius Sev(e)ria(nus)) (http://www.vindolanda.com/_blog/excavation/post/iron-ingot-text/).

Some metal extraction was also carried out by civilians, however. After military control ended, the Charterhouse lead-silver mines were leased to wealthy citizens, many of them apparently immigrants (Todd, 2007, p. 69). A tombstone at Charterhouse is dedicated to a man from Rome (Todd, 2007, p. 69). A number of these lessees are known from stamps on ingots. *C. Nipius Ascanius*, possibly the relative of an Imperial procurator in Rome or an equestrian commander in Pannonia, marked lead ingots from both the Mendips and Flintshire from AD 60, whilst *Ti. Claudius Triferna* operated in the Mendips and Derbyshire in Vespasianic period (Todd, 2007, p. 69). *C. Publius C.* operated in league with an association known as *'Novaec Societas'* (Todd, 2007, p. 69). In the 3rd and 4th centuries, an increasing variation in lead ingot sizes suggests further change, with exploitation perhaps being controlled by individual entrepreneurs (Todd, 2007, p. 71). In the western Weald land may also have been leased to civilian *conductores* or *collegii* (Cleere and Crossley, 1985, pp. 67–8; Hammer, 2003, p. 166; Schrüfer-Kolb, 2004, pp. 104–5), or controlled through taxation rather than directly, especially in the Late Roman period (Manning, 1976b, p. 6; Schrüfer-Kolb, 2004, pp. 104–5).

The overlapping seasonal requirements of smelting and agriculture mean that those involved with ore extraction and smelting are likely to have been specialists rather than part-time farmers, although seasonal work is not impossible (Schrüfer-Kolb, 2004, p. 101). Metal production is thought to have been a male gendered industry (Schrüfer-Kolb, 2004, p. 102), but this deserves questioning. The capacity of women for the physical labour involved in mining is beyond question; women and children worked in mines in early industrial Britain until the Mines and Collieries Act (1842) restricted them to surface processing work, and women and children are recorded in mines in 1st century BC Egypt (Schrüfer-Kolb, 2004, p. 110). Ethnographic literature highlights how industrial tasks, such as ore processing, can be seen in terms which equate them to female gendered tasks, such as grain processing (Giles, 2007, pp. 400–1). Women, children and the elderly may also have been involved in 'invisible' service roles (Schrüfer-Kolb, 2004, p. 102) or supervision (Cleere and Crossley, 1985, p. 75), and would perhaps have moved through different roles throughout their lives.

The ironmaking industry was particularly looked down upon by Pliny (*The Natural History*, 33.1, 34.39) as greedy, intrusive and symptomatic of man's desire to kill rather than heal (Schrüfer-Kolb, 2004, p. 105). Mining itself was seen as a potential cause of earthquakes. Nevertheless, the ability of workers to band into *collegia* and gradually develop their settlements over time demonstrates that they were by no means social outcasts (Schrüfer-Kolb, 2004, p. 106), and this derogatory view of ironmaking may not have been shared throughout Roman society.

6.4.4 Fuel Supply to London

Metalworking is a high-temperature industry that requires large amounts of fuel for hearths. Experiments indicate that a blacksmith could consume 30-50kg of charcoal, or 15-20kg of coal, in a ten-hour working day (Sim, 2003, p. 22). Wood could have been used as kindling to start fires, but charcoal and coal would have fuelled the forge itself (Sim, 2003, p. 22).

Charcoal was the main source of fuel used in London's metalworking centre in Southwark (Starley, 2003, p. 140). Charcoal is obtained by burning wood in a low oxygen environment (Sim and Ridge, 2002, p. 35). It could have been produced by the smiths themselves by burning logs at the back of the hearth (Sim, 2003, p. 22), although in the medieval and early modern periods charcoal was also made by itinerant charcoal burners in larger quantities at temporary clamps (Sim and Ridge, 2002, pp. 35–8; Bond, 2007).

Classical writers recommend young wood for charcoal burning, and this corresponds with practice in the Weald (Sim and Ridge, 2002, p. 39). The charcoal from Southwark was mainly from oak (Starley, 2003, p. 140). Evidence from structural timbers in Southwark indicates that oak coppicing was taking place around London from at least the late 1st century (Brigham, Goodburn and Tyres, 1995, pp. 36–8; Hammer, 2003, p. 167), and this may also have supplied the ironworking industry with young wood for charcoal. Management of the surrounding woodland resources in this way would have mitigated the deforesting effects of charcoal production somewhat (Sim and Ridge, 2002, pp. 41–2).

Although previously thought not to have been used in the Roman period (Manning, 1976a, p. 144, 1976b, p. 1), coal is now known to have been mined and traded in the Roman period (Dearne and Branigan, 1995; Travis, 2010), and appears to have been used increasingly from the early 2nd century (Starley, 2003, pp. 138, 140). Although used less commonly than charcoal, coal may have been used preferentially in iron forging, perhaps mixed with charcoal (Hammer, 2003, p. 168; Starley, 2003, p. 138). Coal cannot be used in iron smelting, however (Manning, 1976b, p. 1).

6.4.5 Metalworking Sites in London

The archaeological study of smiths is hampered by the lack of surviving structures associated with metalworking (Scott, 2017, p. 316). Smithing may have taken place outside of workshops (Scott, 2017, p. 316), or on raised hearths (Manning, 1976b, p. 7; Hammer, 2003, p. 157), leaving no structural traces. The key evidence needed for identifying smithing sites is therefore waste products. For ironwork, this is primarily slag, hearth bottoms, and hammerscale (Sim, 2003, p. 24; Starley, 2003, pp. 131–2; Scott, 2017, p. 316). Non-ferrous metalworking waste will also include crucibles and litharge cakes (hearth bottoms which have absorbed the impurities from precious metal alloys in the refining process (Bayley, 2017, pp. 338–9)). With metalworking being one of the best studied areas of ancient industry, it is possible to place the metalworking sites of London in a wider regional context.

6.4.5.1 Metalworking in the London Area

Non-ferrous metalworking of some kind was practiced across Britain on all site types in the Roman period (Bayley, 2001, p. 74), with copper-alloy working being by far the most ubiquitous. Other non-ferrous metalworking crafts were more restricted. Pewter/lead alloy vessel manufacture was largely limited to the South-West, where the metals were most plentiful (Bayley, 2001), although may have been carried out in London (see p.179). Goldworking, meanwhile, was only practiced in larger towns, including London, possibly reflecting official control or the need for goldworkers to draw on a wide market (Bayley, 2001, p. 74).

Looking at the social distribution of metalworking waste implies that London had a special place in the industrial landscape of south-eastern Britain. Data from the Roman Rural Settlement

Project (in Scott, 2017) suggests that ironworking was only common on some types of rural settlement. Evidence of metalworking was found on 50% of complex farms, but much less frequently on smaller enclosed or unenclosed farms and villas (although this is possibly due to the poor recovery of waste from 19th and early 20th century excavations). Despite evidence for an increase in rural metalworking from the 3rd century (Scott, 2017, p. 318), the scale of production was unlikely to have supplied more than the iron required for local structural requirements, repairs, and the fabrication of basic tools for local use, not for wider markets (Scott, 2017, pp. 318–9).

Larger settlements, such as Westhawk Farm and Springhead, where larger scale smelting, bloomsmithing and barsmithing was taking place (Scott, 2017, pp. 319–20), show that market-scale production of iron was taking place outside of urban settlements, but it is towns that show the most evidence for smithing. Metalworking areas in towns appear to have been located along major roads or near gates, although there is no obvious patterning in location beyond this (Hammer, 2003, p. 15; Scott, 2017, p. 320).

6.4.5.2 Metalworking in London

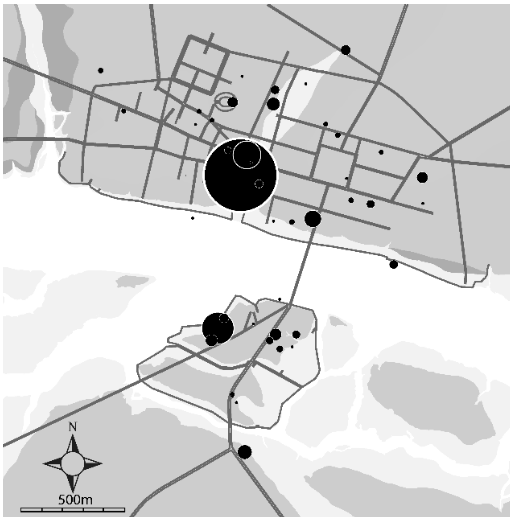


Figure 89 Distribution of copper-alloy waste in London (base map © MOLA).

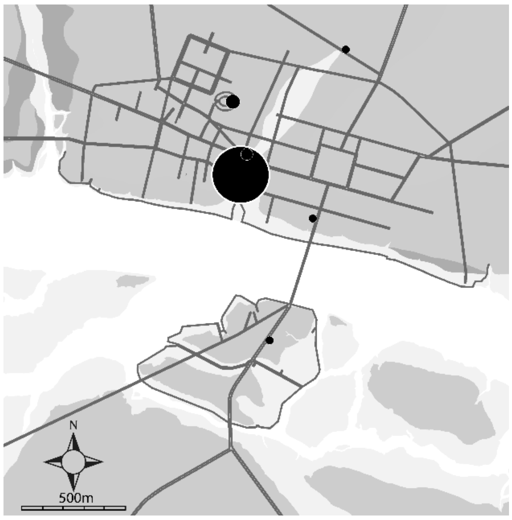


Figure 89 Distribution of ironworking waste in London (base map © MOLA).

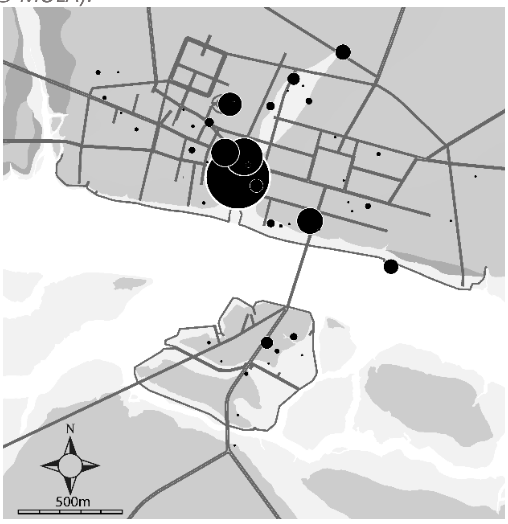


Figure 89 Distribution of lead waste in London (base map © MOLA).

Although it is possible to map the Roman metalworking waste from London recorded on MOLA's Oracle database (Figure 89), this gives a misleading picture of metalworking practice in the city. These maps are particularly heavily skewed by the inclusion of material from BZY10, where extremely deep deposits were excavated with the aid of metal detectors, contributing to the recovery of large amounts of dumped metalworking waste from this site. These maps also fail to demonstrate the level of change seen in London's metalworking areas over time, although a more sophisticated analysis of the waste data could do so.

Early Roman Metalworking Sites

Small-scale metalworking appears to have been common in early Roman London (Merrifield, 1983, p. 102; Perring, 1991, p. 52; Hammer, 2003, p. 168), with numerous small-scale iron and copper-alloy working enterprises operating across the city in the 1st and 2nd centuries (Hammer, 2003, p. 168).

Pre-Boudican ironworking is evidenced at the site of the *forum* (Hammer, 2003, p. 168), and pits containing iron and copper-alloy working waste from the late 1st century were found at Fenchurch Street, Cornhill (Perring, 1991, p. 13; Hammer, 2003, p. 168). Hearths at Newgate Street (GPO75), Ludgate Hill, may have belonged to small smithies operating in an area of shops (Perring and Roskams, 1991, p. 102; Hammer, 2003, p. 168), and were possibly associated with large dumps of slag at Aldersgate (Hammer, 2003, p. 168).

The Walbrook valley has been seen as an important metalworking area in the early Roman period due to the large amounts of metalworking waste found here (Wilmott, 1991, p. 177; Hill and Rowsome, 2011, p. 389). However, the majority of the waste from this area of the city derives from dumped material which may have originated elsewhere (see Chapter 7). The dominance of the Walbrook on distribution maps of metalworking waste from London is largely due to the fact that large amounts of dumped material were excavated at Bloomberg (BZY10) and 1 Poultry (ONE94). Nevertheless, deposits of iron slag from Bloomberg (BZY10) possibly indicate ironworking in the Boudican enclosures at that site (Bryan *et al.*, 2016, p. 36). Metalworking waste was also dumped in the Walbrook stream in the 1st-2nd centuries, potentially reflecting local ironworking at the Bucklersbury House/Bloomberg London site (Wilmott, 1991, pp. 170, 177). In situ metalworking is evidenced at Building 54, 1 Poultry (ONE94), where iron and smelted lead were found associated with a large hearth and drain from the late 1st century (Dungworth and Bowstead Stalllybrass, 2011, p. 390). Material from the dumps may also reveal interesting patterns. Copper-alloy offcuts were found in the landfill dumps at 1 Poultry (ONE94), but crucibles were considerably rarer (Wardle, 2011b). This may suggest that casting and cold-working were carried out by separate groups operating in different areas, although the exact location of these activities is not known. The presence of tin and lead alloy objects in the Walbrook has been used to suggest a tin industry here at some point before the mid 2nd century (Jones, 1983; Perring, 1991, p. 52), although none of the objects involved are stratified.

Southwark was also home to a number of small metalworking operations in the early Roman period (Cowan *et al.*, 2009, pp. 106–10). Hammerscale from a deep ditch in the northwest may indicate early ironworking by the military, although this is by no means certain (Hammer, 2003, p. 151). A short-lived pre-Boudican building on Borough High Street (BGH95) contained a concentration of hammerscale, and appears to have been a smithy (Drummond-Murray and

Thompson, 2002, pp. 28–9; Keys, 2002). Slightly later iron and copper-alloy working evidence also comes from 106-114 (106BHS73) and 201-211 Borough High Street (Hammer, 2003, p. 168). Ironworking evidence was found in the hearth of the Flavian roundhouse at Topping's Wharf (Watson, Brigham and Dyson, 2001, p. 13; Hammer, 2003, p. 168), and evidence of late 1st and 2nd century iron smithing and copper casting comes from the Arcadia Buildings (AB78) (Hammer, 2003, p. 168).

It is possible that some of the metalworkers of this early phase of activity were Continental immigrants. Marshall (in Marshall and Wardle, forthcoming) has suggested that miniature tools recovered from 1st century contexts at Bloomberg (BZY10) demonstrate the presence of Gallic metalworkers. More generally, the introduction of new tool types early in the occupation of London, and the lack of Iron Age tool forms, may suggest the presence of immigrant smiths (Chapter 5). However, evidence from Southwark, including Iron Age type crucibles from the mid 1st century at the Arcadia Buildings (AB78, Rayner, 2009, fig. 19), and the association of ironworking waste with a Flavian roundhouse at Topping's Wharf (Watson, Brigham and Dyson, 2001, p. 13; Hammer, 2003, p. 168), indicate that 'native' metalworkers were operating south of the Thames in this period.

Many of these small enterprises seem to cease operating in the 2nd century (Hammer, 2003, p. 171), after which iron and copper-alloy working in London is concentrated in a small area in north-western Southwark (Cowan, 2003, p. 86; Hammer, 2003).

The Southwark Metalworking Zone

From the 2nd century, north-western Southwark became an extremely important metalworking area, where smithing was 'perhaps more intensive, on a larger scale and lasted for longer than anywhere else known in Roman London' (Hammer, 2003, p. 169). No other sites in southern Britain have produced evidence of ironworking on a comparable scale to that seen in Southwark (Scott, 2017, p. 322). Metalworking began in this area at around AD 70, reaching its peak in the 2nd and 3rd centuries and continuing into the late 4th century (with a brief hiatus in the third quarter of the 4th century) (Hammer, 2003, p. 169; Starley, 2003, pp. 138–9).

Sixty-six hearths associated with metalworking debris were found during 18 archaeological investigations in this area, most of which were clay-lined pit hearths, ranging in size from small fire pits to large 'working hollows' (Hammer, 2003, pp. 157–8). The majority of these hearths were used for both ironworking and copper-alloy working (Hammer, 2003, p. 163, Table 85; Mortimer, 2003; Starley, 2003). Several different types of hearth were found (Hammer, 2003, pp. 158–63), potentially indicating different working practices. An unusual long hearth (Hearth

4) may have been specifically designed for carburising long steel objects, such as 'the blades of swords or other implements' (Hammer, 2003, p. 163). A stone-lined hearth could have been used for smelting, although the excavators considered this unlikely (ibid). The makeup of the

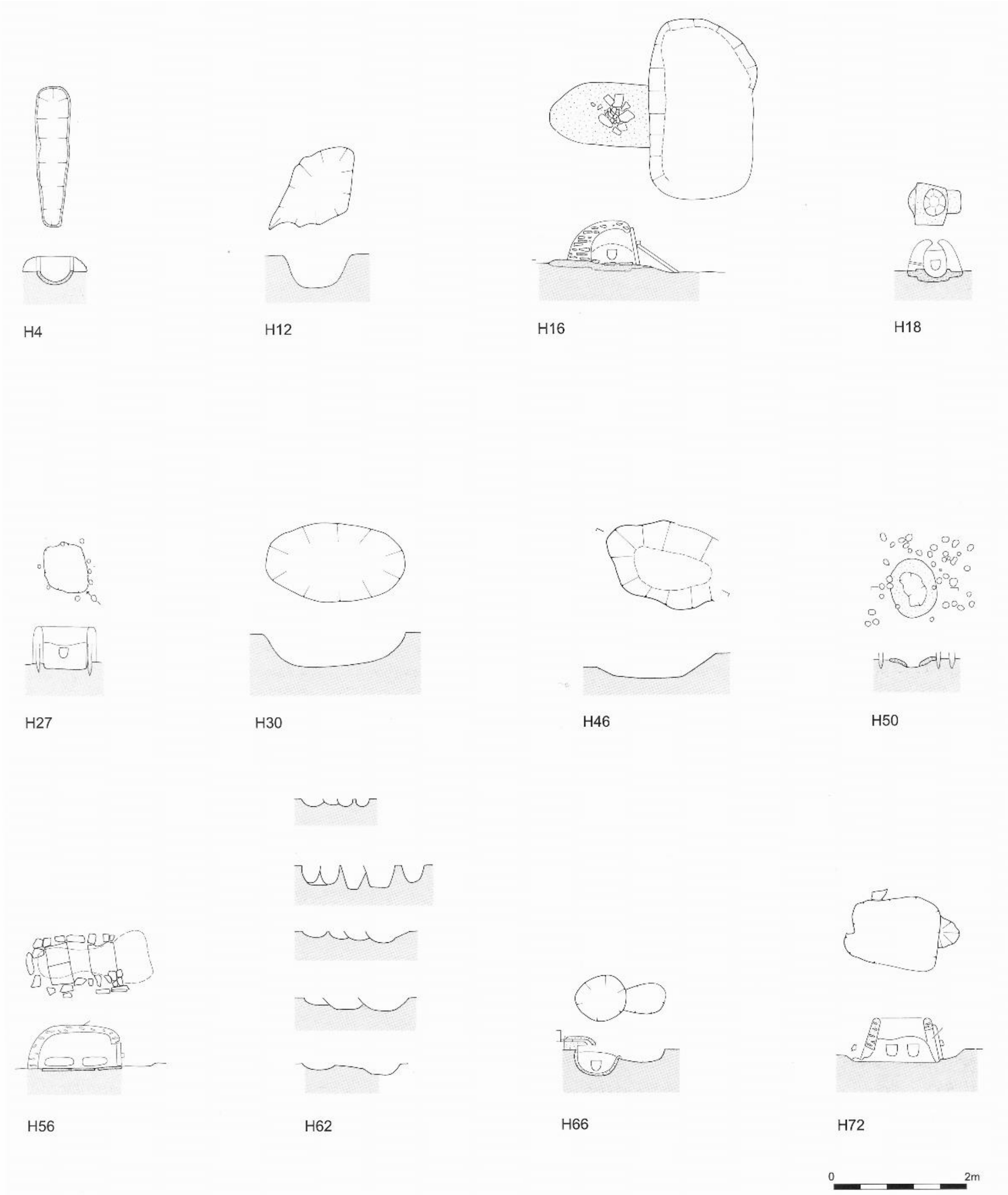


Figure 90 Roman metalworking hearth types from Southwark (Hammer, 2003, fig. 110).

ironworking waste from the site generally suggests low-temperature manufacture of simple artefacts, such as nails, rather than high-temperature welding, bloomsmithing and billet forging (Starley, 2003, p. 140). Mould fragments from the site indicate the use of both simple piece moulds and lost-wax moulds for copper-alloy casting, indicating the occasional production of one-off commissions, perhaps statuettes (Hammer, 2003, p. 164).

Figure 91 A metalworker working by a sunken pit hearth (Sim 2003, fig. 14).

No evidence was found for Mediterranean-style waist-level hearths (Hammer, 2003, p. 157; Starley, 2003, p. 140). Whilst we might not expect evidence of these to survive, the large number of pit hearths suggests that these were the normal features of Roman smithies in Southwark in this period. These hearths potentially represent the continuation of Iron Age working practices (Hammer, 2003, p. 157), although similar ground-level hearths were also used in Continetal Europe (Feugère and Serneels, 1998; Pagès, 2010). Smiths may have worked at these floor-level pit hearths whilst sitting, squatting or kneeling (Figure 91), with experiments deeming kneeling to be more comfortable (Sim, 2003, p. 23). Charcoal staining around some stake holes may indicate the positon of small anvils staked into the ground (Hammer, 2003, p. 161). Some surface hearths were open on all sides, and could have been used by multiple smiths (Hammer, 2003, p. 159). Others were against walls, or contained within superstructures, and could only have been used by one smith at a time (Hammer, 2003, p. 161).

Most of these hearths were located inside timber workshop buildings, with larger external hearths indicating outside working (Hammer, 2003, p. 155; Starley, 2003, p. 140). The workshops appear to have been purely production spaces, with no obvious shop front or living spaces. Some have the appearance of being constructed by amateur builders; perhaps the metalworkers themselves (Hammer, 2003, p. 153). The buildings varied in size; some were only just larger than the 6m^2 space which Sim (2003, p. 21) suggests to be the minimum required for smithing, whilst others were large, potentially accommodating several hearths (Hammer, 2003, p. 155). The wide entrances and openings of these buildings appear to have been designed to ensure good ventilation (ibid). Some drains around these buildings may have acted to collect water, although the majority drain it away from the workshops (Hammer, 2003, p. 157).

It is not clear why the Southwark ironworking industry expanded at the same time that smaller industries elsewhere in the city were closing (Hammer, 2003, p. 171). Although situated outside of the main settlement, this area was downwind of several high-status and public buildings across the Thames, suggesting that noise and pollution were not significant factors (Sim, 2003,

p. 22). It is possible that smaller industries closed in a 3rd century economic slump, whilst Southwark thrived on exporting iron products to the countryside, although Hammer (2003, p. 171) considered the case for a slump to be overstated. The building of the river wall may have forced the industry out of north London, although it is equally possible that the shift in focus represents a successful takeover of the industry by an entrepreneurial Southwark ironworking family (ibid). The lack of substantial reorganisation of this industrial area over a long period of time has been used to suggest that the industry remained in the same hands, potentially being passed through families. The increasing size and comfort of the surrounding buildings may indicate gradual increases in family prosperity over time (Hammer, 2003, p. 170). The re-establishment of the industry after a hiatus in the late 4th century brought with it a new hearth design (Hammer, 2003, pp. 162, 170), potentially indicating a change in the groups working in this area.

Late Roman Metalworking Sites

There is some evidence for more widespread metalworking in the Late Roman period. Small-scale ironworking appears to have taken place in the Huggin Hill baths after their disuse in the late 2nd century (Hammond *et al.*, 1990; Hammer, 2003, p. 168). Ironworking hearths were also found in the eastern range of the *forum basilica* in the 3rd century, and overlying the demolished portion of the east portico (Rogers, 2011, p. 142). These industries conform to a wider pattern seen in other Late Roman towns for public buildings being turned over to industrial uses, of which metalwork is the most visible (Rogers, 2005, 2011; Fulford, 2008, p. 42). 4th century hammerscale and hearth bases from 1 Poultry's (ONE94) Open Area 58 and Building 64 may indicate that iron smithing continued to take place in the Walbrook valley, although this is possibly intrusive (Dungworth and Bowstead Stalllybrass, 2011, p. 390; Hill and Rowsome, 2011, p. 224). Late Roman metalworking waste from Bloomberg (Watson and Bryan, forthcoming) and Southwark comes from redeposited rubbish and levelling layers (Pritchard, 2005; Starley, 2005), and may not have originated on these sites.

Precious Metal Working Sites

Several objects indicating goldworking were found around the 'Governor's Palace' on the Cornhill waterfront (Marsden, 1975, p. 100; Hammer, 2003, p. 168; Bayley, 2017, p. 341). These include crucibles and gold dust from late 1st century wells and pits at Bush Lane House (BLH73, Marsden, 1975, pp. 9–13, 100–1), and crucibles from the early 2nd century Buildings 2 and 4, and Waterfront 4 at Suffolk House (SUF94, Dennis and Ward, 2001). Analysis of the crucibles indicates that they were used for gold melting, cupellation (separating precious and base metals) and parting (separating gold and silver). This could either indicate the recycling of old jewellery, or the assaying of precious metals (Dennis and Ward, 2001, pp. 119–20).

Buildings 2 and 4 were both masonry buildings behind the main 'townhouse', surviving only as fragments obscured by the limit of excavation. Charcoal from Building 2 may suggest that it was primarily a workshop, although fragments of box flue tiles and Purbeck marble may suggest more luxurious domestic occupation (Brigham and Woodger, 2001, pp. 33, 41, 46). Marsden (1975) has suggested that the Bush Lane House material may have been used in the nearby 'Governor's Palace' building, but this cannot be confirmed (Dennis and Ward, 2001, p. 119), and the function of this building is disputed (Milne, 1996). An alternative suggestion is that as the Bush Lane House material is slightly earlier than the Suffolk House material, the construction of the 'Palace' may have displaced the Bush Lane House goldworkers to Suffolk House (Brigham and Woodger, 2001, p. 46).

There is also some evidence of precious metal working elsewhere in the city. A number of crucibles with evidence of gold and silver refining have been found at 15-35 Copthall Avenue (KEY83) in the upper Walbrook valley, indicating precious metalworking occurring alongside copper-alloy and ironworking in the 2^{nd}-3^{rd} centuries (Maloney, 1990, pp. 67–8, 82–3, 124). A further crucible from a pit may indicate that precious metalworking continued here into the 4^{th} century (Maloney, 1990, p. 84). Evidence of goldworking and enamelling was also identified at St. Thomas Street-Joiner Street (Sheldon, 1978, p. 31; Hammer, 2003, p. 168). Hoards of unmounted gemstones indicate the presence of jewellers at Eastcheap and in Southwark (Hall, 2005, p. 133). Other evidence of precious metal working comes in the form of litharge cakes. Two were found at 1 Poultry (ONE94). One, from Road 1, was part of a post-Hadrianic repair to the road surface, and may not have originated on the site. The other, from Open Area 58, was associated with late 4^{th} century ironworking waste, potentially indicating a mixed metalworking space. It is possible that this is intrusive, however (Hill and Rowsome, 2011, p. 224; Wardle, 2011b, p. 392).

6.4.5.3 The Evidence of Tools

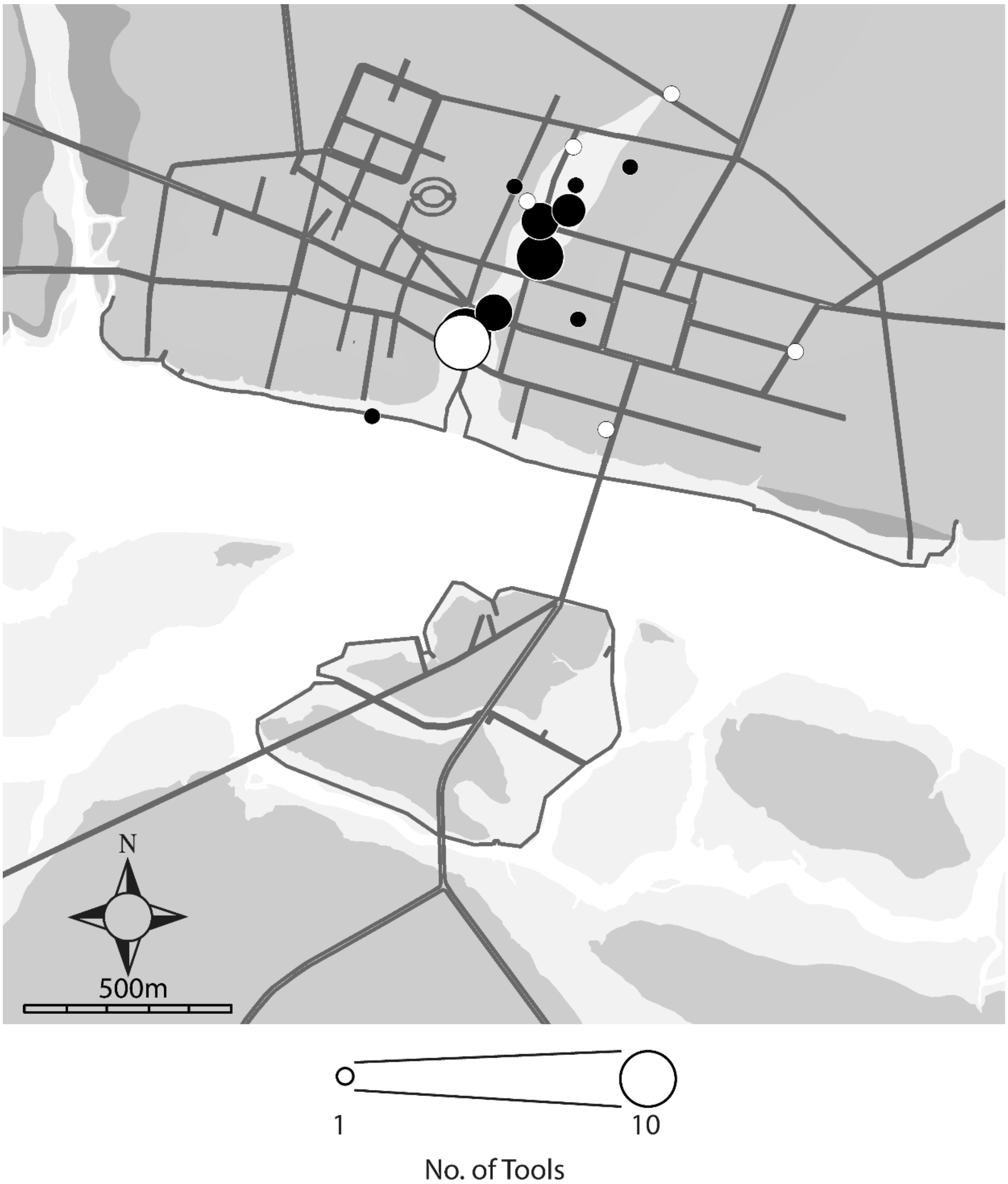


Figure 92 The distribution of metalworking tools in the City of London and Southwark (White dots = sitecodes. Black dots = street addresses, base map ©MOLA).

The overall distribution of metalworking tools in the city of London (Figure 92) adds little to our image of practice in the city. Almost all of the tools are found in the Walbrook valley; a fact which almost certainly reflects rubbish disposal practice rather than metalworking practice (Chapter 7). Particularly notable is the lack of tools from Southwark, which is surprising given the evidence for a metalworking 'zone' there from the 2nd century. The poor preservation of iron in this area of the city and the high likelihood of recycling are probably key reasons for this (Wardle, 2003a, p. 128), although it is worth noting that a large number of metalworking tools were discarded, rather than recycled, in the Walbrook valley. This may be evidence of the different communities involved, with the ‘native’ metalworkers of Southwark less inclined to indulge in the high levels of material consumption seen in the ‘Roman’ settlement north of the Thames.

Most of the tools from the city of London are unstratified finds from the Walbrook valley, presumed to have been deposited in landraising dumps, and may not have had a local origin. A number of hammers and hearth tools (HAM02, HAM05, HEA05, HEA10) come from demolition material, some in-situ, but this probably reflects their use in everyday life rather than the position of dedicated metalworking workshops (see p.317). Other objects, such as HEA08 and TON01, may have been deposited in wells for ritual reasons, and also do not indicate the position of workshops (see p.314). A number of metalworking tools come from the Walbrook stream itself, and may indicate that metalworking was taking place on the banks nearby. This is implied particularly strongly by two chasing punches (FIN01 and FIN11) found together in the stream at Tokenhouse Yard. However, other tools, such as the bent poker HEA07, may have been deposited in the stream for ritual reasons.

Few metalworking tools come from ‘occupation deposits’ which may indicate that specific buildings were used for metalworking. Two punches, PUN21 and PUN05, from a possible floor layer and external midden respectively, may indicate ironworking at the Bucklersbury House/Bloomberg London (BZY10) site. Another punch, PUN20, was found in an alleyway next to a timber strip building on Cornhill (FNE01) which produced evidence of copper alloy working (Birbeck and Schuster, 2009, p. 22).

There is also some evidence from the tools of metalworking, even fine metalworking, in London’s hinterland (Figure 93). A villa site at Beddington (BSF81-87) produced a fine metalworking punch (FIN06), two possible cold chisels (COL08-09), a hot punch (PUN10) and a possible raising hammer (HAM10). Although many of these finds are poorly dated, and some could not be located for physical examination, the presence of the FIN06 in a yard surface and PUN10 and COL08 in a ditch are good evidence of fine metalworking taking place here.

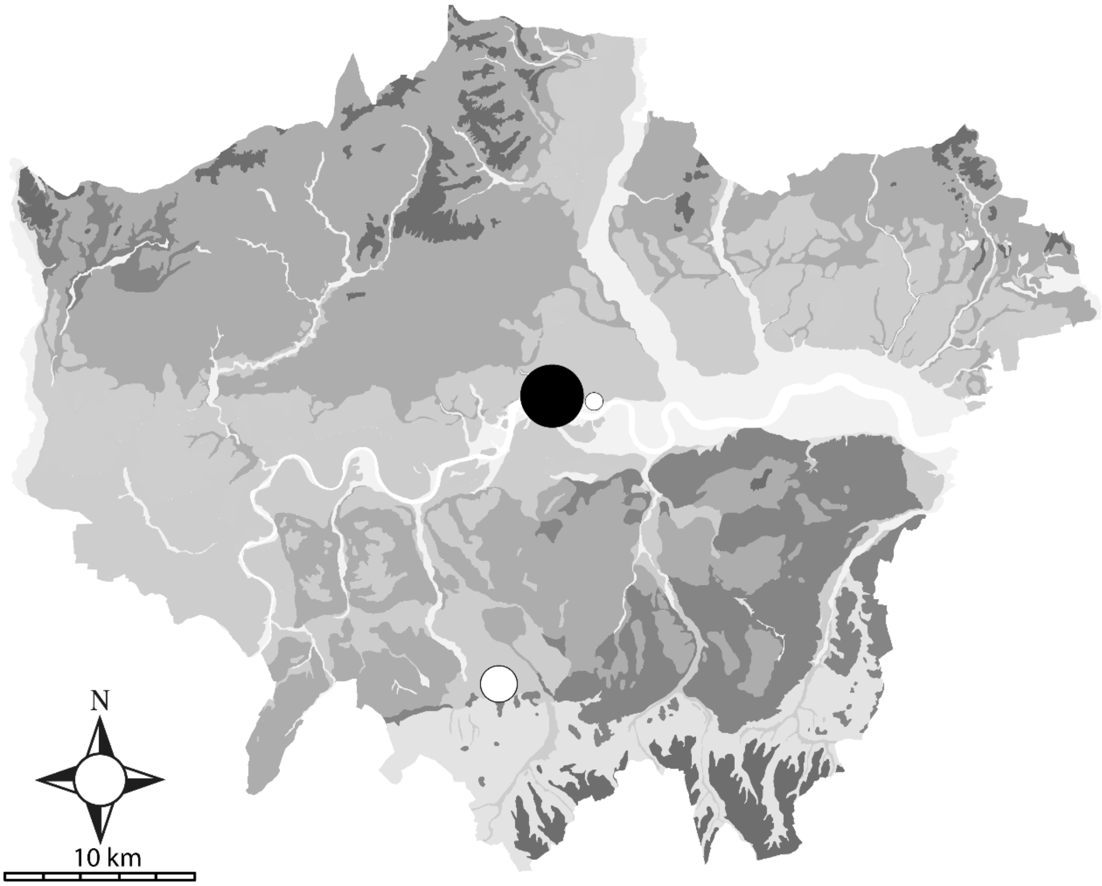


Figure 93 The distribution of metalworking tools in Greater London (base map ©MOLA).

6.4.6 Metalworking Practice in London

Metalworking techniques can be divided into two main groups; casting and wrought work. Casting involves melting metal into a liquid state and pouring it into a mould. This can be either to create an object, or to create bars and billets for further wrought working (Bayley, 2017, p. 332). Metals can also be melted to make or separate alloys. Wrought work falls into two further categories (Bayley and Butcher, 2004); shaping (in which metal is 'deformed by hammering and bending'), and 'machining' (in which metal is 'cut to size and machined' through 'sawing, turning, boring, drilling, reaming, grinding, filing and scraping'). These techniques will have been used differentially on different metal types. Copper-alloy was normally cast (Johns, 1996, p. 190), but wrought copper-alloy objects from London are also known (e.g. BRU02). Precious metals could be cast in the ancient world, but wrought techniques were preferred as they allowed for the creation of lighter objects than casting (Higgins, 1961, pp. 16–7; Ogden, 1991; Johns, 1996, p. 190; Bayley, 2017, p. 335). Iron could not be cast in the Roman period, and was always wrought.

6.4.6.1 Casting

The two main pieces of equipment required for casting are crucibles and moulds. Crucibles are ceramic vessels which can be heated to a high enough temperature to melt the metal without breaking. As well as being used for castings, crucibles can be used to produce alloys or separate and refine metals (Bayley, 2017, pp. 332–3). There is a notable change in crucible technology from the Iron Age to Roman periods, with small hand-made crucibles being replaced by slightly larger crucibles made by modifying wheel-thrown pots with the addition of extra layers of clay to the outside (Bayley, 2017, p. 337). In London, Verulamium Region Wares (VRW) were commonly modified into crucibles (Carlotta Gardner pers. comm.). The crucibles from London are currently the subject of an ongoing study by Carlotta Gardner, and are not considered tools for the purposes of this thesis.

The one tool directly related to crucibles in London is the set of tongs, TON03 (Figure 94). This tool has 'pistol grip' handles, which would be awkward to use one-handed in forging, and may instead have been designed to allow crucibles to be moved. Exactly how they were used is unclear. They may have been used to grip around the body of the crucible, but it would have been difficult for the user to grab a crucible from the side, especially if it was buried beneath charcoal in a sunken hearth. The long jaws of this tool may instead have been used to grip the rim of the crucible from above (Figure 95).

Figure 94 Crucible tongs (TON03) from London.

Apart from the bent handles, these tools resemble standard metalworking tongs, such as those depicted being used by blacksmiths. They appear to have been improvised from a pair of smith's tongs rather than specifically designed for crucible work, and this may reinforce the links seen above between ironworkers and non-ferrous metalworkers. Other tongs from London, including sets of large tweezers (TWE01-11), may also have been used as crucible tongs, although none have specialised forms for this task.

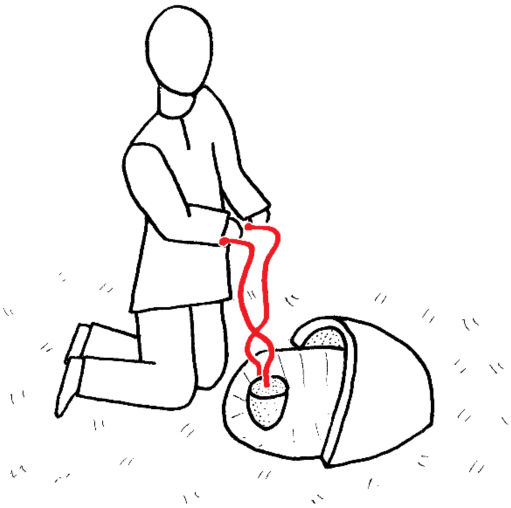


Figure 95 Suggested reconstruction of the use of TON03 (in red) for removing crucibles from a pit hearth.

Three different mould technologies were in use in the Roman world; open moulds, piece moulds and investment moulds (Johns, 1996, p. 190), of which the latter two are represented in London (Mortimer, 2003, p. 141).

Piece moulds are two-piece moulds (Figure 96). They are most easily made by pressing a solid model of the workpiece between two pieces of clay. The resulting mould is single-use, but can be easily recreated as the model survives (Hammer, 2003, p. 164; Bayley and Butcher, 2004, p. 27; Bayley, 2017, pp. 333–4), making this a suitable technology for small everyday items such as brooches (Bayley pers comm in Mortimer, 2003, p. 141). A number of lead models of copper alloy objects are known (Bayley, 2001, p. 76), including from London (Jackson, 1993; Cowan *et al.*, 2009, fig. 89), although some 'chip carved' metalwork may have been carved in wood before

Figure 96 Two-piece brooch moulds (Left; clay mould from Prestatyn (Bayley and Butcher, 2004, Pl. 1)*. Right; metal mould from Old Buckenham* (Bayley and Butcher, 2004, Pl. 4)*).*

being transferred to a lead model (Foltz, 1980; Ager, 2006, p. 248), bringing wood carving tools in the sphere of metalworking. This technology could also be used to create hollow objects if a separate clay core was suspended in the mould with metal pins (Brown, 1976, p. 33). Several fragments of moulds of this type are known from Southwark (Hammer, 2003, p. 164), and hundreds of stacked piece moulds for making coin fakes were found at 85 London Wall (BLM87, Hall, 2014b). The making of these moulds does not require any specialised tools.

Re-useable piece moulds were also used, particularly in vessel manufacture. Carved limestone two-piece moulds were used in Britain to make shallow pewter vessels, such as plates (Brown, 1976, pp. 33–6; Beagrie, 1989, pp. 181–8; Bayley, 2017, p. 334). These moulds may have been lathe-turned, although this is disputed (Blagg and Read, 1977). Steatite moulds were used for casting pieces of jewellery (Higgins, 1961, p. 16), although it is also possible that these, and a few rare metal moulds (Figure 96), were used to cast wax models (Bayley and Butcher, 2004, p. 28). These moulds bring mason's tools and lathe-working tools into the scope of non-ferrous metal casting. Two fragments of such moulds have been found in London (Hall, 2005, p. 132), whilst Late Roman tin alloy ingots from the Thames at Battersea may have been intended for use in pewter vessel manufacture or as solder (Beagrie, 1989, pp. 188–9).

Investment moulds are made by encasing a wax model in soft clay. The clay is fired and the wax poured out, creating a single-piece mould which must be destroyed to remove the casting (Brown, 1976, p. 27; Hammer, 2003, p. 164; Bayley, 2017, pp. 333–4). A variant on this technique, hollow casting, uses a wax model with a clay core to produce an artefact with thin metal walls over a hollow (or clay-filled) interior (Brown, 1976, p. 27). These 'lost wax' methods require a new model to be made for each casting, making them suitable technologies for more complex one-off pieces, such as statuettes (Johns, 1996, p. 190; Bayley pers comm in Mortimer, 2003, p. 141). Fragments of investment mould in Southwark indicate that this process was used in London to produce small objects, potentially statuettes (Hammer, 2003, p. 164), such as the Ganymeade steelyard weight and Cupid statuette from Bloomberg (BZY10, Marshall and Wardle, forthcoming). Larger objects, such as statues, could be manufactured in multiple pieces in semi-subterranean furnace pits using this method (Brown, 1976, pp. 29–30). There is no direct evidence of work on this scale in Britain (Hammer, Bayley and Bareham, 2003, p. 18), although Henig (2012, p. 123) suggests that the twice-lifesize head of Hadrian from the Thames has 'provincial features' and may have been made locally.

The manufacture of wax models for casting will have required the use of modelling tools. 'Modelling tools' have frequently been identified in Roman archaeology, but in no case is it certain what these objects were used for. Two of the tool types which Manning (1985a, p. 31) identifies as ‘for shaping clay, wax or wet plaster’ (Type B and C spatulas, described by Manning as Type 1 and 3 modelling tools) have been reinterpreted by Feugère (1995) as wax tablet spatulas associated with writing. However, amongst a number of bone modelling tools found in association with Iron Age metalworking debris at Gussage All Saints (Spratling, 1979, p. 141; Bayley, 2017, p. 337) is a tool which resembles a Type B wax spatula (Figure 97). It is therefore possible that some of these tools were used in metalwork. The discovery of the B2 spatula WXS21 in association with an industrial hearth of unknown function on Ludgate Hill (GPO75) may provide some support for this. Numerous other spatula types from London (see p.592) have a range of potential functions, none of which is immediately obvious. Whilst some of these objects may have been used in shaping wax models, this is also likely to have been carried out with tools of bone or wood, which are not part of this thesis.

Figure 97 Top, bone 'modelling tool' from Gussage All Saints (Spratling, 1979, fig. 98, 4). *Bottom, Type B2 spatula from London (WXS08).*

Mould-made castings need to be cleaned by machining processes before they are considered finished products. Unfinished castings from London include a copper alloy key from a two-part mould found at Bloomberg (BZY10, Marshall and Wardle, forthcoming). Surfaces can be neatened with whetstones or files (Bayley, 2017, p. 334). A number of very fine files (FIL01, FIL05, FIL06) were found in London, and these may have been used in refining castings.

Some decoration may be sharpened with chasing or engraving tools (Johns, 1996, p. 190), with chased castings from London running the range from simple retouched brooches (Bayley and Butcher, 2004, p. 30) to the elaborately cast and chased 3rd century silver strainer from the Bucklersbury Mithraeum (Strong, 1966, p. 170). Four types of fine metalworking punches were found in London, but only Type 1 has the full range of forms needed for chasing. Types 2-4 may have been used for tasks requiring a more limited range of tools, such as cleaning castings.

6.4.6.2 Shaping

Shaping processes are those in which the metal object is 'deformed by hammering and bending' (Bayley and Butcher, 2004). The gold used in ancient sheet jewellery was typically around 0.1mm thick, at which point shaping it would require only wooden or bone tools (Ogden, 1992, p. 43). Shaping other metal objects will have required a wider range of more robust tools. The most basic suite of shaping tools are the hammer, tongs and anvil. These tools were both functionally and symbolically important to metalworkers, so much so that they became emblematic of metalworkers and metalworking gods (Manning, 1985a, p. 1; Ogden, 1992, p. 41; Garrow, Lucy and Gibson, 2006, p. 167; Hanemann, 2014, p. 323). To these can be added punches and drifts. However, there are also some tools from London which represent more specific shaping practices; chasing, repoussé, and vessel manufacture.

Basic Shaping Practices

Iron is solid at room temperature, and must be heated in a forge in order to become malleable. Non-ferrous metals are softer, and so can be shaped at room temperature, although doing so creates stress in the metal which needs to be relieved with periodic annealing; heating and cooling in a furnace (Bayley and Butcher, 2004, p. 31). Moving objects in and out of the forge, and manipulating hot objects over an anvil, will therefore have necessitated the use of tongs. Several types of tongs are found in the Roman world, with a variety of jaw types suited to different purposes (see Hanemann, 2014, Abb. 285). However, most from London are the simple Type 1, which could have been used for almost any task. The range of sizes of tongs of

Figure 98 Forging tools from London (Top row, left-right; drift, PUN24; round punch, PUN02; square punch, PUN11. Second row, left-right; tongs, TON02, TON05, TON01. Third row, left-right; hammer, HAM01; anvil, ANV01. Bottom; miniature hammer, HAM07; miniature anvil, ANV02).

this type found in London indicates a range of different activities, although it is impossible to say precisely what sort of work was being carried out. One pair, TON05 (above), was almost certainly used in moving crucibles rather than manipulating metal over an anvil.

Only two anvils (ANV01-02) could be definitively identified in London. ANV01 is small, whilst ANV02 is exceptionally tiny, and may be a miniature. Both anvils may indicate a degree of delicate metalworking, potentially complementing the evidence from crucibles and hearth waste for precious metalworking in London. ANV02 in particular may have been associated with jewellery manufacture. They lack the swages and pritchel holes of the more sophisticated anvils from the Late Iron Age Waltham Abbey hoard, however (Manning, 1977). No beaked anvils were found in London, although one is depicted on the Screen of the Gods (Manning, 1980).

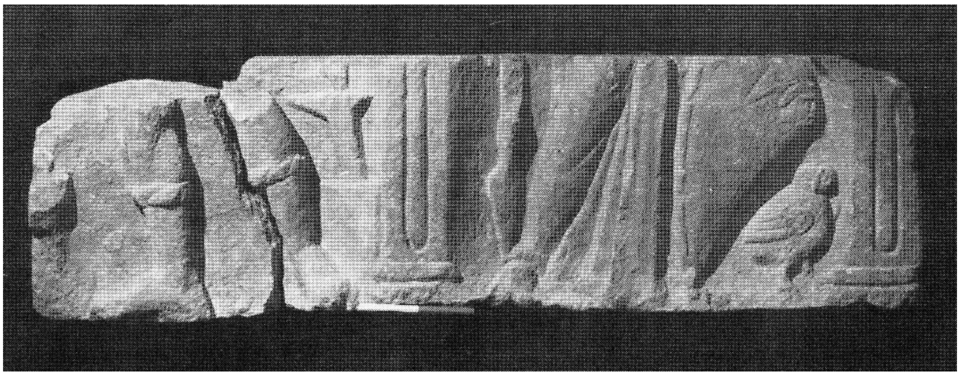


Figure 99 Roman Riverside Wall Block 32, showing the legs and anvil of Vulcan on the left hand side (Hill, Millett and Blagg, 1980, Pl. 49).

The majority of the hammers from London are cross-pene hammers of the sort depicted in use by Roman smiths (Figure 81). However, these tools also appear to have been the normal type of hammer used in carpentry or domestic situations, so it is impossible to state with certainty which were used in metalworking. No sledgehammers, which indicate the presence of a striker assisting the smith, were found in London, possibly due to their larger size making them more appropriate for recycling. Two hammers from London (HAM07 and HAM11) may represent embossing hammers. Their small, domed striking faces could be used to add texture to metal surfaces, although this does not appear to have been common in Roman metalwork. A copper alloy dish from the Neupotz hoard has been treated in this way, although with a larger tool (Künzl, 1993, Taf. 350-1). The very small size of these tools indicates that they were for fine work, potentially involving precious metals.

These objects make up only the most basic kit of a blacksmith, allowing them to heat, shape and punch holes in iron objects. However, a number of other shaping tools, such as mandrels, draw plates, sledgehammers, fullers, swages and flatters, complex tongs, and many types of anvil are missing from the London tools assemblage. There are several possible explanations for this restricted suite of tools. It is possible that the ironworking taking place in London was limited to basic fabrication, which required few tools. This seems to have been the case in Southwark, where simple objects such as nails may have been the primary product produced (Hammer, 2003, p. 128), but is contradicted by the evidence for specialised manufacture of tools (Chapter 5), and fine metalwork (below). It is also possible that the toolkit was deliberately basic or conservative, forming part of a smithing culture which applauded the ability to produce complex work with a few tools rather than owning a large suite of tools with a narrow range of functions. However, London is not unusual in only producing a basic suite of tools. Several studies of tool marks have found evidence of tools not represented elsewhere in the archaeological record (Hewitt, 1982; Walker, 1982, pp. 350–1; Sands, 1997). The fact that some of the ironworking tools 'missing' from London can be found in hoards from nearby sites (see for example the swage hammer and anvils from Waltham Abbey (Manning, 1977, fig. 114-6, 1985a, A2-4), or the tongs and draw plates from Silchester (Evans, 1894, fig. 10)) can be taken as evidence that the restricted nature of the smithing tools assemblage from London is in part due to depositional and recycling practice rather than working practice.

Chasing, Repoussé and Embossing

Chasing and repoussé are two processes for decorating the surface of metalwork. In chasing, shaped tools are used to indent the surface of a workpiece, which is placed on a hard surface. In repoussé, the workpiece is placed on a yielding surface, such as pitch, and worked from the back with tools, creating raised decoration. Although technically distinct, these two processes were often used in conjunction (Johns, 1996, p. 190), and rely on a similar suite of tools. Chasing was the more common technique used in Roman metalwork (Ogden, 1992, p. 53), and many objects described as repoussé are in fact only chased (Bennett, 1985, p. 112).

Four types of punch possibly associated with chasing and repoussé were found in London (FIN01-22). However, only one of these types, Type 1, produced the full range of tool types needed for this work. This includes tracers, points, planishing tools and matting tools. None of the tools found in London have the extremely rounded tips characteristic of embossing tools, however. Type 1 fine metalworking punches (FIN01-12) can therefore be seen as tools of professional metalworkers practicing the art of chasing, but potentially not repoussé, in London.

Figure 100 Chasing tools from London (Left-right; tracer, FIN02; point, FIN03; planishing tool, FIN08; matting tool, FIN10)

Modern metalworkers can have extremely large numbers of chasing and embossing punches (Figure 112), and the surviving tools from London may therefore represent less than one craftsman's original toolkit. The majority of these punches are tracers, which are used to make lines. The next most common are point tools, which would produce individual dots. Dotted decoration is seen on many objects, and can be used to produce simple geometric decoration (Humphreys and Marshall, 2015, fig. 3), more elaborate figurative designs (Obrecht, 2012, Abb. 82) or inscriptions (Collingwood and Wright, 1991, RIB 2428.4). Much rarer are matting tools (FIN09-10), which would be used to add texture to areas of metalwork. Texture can be added around decorated areas to increase their prominence, but on many of the vessels from the Mildenhall treasure matting was added to prepare surfaces for decoration and later largely erased by raising (Lang and Hughes, 2016, p. 245). The Mildenhall vessels also required the use of a range of O- and U-shaped punches (Hobbs, 2016, p. 59, Pl. 115), and it is not impossible that some of the solid-handled gouges (GOU04-13) or hole punches (HOL01-04) from London were used in decorating metalwork.

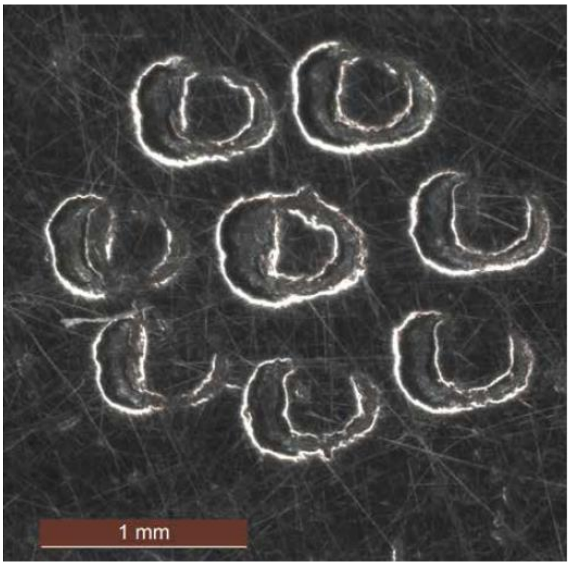


Figure 102 Ring-shaped punch marks on the Bacchic Platter, part of the Mildenhal Treasure (Hobbs, 2016, Pl. 115).

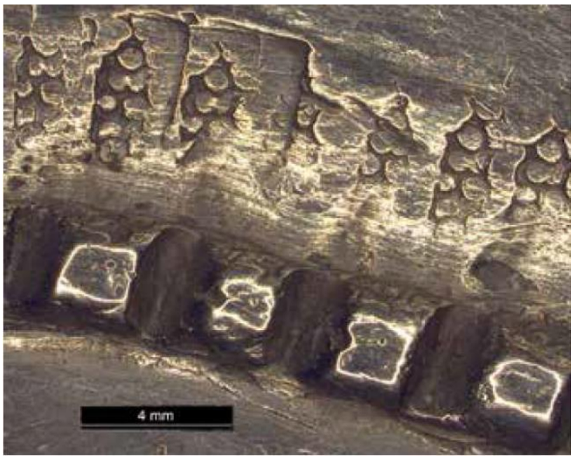


Figure 101 Marks made by a matting punch on the Mildenhall Treasure (Hobbs, 2016, Pl. 247).

Figure 104 Metalworker adding chased decoration to a helmet. Detail from a fresco from the Casa delle Quadrighe, Pompeii. (https://commons.wikimedia.org/wiki/File:Officina_di_vulcano,_da_casa_delle_quadrighe_a_pompei,_9529,_03.jpg).

Figure 103 Chased decoration on the Oceanus dish, part of the Mildenhall Treasure (http://www.britishmuseum.org/research/collection_online/collection_object_details/collection_image_gallery.aspx?partid=1&assetid=1613209611&objectid=808632).

Whilst these tools clearly indicate that decorated metalwork was being produced in London, the exact artefacts being made are unknown. Chasing and repoussé were used to decorate a wide variety of objects in the Roman period. Everyday objects such as brooches could have simple chased decoration added to their surfaces to create texture (Bayley and Butcher, 2004, p. 30), whilst some disc brooches have more elaborate silver or copper alloy repoussé front plates soldered to separate back plates (Johns, 1996, pp. 180–1; Bayley and Butcher, 2004, p. 44). Chasing and repoussé could be used to create decorated military helmets and belt fittings (Bennett, 1985; Bishop and Coulston, 2006, p. 245), and precious metal tableware, including the elaborately decorated vessels from the Mildenhall treasure (Maryon, 1948; Strong, 1966, p. 9; Hobbs, 2016, p. 59; Lang and Hughes, 2016, p. 245), the technology of which has been studied in detail.

Embossed decoration could also be 'mass produced' using shaped dies and formers. Three-dimensional metalwork can be created by forming sheet metal over a wooden or stone shaper (Ogden, 1992, pp. 43–4), whilst elaborate low-relief designs can be produced on sheet metal using metal dies (Brown, 1976, pp. 37–8; Higgins, 1976, p. 55; Johns, 1996, pp. 190–1). The existence of figurative dies in London is suggested by repeated stamped designs, possibly of a lion fighting a boar and a hippocamp (Figure 105), on clay luting (clay applied around the lid of a crucible to act as a seal) found in association with evidence of goldworking around the 'Governor's Palace' on Canon Street. This may have been produced with a die or mould used to make embossed votive plaques or jewellery in London (Marsden, 1975, p. 100; Merrifield, 1983, p. 103), but the die itself has not been found.

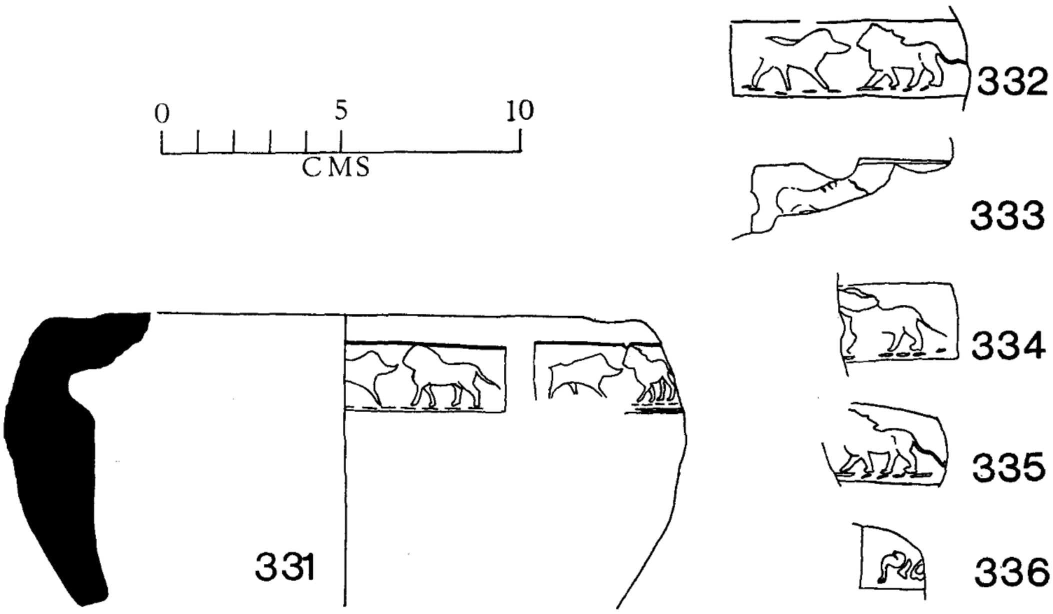


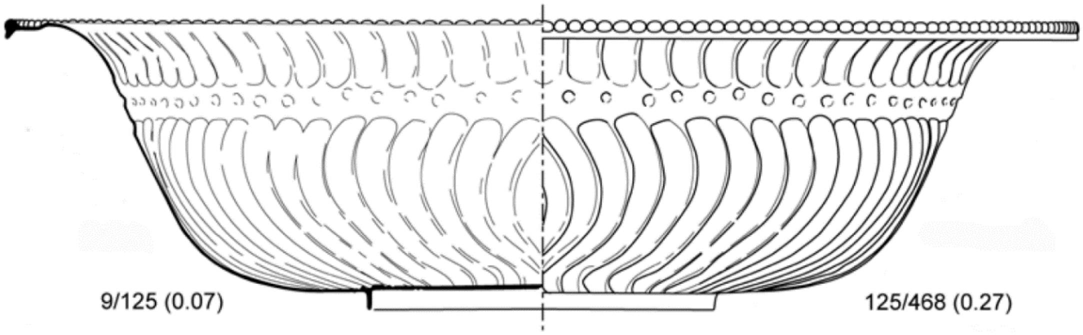
Figure 105 Stamped designs on the luting on gold-refining crucibles from Canon Street (Marsden, 1975, fig. 46).

Vessel Raising

One particular form of shaping is the raising of metal vessels from sheet metal. In this process, a circle of cast metal is rotated over an anvil, with a narrow-faced raising hammer used to beat concentric rings from the centre, gradually dishing the metal. Raising was widely used to manufacture vessels from the Bronze Age (Strong, 1966, p. 8), but it is unknown where most Roman vessels were made. Fragments of cast copper alloy vessel components from Bloomberg (BZY10, Marshall and Wardle, forthcoming) indicate that some vessel production was taking place here, and it is thought that silver plate may also have been manufactured in Britain (Henig, 2012, p. 125; Hobbs, 2016, pp. 263, 266). A few tools from London may be associated with this activity, although none can be identified as such with certainty.

The two Type 8 hammers from London, HAM09-10, may have been used as raising hammers, although it is also possible that they were used as saw-setting tools. The stake anvil ANV01 may also have been suited for use in raising shallow vessels, although a beaked anvil would be more appropriate. Type 7 hammers, such as HAM08, may have acted as planishing hammers, which are used to smooth the surface of a vessel after raising (Strong, 1966, p. 8), although they are also similar to modern leatherworker's hammers.

The best evidence for vessel production in London is DIE05 (Figure 106), which may have been used to create fluting on raised vessels. This tool would have produced a 'gadroon' design; a sort of curved flute of the type seen on the bases of metal vessels, such as the silver bowls from the Late Roman Sevso and Thil treasures (Figure 107). However, designs of this type were clearly not always made with a tool such as this. The curved flutes on the small bowls from the Mildenhall Treasure were created by chasing the inside of cast, lathe-turned vessels (Lang, 2016b, p. 157), whilst those on the larger fluted dish were carried out by freehand raising with a variety of tools (Lang, 2016a, p. 192). The date of DIE05 is uncertain as no comparable object is known, and further work on fluted vessels is needed to establish whether any known Roman examples were manufactured with a tool such as this.



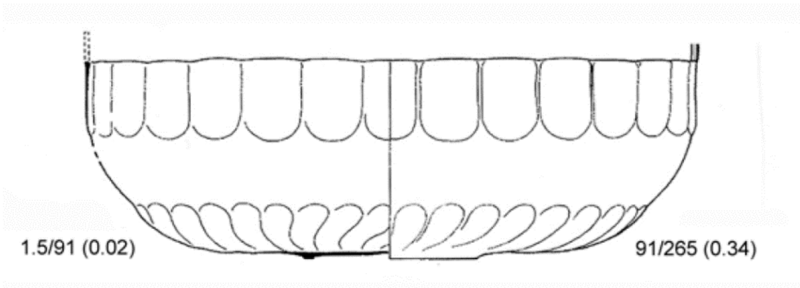


Figure 107 Fluted silver vessels from the Sevso (top, Hobbs, 2016, Pl. 316) *and Thil* (below, Hobbs, 2016, Pl. 317) *treasures.*

Figure 106 'Gadroon' die from London (DIE05).

6.4.6.3 'Machining'

'Machining' processes are those which modify an object's shape through 'sawing, turning, boring, drilling, reaming, grinding, filing and scraping' (Bayley and Butcher, 2004). Whist 'shaping' bends the metal, these machining processes all remove metal from the finished object. With the exception of drill- and lathe-work, they can be carried out with hand tools rather than 'machines' as such.

Cutting could have been accomplished with shears or chisels. Although metal-cutting shears were used in the Roman period, they are rare (Gaitzsch, 1980, pp. 216–9). Only one object from London, TON10, is possibly a pair of metal-cutting shears. This object is only known from X-ray, however, and cannot be identified with certainty. Thin sheet metal could probably be cut with normal domestic shears or knives, but it seems likely that most Roman metal was either worked hot or cut with cold chisels, such as COL01-09.

A number of files were found in London, most of which are thought to have been used in metalwork owing to the fineness of their teeth (see p.481, Figure 108). Files have a range of uses, and would presumably mostly have been used in general shaping and cleaning work, as well as possibly in sharpening other tools. Files could also have been used to cut notches into the edges of artefacts; a common decorative scheme used on a number of Roman iron and copper alloy artefacts (e.g. Humphreys and Marshall, 2015, p. 9), and some iron tools (Figure 63). Three files (FIL01, FIL05 and FIL06) have very fine teeth. These tools may have been used in precious metalworking, or for cleaning up castings. Very slender fine files, such as FIL05, could have been used in precision machining, for example in making keys.

None of the drill bits from London were obviously used in metalwork, although those with robust points resemble metal drilling bits described by Salaman (1975, p. 85). No centre bits were found, which would have allowed the production of ring and dot decoration (Bayley and Butcher, 2004, p. 30).

Figure 108 Metalworking files from London (Top left, FIL05. Top right, FIL06. Bottom row, left-right; FIL01, FIL03, FIL09).

Engraving

Two possible engraving tools (ENG01-02, Figure 109) were found in London, although neither can be identified with certainty. Unlike chasing and repoussé, engraving cuts metal away from the surface of the workpiece. Engraving was used much less frequently on ancient jewellery than chasing, possibly because of thinness of the metals used (Ogden, 1992, p. 53). Engraving was nevertheless common on rings, and could be used to make lines for inlay (Strong, 1966, p. 12; Bayley and Butcher, 2004, p. 45). Gravers could be used for cutting lettering as well as decoration. Engraved letters could range in significance from legal documents, to religious dedications or ownership marks, and indicate the literacy of some Roman metalworkers. Other engravings were much simpler, including the 'rocked' zig-zag patterns seen on some Roman metalwork (e.g. Humphreys and Marshall, 2015, p. 9).

Figure 109 Possible engraving tools from London (Top, ENG01. Bottom, ENG02).

Lathe Turning

Lathes have three potential functions in metalwork; polishing, carving, and spinning (Craddock and Lang, 1983). Lathes were also used to produce stone moulds for vessels (Brown, 1976, pp. 33–6; Beagrie, 1989, pp. 181–8; Bayley, 2017, p. 334). This potentially brings lathe tools (CHI45-46) into the sphere of non-ferrous metalworking. However, the extent to which these were used in Roman metalwork is a matter of debate. Polishing and cleaning certainly took place on the lathe. Compass marks on the bases of cast pewter vessels show where the centre was established, and unpolished areas in the centre show where the chuck of the lathe came into contact with the plate (Brown, 1976, pp. 35–6). Lathe marks are also found on silver vessels (La Niece, 2010, p. 185; Lang and Hughes, 2016, p. 245). Polishing vessels requires only low-energy lathes, which would have been the same as those used in woodwork (Craddock and Lang, 1983, pp. 79–80).

Mutz (1972) suggests that the deep concentric grooves in the bases of *paterae* were cut on a lathe, highlighting the thickening of one side of the vessel as evidence of their having been mounted on lathes in slightly different positions when the base and inside were turned. However, Craddock and Lang (1983) use metallography to show that these ridges were cast in place. It therefore seems unlikely that the lathe-turning tools from London, all of which are suitable only for carving, could have been used in non-ferrous metalworking. Vessels can also be shaped on a lathe by spinning, in which the metal is bent to shape as it rotates. Whilst this is favoured by Mutz (1972) as a method for shaping vessel rims, others (Craddock and Lang, 1983; La Niece, 2010, p. 185; Lang and Hughes, 2016, p. 245) doubt that it was used in the Roman period. Both of these techniques require high-energy continually-spinning lathes (Craddock and Lang, 1983). Mutz (1972) reconstructs a possible hand-cranked lathe capable of this work, although there is no evidence for the use of this drive mechanism in the Roman period (Craddock and Lang, 1983) other than a small number of possible crank handles identified by Hanemann (2014, pp. 150–1). It must be admitted, however, that the amount of evidence for lathes of any kind is small.

6.4.6.4 Gilding

Two main gilding methods were used in the Roman period; mercury gilding and leaf gilding. Normally, leaf gilding involves the application of gold (or base metal) leaf to an area of organic adhesive on the object's surface, although there are suggestions that other methods were also used (Lins and Oddy, 1975, p. 371). Mercury gilding (also known as fire gilding) involves painting a mixture of gold and mercury onto the surface of a metal object, or applying gold leaf to a surface prepared with mercury. When the object is heated, the mercury evaporates, leaving only the gold (Lins and Oddy, 1975, pp. 365–70; Bayley and Butcher, 2004, p. 42). Mercury gilding was primarily used from the Late Roman period (Lins and Oddy, 1975), but may have been understood earlier, as the gold leaf and mercury method is potentially described by Pliny (*The Natural History*, 33.20). Raux (2015, p. 689) has observed thickened areas of gilding on surviving Roman metalwork, showing where sheets of gold leaf overlapped. These demonstrate that, whatever gilding method was used, sheets of gold leaf were being applied to metalwork. Gilt bronze statuary from London has been shown to have been leaf-gilded (Bayley *et al.*, 2009), potentially bringing the brushes from London (BRU01-07, Figure 130), which Raux (2015) believed were used for applying gold leaf, into the sphere of metalworking tools. No obvious leaf-beating hammers were found in London, but this may also have constituted a distinct profession.

Figure 110 Gilded bronze dolphin from Vienna. The diamond pattern is created by overlapping sheets of gold leaf of standard sizes (Raux, 2015, fig. 12).

6.4.6.5 Soldering

Soldering, the joining of two metal surfaces by melting another metal (solder) between them (Gaitzsch, 1980, p. 127), was used in almost every sphere of non-ferrous metalwork; in assembling jewellery (Ogden, 1992, p. 51), attaching bases and handles to vessels (Brown, 1976, p. 37), assembling statues, repairing faults during manufacture (Lang and Hughes, 2016, p. 246), and in plumbing and construction (Bayley, 2017, p. 336).

There is an extensive body of literature devoted to ancient soldering, which has largely concentrated on the metallurgy of ancient solders (Lang and Hughes, 1984; Paparazzo, 1994; Paparazzo and Moretto, 1998). Solders are typically broken into 'hard' and 'soft' groups; hard solders being alloys of the metal being soldered (e.g. gold or silver) and copper, soft solder typically being composed of lead and tin, and having a lower melting point (Strong, 1966, p. 9). Different solder compositions were used in different situations depending on the properties required; for example, to match the colours of the objects being soldered (Ogden, 1992, p. 53). It has been suggested that Roman solders follow standardised recipes described by Pliny (Beagrie, 1989; Ogden, 1992, p. 53). These standardised solders may have been imported to London ready-mixed. Five of the six ingots found in the Thames at Battersea contained 33-48% lead, and may have been destined for use as soft solder, although high lead-content tin alloy was also used to make vessels in the Late Roman period (Beagrie, 1989, p. 189).

Although Bayley (2017, p. 336) considered there to be 'no specialised tools' for lead working, it is likely that one object from London, the soldering iron SOL01, was used to melt soft lead-based solders. This tool strongly resembles modern 'hammer soldering irons', which are used for joining large pieces of sheet metal, rather than fine metalwork. As such this tool may represent the working of sheet lead in London. This could have been in construction (to make roof flashings or attach iron fittings to masonry), plumbing (to manufacture and install water tanks and pipes) or in the manufacture of coffins (Bayley, 2017, p. 336). Another possible soldering iron from London, SOL02, cannot be tied with any specific process.

6.4.6.6 Assaying, Minting and Official Control

Several objects from London may relate to aspects of the official control of metals in the Roman city. The most obvious of these are coins. Coins in the Roman period were usually made by striking a pellet of metal of the correct weight between two dies, with the intended design cut in reverse into the die surfaces (Hall, 2014b, p. 167). However, whilst coins were produced in Late Roman London (Merrifield, 1983, p. 197; Cloke and Toone, 2015), no dies of this kind have been found. However, hundreds of mould fragments have been found in London, indicating the large-scale manufacture of fake cast coins in copper alloy from the late 2nd to mid-3rd centuries (Hall, 2014b; Hall and Goodburn Brown, 2015). Whilst this has typically been interpreted as the work of forgers, it is also possible that this activity was a semi-official way of maintaining a constant coin supply (Hall, 2014b, p. 183).

Official oversight of the metal trade in London may nevertheless be suggested by DIE01 (Figure 111). This tool is thought to have been used to mark metal ingots as having originated in British mines (Wright, 1984). As the metal for these ingots cannot have been mined or smelted close to London, this tool may have been used as a form of official customs mark for metals being exported from Britain (ibid).

Figure 111 DIE01, from an unknown site in London.

The extent of Roman state interest in the British metal industries is a matter of debate. The possibility of metal wealth was cited by Strabo (*Geography*, 4.5.2) and Tacitus (*Agricola*, 12) as a reason for the invasion of Britain (Hammer, 2003, p. 166). Pliny (*The Natural History,* 34.49) expressed concern that too much mineral exportation from Britain may undercut prices of metal mined in Spain, and it is possible this lead to lead exports being curtailed during Vespasian's reign (Todd, 2007, p. 70). Millett (1990, pp. 41–2), however, argues that the prospect of mineral extraction could be a retroactive justification of the invasion, and that Britain was never a major exporter of metals. Metals were nevertheless exported from Britain; Mendip lead ingots have been found in Northern Gaul (Todd, 2007, p. 68). It is less certain whether this metal would have passed through London, rather than being moved directly to France from the Southwest coast. Diverting metals to London before allowing them to leave the country would have added to their cost, and it is possible that any official oversight in London may have been limited to precious metals. Crucibles recovered from around the 'Governor's Palace' at Canon Street were used in cupellation and parting; both processes which may have been associated with assaying (Dennis and Ward, 2001, pp. 119–20). This has been taken as evidence of goldworkers assaying metals under official control (Merrifield, 1983, p. 103), although other explanations are possible (Dennis and Ward, 2001, pp. 119–20), and the function of this building is disputed (Milne, 1996).

6.4.6.7 Aspects of Ownership

Only two of the metalworking tools from London, FIN03 and FIN10, have obvious ownership marks (Figure 113). These objects, both fine metalworking punches, have linear notches cut across the handle near the head, perhaps made with a file. Similar marks can be seen on the modern chasing and repoussé tools in The Goldsmith's Centre. FIN10 is marked with two notches; possibly a reference to the fact that the tool would have produced two dots. FIN03 reads 'VIIII', although the significance of this numeral is not clear. These notches were perhaps added to make individual tools easier to recognise amongst large toolkits, rather than to show individual ownership in a communal workshop. As such they may be evidence of the smiths owning large tool kits, containing similar-looking tools. This is not surprising, as modern chasing and repoussé toolkits can be extremely large (Figure 113). The fact that both tools are marked on the butts may indicate that the tools were stored in pots or wooden blocks with their tips pointing downwards, although this would make unmarked tools (which make up the majority of these fine metalworking punches) very difficult to identify.

Figure 112 One of three similarly-sized boxes of fine metalworking punches donated to the Goldsmiths Academy by a single metalworker on their retirement.

6.4.7 Discussion

Figure 113 Fine metalworking punches with possible ownership marks (Left, FIN03; right, FIN10).

With large amounts of waste surviving, tools have often been side-lined as a useful class of evidence for studying ancient metalworking techniques (Sherlock, 1978, p. 11; Fell, 1990, p. 276). However, this chapter has shown that whilst waste products (unfinished castings, moulds, crucibles, hearth bases etc.) provide crucial information about the initial stages of metalworking (smelting, refining, casting, etc.), ancient metalworking also involved a wide range of wrought techniques (cleaning, forging, decorating, etc.), which are not easily evidenced in traditional non-ferrous metalworking waste (Bayley, 2001, p. 76). The tools from London are evidence of these techniques, and the people who carried them out.

The development of metalworking (particularly copper-alloy and ironworking) is well understood in the city. In the early Roman period small workshops were scattered across the city, after which, in the 2nd to 4th centuries, they coalesce around a regionally significant metalworking centre in Southwark. Most of the tools from London relate to the earlier phases of the city, and no tools were found in association with the other evidence of metalworking in Southwark. The tools have also provided evidence for fine metalworking taking place in villas in the London hinterland. When taken together, these various classes of evidence demonstrate the working of a range of metals in the Roman city. The most common were copper alloy and iron, which appear to have been worked by the same group of smiths, but there is also evidence for the working lead alloys and precious metals. The majority of the tools cannot be closely related to the manufacture of specific artefacts. However, a suite of tools including small anvils, embossing hammers, chasing and engraving tools, and a die for making fluted metal vessels, suggest that London functioned as a centre for the production of decorative metalwork, as well as more basic staple items.

A number of different cultural groups appear to have interacted around metalworking in London. The forms of the hearths in Southwark suggest that native traditions continued here throughout the Roman period, although there is also evidence of changes in ownership here in the 4th century. DIE05 may provide some evidence of official involvement in the export of Britain's mineral resources through London. The majority of the metalworking tools from London are simple, and some appear to be home-made. A number of specialised forging tools, which have been found on sites elsewhere in the country, are missing from London. Whilst recycling is likely to have heavily skewed the surviving tools, it is possible that this indicates that metal forging in London was a conservative craft, in which 'being a metalworker' did not rely on 'having metalworking tools' in the same way that wood- or leather-working did. We are perhaps looking at a situation in which craft skill was expressed through the ability to produce objects with basic tools, rather than through the ability to make or acquire specialist tools.

6.5 Leatherwork

As in so many other areas of craft, leatherworking technologies in Britain undergo a number of substantial changes from the time of the Roman conquest. The Roman period sees the introduction of new products, manufacturing techniques, and tanning technologies, as well as a greatly increased scale of production (van Driel-Murray, 2016, pp. 136–7; Keily and Mould, 2017, p. 237; Scott, 2017, p. 306). However, like woodworking, the study of leatherwork in the Roman period is hampered by issues of preservation, as leather only survives in very wet or very dry conditions. The vast majority of preserved Roman leatherwork from northern Europe comes from military sites, and London is therefore exceptional for being a civilian settlement producing huge amounts of leather objects and waste. As well as these, 83 possible leatherworking tools have been recovered from London, including awls, specialised leather cutting knives, hole punches, tanning knives, a possible tanning die and a possible skin scraper. These provide an excellent opportunity to study the leather makers (the tanners and curriers who produced leather from raw animal skins) and leatherworkers (who manufactured goods from tanned leather) of Roman London.

6.5.1 Leather Technology in the Roman World

Leather is of course made from animal skin, but leather itself differs substantially from raw animal skins. Untanned hides are hard and unusable when dry, but flexible and prone to putrefaction when wet. Skins may be cleaned and left as 'rawhide' for applications where this hardness is desirable. Some shoes from London may have been held together with rawhide thongs (Rhodes, 1980, p. 109), and shield covers may have been made of rawhide (van Driel-Murray, 2009), although as the material does not survive archaeologically this is only conjecture. Skins can also be temporarily 'cured' by drying or salting (Forbes, 1966, p. 3; Waterer, 1976, p. 179; Salaman, 1986, p. 293), and this appears to have been carried out in the Roman period (van Driel-Murray, 2011, pp. 74–5). This preserves the hides for future tanning, but does not convert them into leather.

In order to be transformed into leather, skin must undergo multiple physical and chemical processes that make it flexible, attractive, and indigestible to bacteria (Salaman, 1986, pp. 293–4). These processes can be broken down into three stages; preparation, tanning, and finishing (currying) (Forbes, 1966, p. 3). Reconstructing these processes is difficult, however. Normally it is presumed that 'traditional' tanning practices are unchanged from the ancient past. However, this is disputed by van Driel-Murray (2001, p. 60), who argues that many of the 'traditional' processes carried out in modern tanning are recent introductions designed to speed up the process, and were not used in Roman leather making.

6.5.1.1 Preparation

Skin is made of several layers (Figure 114), of which only the central *derma*/*corium* layer is converted to leather (Forbes, 1966, p. 1; Waterer, 1976, p. 179; Salaman, 1986, p. 293). The outer hair and epidermis layers and internal flesh layer are removed early in the tanning process through the processes of de-hairing (scudding) and fleshing. The tannery excavated at Pompeii had limited space for these procedures to be carried out, and they may therefore have represented a separate industry from tanning in the Roman period (van Driel-Murray, 2011, p. 76).

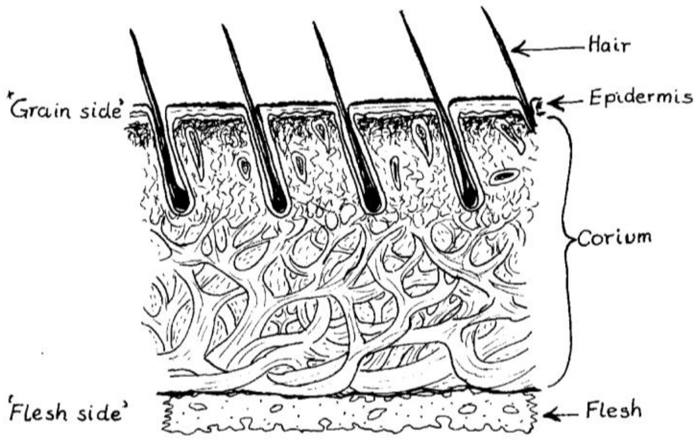


Figure 114 Cross-section of a typical animal skin (Salaman 1986, fig. 11:1).

In order to loosen these layers, hides are first soaked in baths of urine or wood ash, before being scraped with de-hairing or fleshing knives (van Driel-Murray, 2001, p. 60). In modern practice, hides are also soaked in lime solutions of increasing strength (liming) to plump the hides and loosen the outer layers (Forbes, 1966, pp. 2–4), but this appears to have been a medieval innovation (van Driel-Murray, 2001, p. 60). It is unclear whether Roman hides were puered or bated; soaked in animal dung to clean the skin and allow penetration by tanning agents (Forbes, 1966, p. 4; van Driel-Murray, 2001, p. 60).

Figure 115 Using a fleshing knife to remove the 'flesh' from an untanned hide (Salaman, 1986, fig. 11.8).

6.5.1.2 Tanning

The *corium* is formed of 'a complex three-dimensional interwoven network of tough fibre bundles' made of long collagen molecules held together with short protein-based chains

(Salaman, 1986, p. 295). It is this felt-like structure that gives leather its desirable properties (Forbes, 1966, p. 2). However, the protein chains which hold the collagen together begin to break down after an animal's death, making the skin compact and hard, and need to be replaced through tanning (Salaman, 1986, p. 295).

There are four principal ways in which tanning can be achieved; vegetable tanning, mineral tanning (tawing), oil tanning, and aldehyde tanning (Forbes, 1966, p. 5). Methods other than vegetable tanning are sometimes referred to as 'pseudo-tanning', as they produce products which remain water soluble and at risk of decay to some degree (van Driel-Murray, 2002a, p. 252). The extent of the use of these methods is largely unknown, as only vegetable tanning produces leather which survives archaeologically (ibid). The lack of surviving Roman shoe uppers, clothing, belts and horse harness may suggest that a large number of objects were made from non-vegetable tanned leather (Rhodes, 1980, pp. 100–1; van Driel-Murray, 2001, p. 62, 2002a, p. 253, 2009; Bishop and Coulston, 2006, p. 247). Of these pseudo-tanning methods, Iron Age tanning may have predominantly used vegetable oils from the Gold-of-pleasure (*Camelina sativa*) plant (van Driel-Murray, 2002a, p. 254).

The exact origins of vegetable tanning are unknown, but its spread across Northern Europe and the Mediterranean, including to Britain, has been linked to the expansion of the Roman Empire and the agency of the Roman army (van Driel-Murray, 2002a). Vegetable tanning requires hides to be soaked in increasingly strong solutions of finely ground oak bark or oak galls (van Driel-Murray, 2001, pp. 60–1). In this process, the protein-chains lost to decomposition are replaced with polyphenol molecules present in the vegetable tannins (Salaman, 1986, p. 295). Without the intermediate preparation stages discussed above, Roman tanning may have been an extremely slow process, with hides being soaked for up to two years (van Driel-Murray, 2001, p. 62; Keily and Mould, 2017, p. 240).

6.5.1.3 Finishing/Currying

Currying refers to the processes involved in making a tanned hide flexible and attractive. Salaman (1986, pp. 307–12) describes the tools and techniques of modern curriers, which include knives for trimming and shaving down hides to the desired thickness, stakes for stretching them, and numerous scrappers and rubbing tools for improving surface appearance. Roman hides appear to have been tanned with the heads and legs removed, but necks, upper limbs and udders may only have been removed by curriers or the leatherworkers themselves (van Driel-Murray, 2001, p. 60). Hides can be made flexible by impregnating them with fat or grease (Waterer, 1976, p. 179), and the 'sheen' on the surface of Roman leatherwork may relate to 'polishing and careful smoothing' (van Driel-Murray, 2001, p. 61).

6.5.2 Leatherworkers in the Roman World

6.5.2.1 Leather Makers

The shift to vegetable tanning in the Roman period has been seen as the cause of a major shift in the status of leather makers in Britain. Although it is unknown who processed hides in Iron Age society, analogy to anthropological studies suggests that it may have been carried out by women. Curing and pseudo-tanning are suited to domestic production, as although labour intensive they can be carried out by just one person (van Driel-Murray, 2001, p. 58). Vegetable tanning, meanwhile, requires large purpose-built structures and considerable investment of time (van Driel-Murray, 2001, p. 58). It is therefore possible that the introduction of this technology led to a social shift, 'from female-controlled skin-processing to male-dominated large-scale manufacturing' (van Driel-Murray, 2016, pp. 136–7). This interpretation is somewhat at odds with the suggestion that leather was exported from Southern Britain before the conquest, however (Forbes, 1966, p. 55; van Driel-Murray, 1977, p. 161; Rhodes, 1987, p. 176). It is also possible that pseudo-tanned leathers continued to be produced at a household level in the Roman period (van Driel-Murray, 2011, p. 80), although these products do not survive archaeologically. The professionalization of the industry in the Roman period is demonstrated by inscriptions by professional tanners and their guilds (Forbes, 1966, p. 57; Flohr, 2013), although none are known from Britain. This technological shift has been seen largely as responding to the needs of the military (van Driel-Murray, 2001, 2002a, 2016, pp. 136–7), although van Driel-Murray (2001, p. 58) points out that the earliest civilian adopters of vegetable tanned goods were women, perhaps glad to be free of the 'drudgery' of household level hide processing.

Tanners were routinely satirised in Classical sources, owing to the dirtiness of their work. The 2nd century Greek writer Artemidorus (*Differentiations of Dreams*, 1.51) writes that:

> *'to tan hides is base to all. Since the tanner has to handle animal corpses, he has to live far out of town, and the vile odour points him out even when hiding...'* (Bond, 2016, p. 97)

However, Bond (2016, pp. 97–125) considers this to be largely a matter of literary convention, pointing to documentary and archaeological evience to show that tanners were not as marginalised socially (with evidence of people with connections to tanning entering politics) or physically (with evidence of tanneries located within towns) as these sources suggest.

6.5.2.2 Leatherworkers

Like other craftsmen, leatherworkers are seen as low-status figures who took pride in their professionalism (Flohr, 2012). As with other crafts, leatherwork is thought to have been learned primarily through apprenticeship. It is also likely that leatherworkers in civilian settings could be veterans who learned their trade in military service (van Driel-Murray, 2016, p. 140). The widespread use of nailed shoes by civilians in the northern provinces is particularly suggestive of the introduction of Roman leatherworking styles by the army (van Driel-Murray, 2001, p. 58, 2009).

Figure 116 Tombstone of Septimia Stratonice, Ostia (https://uk.pinterest.com/pin/271130840044242595/).

A number of leatherworkers' tombstones are known, although none come from Britain. A particularly famous example from Ostia, showing a seated figure holding a last (Figure 116), is dedicated to the female shoemaker (*sutrix*) Septimia Stratonice (Treggiari, 1979, p. 70; Dixon, 2004, p. 61; van Driel-Murray, 2016, p. 139). These carvings usually depict lone workers, and could be taken as evidence for Roman leatherworkers as a mixed-gender workforce of independent operators. An inscription to a professional association for shoemakers in Nijmegen also suggests the existence independent professionals (van Driel-Murray, 2016, p. 139). A note of caution is that these depictions represent 'symbolic vignettes' dedicated to those who controlled the industry, rather than realistic depictions of those who worked in it (van Driel-Murray, 2009, 2016, p. 139). Nevertheless, that this may have been the case in Britain is supported by the fact that shoemaking waste is common wherever waterlogged conditions exist, indicating that shoemakers operated on most settlement types (Mac Mahon, 2005, p. 63; van Driel-Murray, 2016, p. 138).

Other evidence suggests that some leatherworkers may have worked together in corporate workshops serving an export market (van Driel-Murray, 2016, p. 139). Concentric circle stamps on sandals from London indicate that they were made in a common workshop, which was probably local (Rhodes, 1980, p. 121). Matching stamps on shoes from London and Vindolanda (Keily and Mould, 2017, pp. 245–6), and matching nail patterns on shoes from London and

Vindonissa (Rhodes, 1980, p. 103), may suggest that they were also produced in specialised workshops, which targeted regional and international markets. The locations of these workshops are unknown.

The workers in these corporate workshops would have had a different relationship with their customers to other leatherworkers, with their products probably being traded through intermediaries (Flohr, 2012; van Driel-Murray, 2016, p. 147). However, even independent leatherworkers would have been part of new consumer relationships in the Roman period. The styles of leather objects changed considerably with the Roman conquest (van Driel-Murray, 2016, p. 141). This is accompanied by a consumer revolution driven by novelty, with some designs of shoes only lasting for a season. Leatherworkers in London therefore needed to respond to changes in Empire-wide fashion trends, knowledge of which may have been disseminated through itinerancy, craft workbooks, or customer demand (van Driel-Murray, 2016, pp. 132–46).

Some leatherwork trades may have been as highly specialised as other crafts in the Roman period. Tombstones and inscriptions suggest that shoemaking was a separate profession (van Driel-Murray, 2016, p. 139), with different types of shoes made by different specialists (Rhodes, 1980, p. 128). A street in Rome (the *Vicus Sandalarius*) was named specifically after sandal makers, whilst another was named for harness makers (the *Vicus Loriarius*) (Forbes, 1966, p. 54).

The ubiquity of leather in everyday life means that some leatherworking practices were also undertaken by non-specialists. Discarded tent panels often show differences between the 'expertly stitched' seams made by the original manufacturers, and the sometimes crude repairs made by their owners, in this case soldiers (Winterbottom, 2009, p. 820; Keily and Mould, 2017, pp. 240–1). Whether non-specialists were involved in manufacture is less clear. One-piece sandals (*carbatinae*) are sometimes dismissed as simple shoes made by unskilled workers, but the range of techniques used to make them indicates that they must have been made by professional shoemakers (Rhodes, 1980, p. 127).

6.5.3 Leather Supply to London

Leather can be made out of almost any animal skin, although there is only direct evidence for a few species being used in London. The majority of the shoes from London are made of cow leather (Keily, 2011, p. 540), whilst large sheet objects (tent panels, saddles, cases, covers etc.) are typically made from goatskin, and more rarely of calf skin (Keily and Mould, 2017, p. 240). Animal bone pathology suggests that horses, donkeys and cats may also have been skinned in

London (Bendrey, 2002, p. 60; Reilly, 2005, p. 165; Pipe, 2011c, p. 397). Little is known about the supply of hides to London. Local food production would presumably have provided a large number of animal skins. However, there is also evidence that uncured hides and finished leather were widely traded. This includes inscriptions in Rome (*CIL* vi, 9667), and Numidia (*CIL* iix, 4508) (Forbes, 1966, p. 55; van Driel-Murray, 1985, p. 61, 2009; Flohr, 2012). That this extended to Britain is confirmed by a tablet from Vindolanda, in which a merchant writes that:

> *'The hides which you write are at Cataractonium - write that they be given to me and the wagon about which you write. And write to me what is with that wagon. I would have already been to collect them except that I did not care to injure the animals while the roads are bad.'* (*Tab. Vindol.* II, 343)

Strabo (*Geography*, 4.5.2) suggests that hides were being exported from the south-east of Britain in the pre-Roman Iron Age, and this may have continued as an export industry in the Roman period (van Driel-Murray, 1977, p. 161; Rhodes, 1987, p. 176). Tacitus (*Annals*, 4.72) records that the need to supply hides could even become a political matter, with unreasonable levels of hide extraction being cited as a reason for a Frisian revolt (van Driel-Murray, 2009).

Recycling was also a major source of leather in London. Large sheet objects, such as tents or document cases, were often cut up for re-use, leaving only the outer seams to be disposed of (Keily and Mould, 2017, pp. 240–1). Recycled leather was even used for prestige pieces, such as the embroidered panels from Bloomberg (BZY10, Figure 124), which were made from re-used tent panels (Marshall and Wardle, forthcoming). It is unclear if this propensity for recycling means that the supply of leather was unreliable, or whether this was simply a way of keeping the costs of production low (Keily and Mould, 2017, p. 241).

As well as hides, a number of other products were required for tanning and leatherwork to take place. Some types of shoe required wool for linings (Rhodes, 1980, p. 100), wood and cork for soles (Pugsley, 2003, pp. 32–59), and iron hobnails, creating links between leatherworkers and other craftsmen in Roman London. Whilst Iron Age oil tanning may have relied on specially cultivated *Camelina sativa* plants, which decrease in abundancy after the Roman conquest (van Driel-Murray, 2002a, p. 254), vegetable tanning requires oak bark and galls. Oak was the most common wood used in London for a variety of functions, from construction to charcoal production, and oak bark could have been supplied from the same wild and coppiced woodland around London that supplied these industries (van Driel-Murray, 2001, pp. 60–1). Bark collection is a seasonal activity, taking place in the spring and summer (van Driel-Murray, 2002a, p. 76). A possible bark-harvesting spud, SPU06, may be evidence of the collection of materials for tanning, although neither the date nor the function of this tool can be established with satisfaction.

6.5.4 Leatherworking Sites in London

6.5.4.1 Tanning and Currying Sites

Tanning sites have a number of specific requirements which should make them readily archaeologically identifiable, although van Driel-Murray (2011) cautions that these may not always appear as part of a single complex. Requirements include access to water, a tanning agent and hides (Keily and Mould, 2017, p. 242), and space for multiple interconnected tanks or vats in which the hides could be soaked (van Driel-Murray, 2009). Tanning sites can also be recognised by the presence of waste, although this rarely survives in situ (van Driel-Murray, 2009, 2016, p. 137; Keily and Mould, 2017, p. 242).

Despite this, very few Roman tanning sites are known from the Roman Empire. A tannery perhaps specialising in alum or oil tanned leather has been found in Pompeii (van Driel-Murray, 2001, p. 61, 2009; Keily and Mould, 2017, p. 241), and other tanneries are known from Roman Italy (Leguilloux, 2002). In the northern provinces a small tannery has been located in Vitudurum (van Driel-Murray, 2001, pp. 61–2, 2009), but no unquestionable Roman tanning sites have been identified in Britain (Keily and Mould, 2017, p. 241). Sites suggested to have been tanneries on the basis of large amounts of leatherworking waste have been rejected, as these represent the disposal of leather rather than its manufacture (van Driel-Murray, 2009, 2011, pp. 69–71; Keily and Mould, 2017, p. 241).

Whether tanning would have taken place in London is therefore a matter of debate. Rhodes (1987, p. 176) suggests that a dirty, smelly industry such as tanning is unlikely to have taken place in the city. Others (van Driel-Murray, 2011, p. 74) have pointed to the lack of urban tanneries discovered to suggest that Roman leather was predominantly produced in a rural setting, although no rural tanneries have been discovered either. Butchered cattle remains from Southwark may indicate the processing of hides, with the skull and feet left attached to make them easier to manipulate in the tannery (Ainsley, 2002, p. 271). However, van Driel-Murray (2001, p. 59) doubts the logic of this as evidence of tanning.

The Walbrook valley has frequently been cited as a location for tanning within London. Tanning has been suggested for the middle Walbrook based on Grimes' (1968, p. 97) discovery of 'the surviving portions of a skin held down by the pegs which had been used to stretch it for cutting up' at Bucklersbury House (Merrifield, 1983, p. 104; Maloney, 1990, p. 124; Wilmott, 1991, p. 172). However, the fact that these fragments survived suggests that they had already been tanned, and may have been, as Grimes suggested, pegged out for cutting rather than tanning (Keily and Mould, 2017, p. 243). The possible tanning knife DRW04 (Figure 119) was found in the middle Walbrook valley, but does not have good contextual information associated with it, and may have derived from imported dumped material. DIE02 (Figure 48), also from the middle Walbrook, is perhaps more likely to relate to cooperage than tanning.

Evidence from the upper Walbrook valley is more promising, although conclusive proof that tanning took place here remains lacking. This area has been seen as an ideal location for tanning, being on the periphery of the city and having access to flowing water (Maloney, 1990, p. 81; Butler, 2006, pp. 49–50; Myers, 2016, pp. 317–8; Keily and Mould, 2017, pp. 242–3). A number of clay-lined pits found at 60 London Wall (LOW88) were suggested to be tanning pits (Lees and Woodger, 1990, pp. 17–8), but this could not be confirmed (Keily and Mould, 2017, p. 243). AWL082 was found in a wood-lined structure, possibly a tanning tank, at 8-10 Throgmorton Avenue (TGM99), but the function of this feature is not confirmed, and AWL082 is of an unusual form which may not be related to leatherwork. The probable tanning die DIE03 (Figure 119) was found in the upper Walbrook valley, although as this find is unstratified we cannot know whether it was used here or only dumped here.

Currying was certainly taking place in the upper Walbrook valley. Recent excavations at Drapers' Gardens (DGT06) found thick pieces of uncurried 'crust leather' in a drain and water channel near Building 2 (Keily and Mould, 2017, p. 243). These are the only pieces of this unfinished material found in Britain, and suggest that some stages of currying were taking place here in the first half of the 3rd century (Hawkins, 2009a, p. 44; Keily and Mould, 2017, p. 243), possibly associated with the shoemaking which took place in the same building in the 2nd century (Keily and Mould, 2017, p. 246). The possible skin scraper SCR06 was also found in the upper Walbrook, although it is unstratified.

The tanning knife DRW03 (Figure 119) is interesting as it was found in the west of the city, at St Martin's-le-Grand. This may suggest that tanning or currying was taking place in parts of the city where leather waste has not survived. This peripheral location, on the far western edge of the city, would suit a tanning site (or one on which skins were processed (van Driel-Murray, 2011, p. 76), although the lack of flowing water may suggest that this is unlikely. It may be relevant that this tool was found close to the Cripplegate fort, although with no dating evidence it is not clear if the two are contemporary. The toothed scraper SCR05 may have been used in hide processing at the Beddington Villa, but cannot be dated to the Roman period with certainty.

6.5.4.2 Leatherworking Sites

Unlike tanning, leatherwork has few restrictions on where it can occur. The only structural requirements are a roof, walls and space to lay out hides. With the exception of hammering nails and using punches, leatherwork is not a noisy industry, nor does it produce any waste other than leather scraps, used water and dye. Even in the 19th century, leatherworking workshops and factories could be found within towns, 'in an upper floor garret, or in a dismal basement' (Salaman, 1986, p. 23).

As a result of this, there is very little direct evidence for leatherworking workshops in the Roman world (van Driel-Murray, 2016, p. 138). A building on the Athenian *Agora* was interpreted as a shoemaking workshop on the basis of hobnails on the floor, and was perhaps the workplace of 'Simon the Shoemaker', who figures in Greek philosophical texts (Thompson, 1960; Sellars, 2003). At Cirencester, c.2,000 hobnails and a furnace were found on the floor of a building, potentially indicating the presence of a shoe- or hobnail-making workshop (Wilson, 1975, p. 273; Mac Mahon, 2005, p. 63).

Deposits of leatherworking waste in London (Figure 117) are mainly clustered along the Thames waterfront and Walbrook valley (Keily and Mould, 2017, p. 236). Whilst this is almost certainly due to preservation, with leather only surviving in waterlogged soils, it is curious that only small quantities have been recovered from Southwark, despite the waterlogged conditions here (Keily and Mould, 2017, pp. 236–7, 246). This may suggest that leatherworking was not a major industry south of the Thames.

The Walbrook valley is thought to have been a centre for leatherworking, particularly shoemaking, although the majority of the waste material found here derives from dumps (Keily and Mould, 2017, p. 246). Excavators of sites in the upper Walbrook valley have argued that the quantity of waste recovered from some deposits is so great that it must represent dumping from nearby industries (Lees, Woodger and Orton, 1989, p. 119; Maloney, 1990, p. 124). However, there is evidence of the movement of waste across the city (Chapter 7), and this leather waste could have been produced elsewhere. The only leatherworking workshop to be confidently identified on the basis of waste is a room in Building 2 at Drapers' Gardens (DGT06), where waste products suggested use as a shoemaker's workshop from c. 129-60 AD (Keily and Mould, 2017, p. 246). Unfortunately, this site has yet to be published in full.

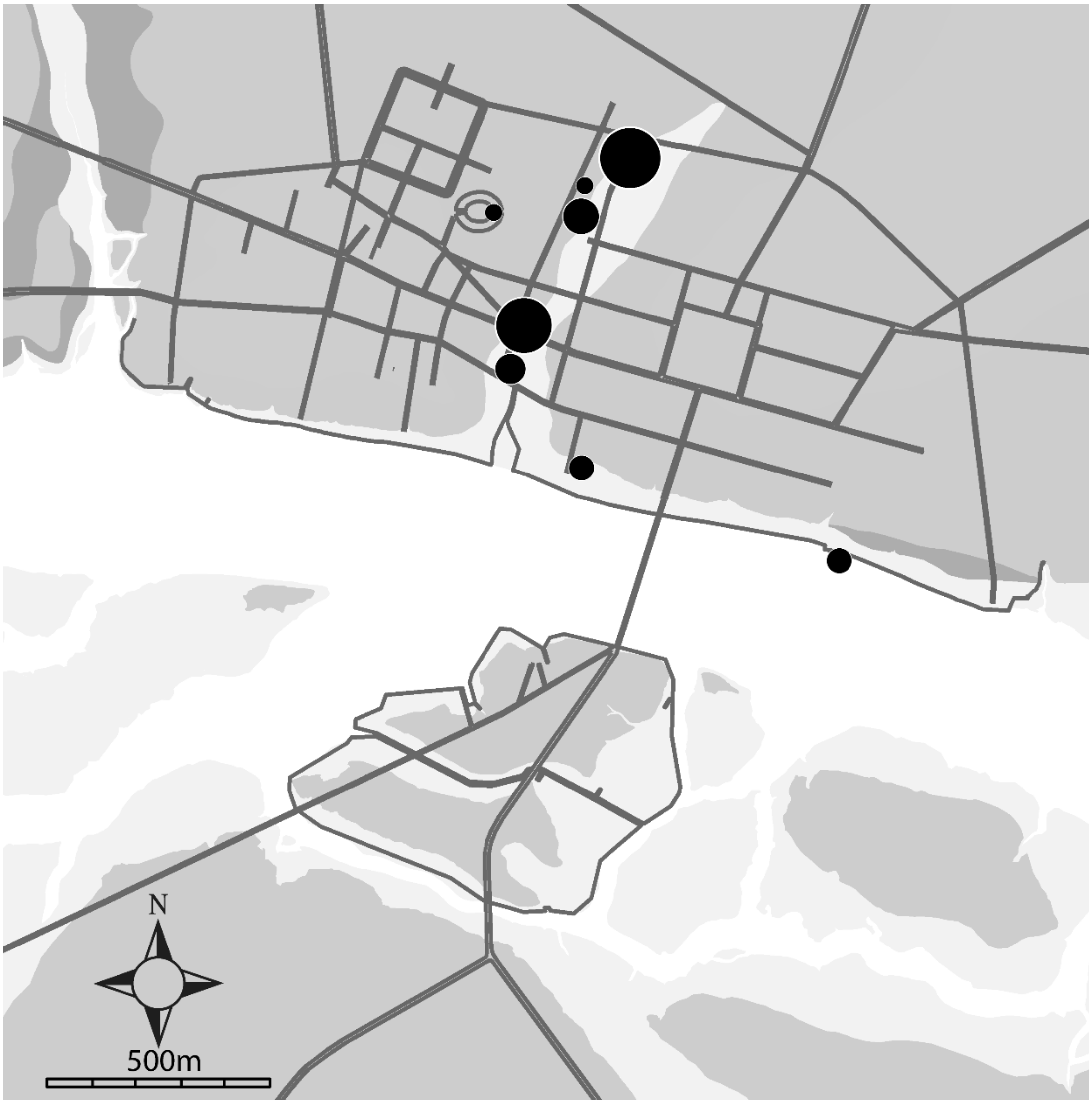


Figure 117 The distribution of leather waste recorded on Museum of London Archaeology's Oracle database (base map © MOLA).

6.5.4.3 The Evidence of Tools

As iron survives in a wider range of contexts than leather, tools may provide new evidence for the location of leatherworkers' workshops in London. The overall distribution of these tools (Figure 118) is similar to that of leather waste, being mostly in the Walbrook, with no certain leatherworking tools coming from Southwark. However, as this pattern is also seen for other tool types (Chapter 7), this is unlikely to be a reflection of the distribution of leather workshops in London. Most of these city finds are unstratified, or come from dumped material which may have originated anywhere in the city. Nevertheless, a few can be associated with local activities.

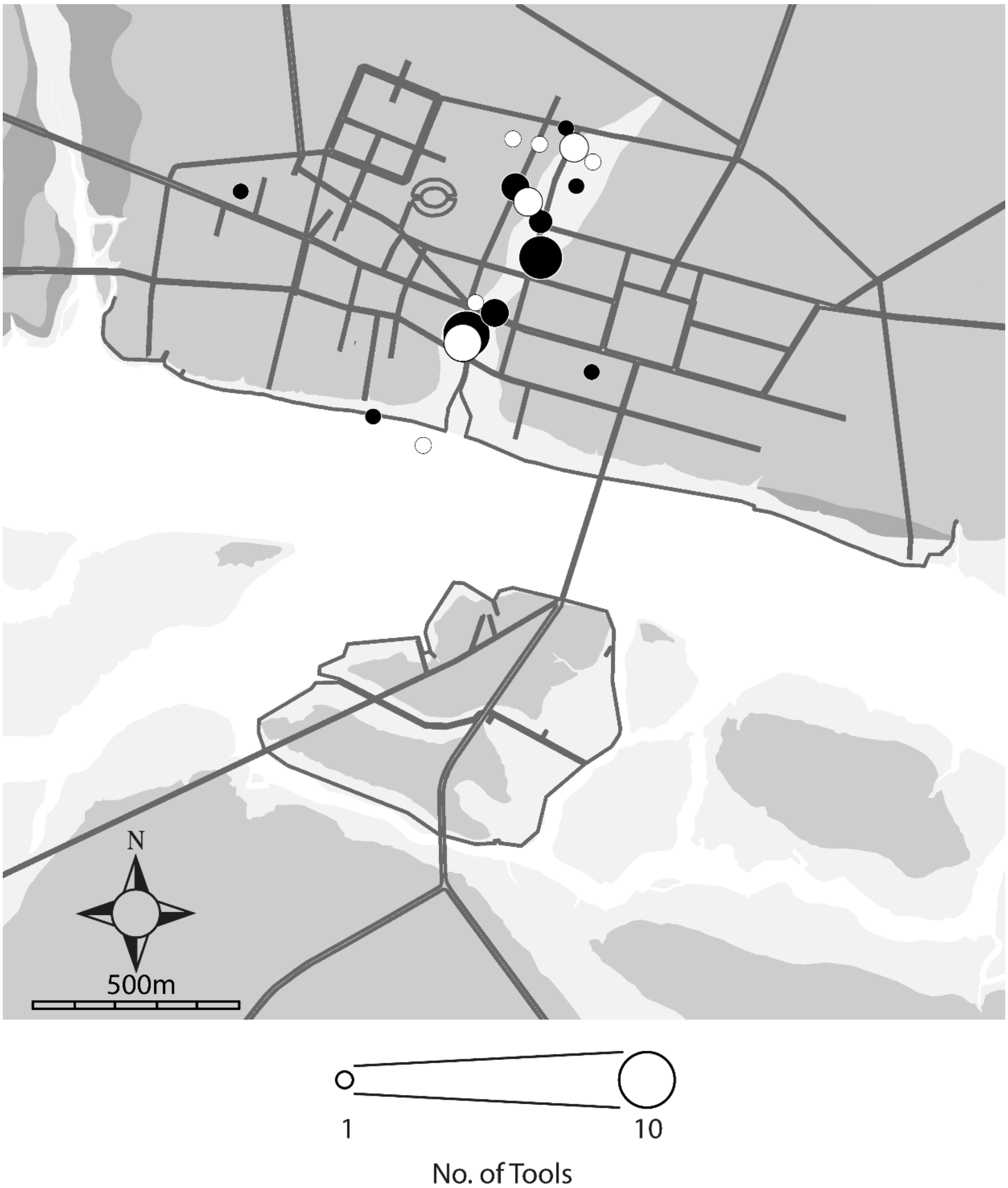


Figure 118 The distribution of leatherworking tools in the city of London and Southwark (White dots = sitecodes. Black dots = street addresses, base map ©MOLA).

Two awls come from floor layers within buildings. AWL046 was found in the brickearth floor of a timber building in the upper Walbrook valley (OPT81). This building contained a number of possible hearths, and may have had an industrial function. However, the other waste from the building, including iron slag, glass waste and furnace lining, and domestic waste (Maloney, 1990, pp. 67–8, 83), does not obviously suggest that this building was a leather workshop. The other, AWL023 from a timber strip building on a Ludgate Hill site (GPO75), can only be tentatively identified as an awl, and does not provide strong evidence for leatherworking.

The possible shoemaker's hammer HAM08 (Figure 121) was found in in-situ demolition rubble from the first phase of a late 1st century residential building on Cornhill (FER97). Although truncated, this appears to have been a reasonably large 'relatively wealthy…middle class' building (Dunwoodie, Haward and Pitt, 2015, p. 107), with painted wall plaster and possibly tessellated floors (Dunwoodie, Haward and Pitt, 2015, pp. 82–3). It is possible that this tool represents shoemaking taking place here, although the identification of this tool is uncertain, and no other tools or waste were found to indicate industry.

A number of other tools derive from cut features. The knife LEA07 (Figure 121) was found in a pit containing leather waste at Bloomberg London (BZY10). Although no associated buildings were found, it is possible that this feature relates to a 1st century leather workshop outside the limit of excavation, possibly fronting onto the main east-west road through the city. Two awls come from cut features at the same site. AWL104 may indicate leatherworking here later in the 1st century. AWL007 may indicate Late Roman leatherworking in the area, although it is possible that this tool is a bradawl.

Four awls (AWL038, AWL044-45, AWL047) come from pits at 60 London Wall (LOW88), a site in the upper Walbrook valley which has also produced large amounts of leather waste and has been associated with leather tanning (Lees and Woodger, 1990, pp. 17–8). It therefore seems likely that these tools were used in leatherwork at this site, although two (AWL044-45) may have derived from dumps rather than pit fills.

There is also some evidence of leatherworking outside of the city. Late Roman leatherworking has been claimed to have taken place at the Shadwell baths, east of the city (Gerrard, 2011b, pp. 98, 103; Keily and Mould, 2017, p. 249), but the evidence for this is limited to a fragmentary awl (AWL109) from a dumped layer, the date of which is open to doubt. A possible leatherworking knife (LEA03) and serrated scraper (SCR05, Figure 119) from the villa at Beddington (BSF81-87) provide more convincing evidence for hide processing and leatherworking outside the city in the Late Roman period, although neither tool can be identified with absolute certainty.

6.5.5 Leatherworking Practice

6.5.5.1 Leather Making Practice in London

Only a small number of tools related to tanning and currying have been found in London (Figure 119). These include two tanning knives (DRW03-04), the die DIE03, and the possible scraper SCR05. Some of the tongs, spades and hooks from London could also have been associated with the movement of hides between tanning pits. Quernstones may have been used in the grinding of oak bark (van Driel-Murray, 2011, p. 76), but are not part of this thesis.

DRW03 and DRW04 could have been used either to remove flesh and hair from hides as part of the preparation process, or to shave hides to the desired thickness as part of the currying process. These tools are rare in the Roman world, and may represent 'particularly large scale

Figure 119 Leather making tools from London (Left, tanning knives, DRW03, DRW04. Top right, tanning die, DIE02. Bottom right, toothed ?scraper, SCR05).

tannneries' or the preparation of particularly thin leathers (van Driel-Murray, 1985, p. 62). As specialised objects, they represent a professionalization of the tanning industry, and may have necessitated the use of large benches.

A pair of iron dies, DIE02 and DIE03, could have been used to mark leather, although DIE02 is perhaps too large for this purpose (Rhodes, 1987, p. 176). Rhodes (1987, p. 175) suggests that most stamps of this type were made before tanning, and may be related to the organisation of tanneries. They may have served to mark the ownership of bundles of hides left for long periods of time in communal tanneries (Rhodes, 1987, p. 176). Some marks were also made after tanning, and are likely to be related to trade. They have been seen as indicating an inter-regional trade in leather, functioning as property markers, customs marks or marks of quality and price (van Driel-Murray, 1977, pp. 159, 162, 1985, p. 61; Rhodes, 1987, p. 175; Baratta, 2008, pp. 8–9). Both kinds of marks suggest that London was an important centre for leather production, but their presence is unusual, as London is the only civilian settlement in Britain on which they are found (Rhodes, 1987, p. 176).

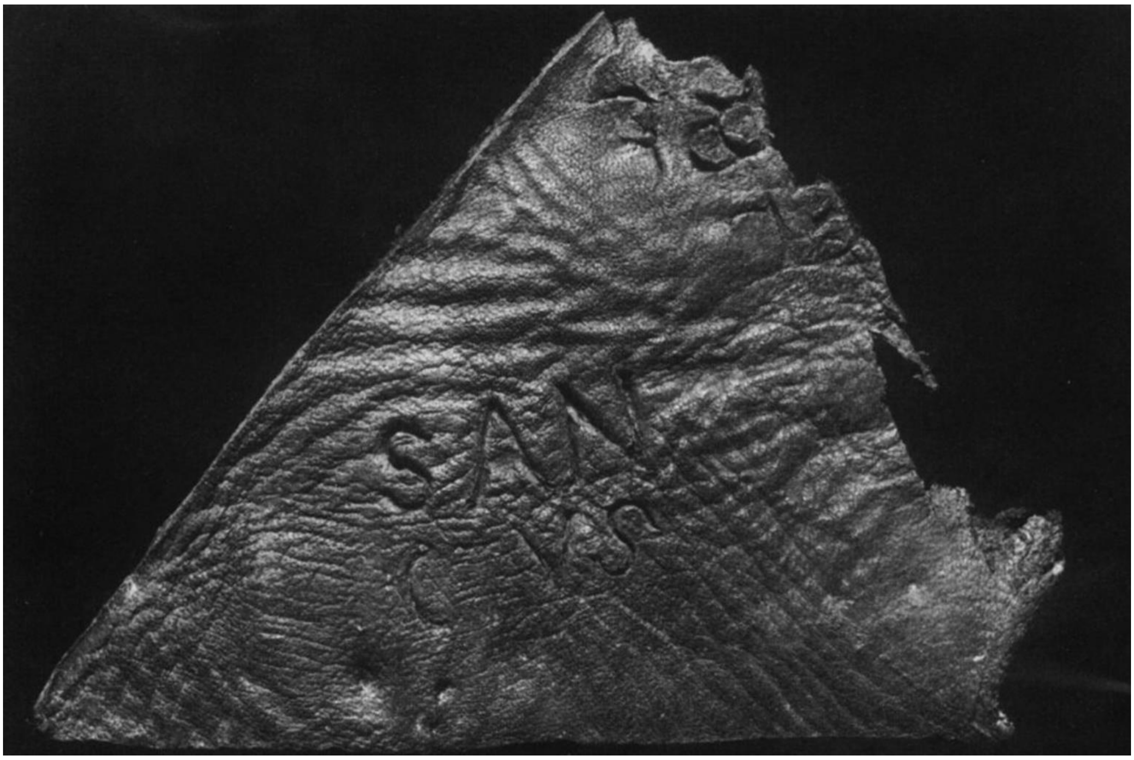


Figure 120 Stamped inscription on a leather offcut from Upper Thames Street (SWA81) (Rhodes, 1987, Pl. XVIII, B).

There is not a clear consensus in the literature as to what the implication of these marks for the scale of the tanning industry should be. They could indicate a level of official control of tanning or hide supply in London (van Driel-Murray, 1985, p. 61), with van Driel Murray (2016, p. 138) arguing that the scale of leather production in the Roman world was such that 'only major entrepreneurs would have the managerial skills and financial resources' to enter it. However, the wide variety of stamps used suggests that tanning was a smaller-scale, private enterprise, rather than a centrally controlled industry (van Driel-Murray, 1977, p. 161, 1985, pp. 61–2, 2016, p. 138). This is supported by the fact that both DIE02 and DIE03 show *tria nominae* (Roman citizens' names) rather than institutional names, indicating high-status but not necessarily official involvement (Rhodes, 1987, p. 175). These stamps may indicate that multiple independent tanners brought their wares to larger centralised tanneries, where stamps allowed their products to be identified when they emerged from the vats years later (van Driel-Murray, 2001, p. 63).

Of the six names identified by Rhodes (1987, p. 175) on leather waste from London, four were Latin, and only two were of Celtic origin, both paralleled on the Continent rather than in Britain. Whilst Keily and Mould (2017, p. 245) take this as evidence of the 'native population' gradually becoming involved in the tanning industry, it is perhaps more indicative of their near total exclusion from control of an industry which may have been an important part of the economy of the Iron Age Southeast (van Driel-Murray, 1977, p. 161; Rhodes, 1987, p. 176).

These manufacturing marks may have been meaningful to Roman tanners and leatherworkers, but not to the consumers of leather goods. The majority of stamps appear to have been considered undesirable, and were cut off from the hide rather than incorporated into finished objects (Rhodes, 1987, p. 173). Stamps could also be applied to finished objects, particularly the soles of shoes (Baratta, 2008, pp. 9–10), but these differ in form to the large letter stamps used in tanning (Figure 128).

Currying tools are very difficult to identify archaeologically, and could have been as simple as rounded stones, bones or fragments of pottery (van Driel-Murray, 2011, pp. 79–80). A rectangular iron card scraper fitted with a wooden handle, found in the tannery at Pompeii, is thought to have been used to smooth the grain of the leather during currying (Leguilloux, 2002, p. 270), and wooden scrapers are also known (van Driel-Murray, 1985, p. 62). It is possible that the flat iron scraper SCR04 was also used in this way, although it has multiple other possible uses. Other possible currying tools from London include the scrapers SCR05 and SCR06, which may have been used to make hides more flexible. Conversely, some of the shoe soles from the Billingsgate Buildings may have been hammered to increase their hardness (Rhodes, 1980, fig. 100), and tools similar to HAM08 may have been used in this way (Salaman, 1986, pp. 124–6, 144, 255–6; Hanemann, 2014, p. 430).

6.5.5.2 Leatherworking Practice in London

Leatherwork in London is represented by awls, specialised knives, hole punches, creasers and a thonging iron. The vast majority of the processes involved in leatherworking use only a small toolkit, consisting of knives, awls, needles and thread. Despite this, a wide range of objects were produced. By far the most common leather objects recovered from London are shoes and shoemaking waste (Hall, 2005, p. 135; Keily and Mould, 2017, p. 246), making them an extremely important resource for studying Roman leatherworking practice. This is because the thick vegetable tanned leather from shoe soles survives better than the thin leather used for shoe uppers, or for other items. Other leather artefacts from London include military tents (Wardle, 1998, p. 87), furniture covers (Hill and Rowsome, 2011, fig. 342, <L22>), satchels and document wallets (Waterer, 1976, fig. 305), and clothing (Wilmott, 1982; Rhodes, 1986; van Driel-Murray, 2002b, 2015). Belt fittings and horse harness fittings indicate that leather belts and straps would also have been used here. Making these different types of objects would have required different combinations of tools and techniques, which may give us an insight into the working practices of London's leatherworkers.

Laying-Out and Cutting

Faint lines can be impressed on leather with awls, providing guide lines for cutting. Examples of scratched template outlines were identified by Rhodes (1980, pp. 103, 115) on shoe soles from London. Numerals incised on some shoes from London have been taken to suggest a form of sizing, with shoes perhaps being produced in batches rather than made to measure (Keily and Mould, 2017, p. 245). This implies the use pre-made templates, although none have been found. Other products, such as toed sandals, appear to have been made to measure, by tracing around the foot of the intended wearer (Rhodes, 1980, p. 119). Four of the awls from London, (AWL039, 47, 68 and 73), have rounded tips, and may have been used as scribing awls for this purpose.

Primary cutting could have been done with specialised half-moon knives, such as LEA01-03, or angled 'bridle' knives, such as LEA04-05 (Figure 121). These tools have wide, curved edges which would have allowed leatherworkers to cut thick leathers accurately. Cutting thick leather with a knife leaves sharp right-angled edges, which could prove uncomfortable in one-piece shoes where the sole was pulled around the foot to form the upper. To counter this, the cut edges of thick leather can be bevelled. Today this is done with specialised edge-bevelling tools, although in Roman London it was achieved through patient work with knives (Waterer, 1976, p. 182).

Wooden-soled shoes were also used in Roman London (Pugsley, 2003, pp. 32–59). The traditional tool for making clogs, the bench knife (Salaman, 1986, pp. 188–9), is represented in

London by two potential examples (BEN01-02), and these may have been used in shaping wooden shoe soles.

Figure 121 Leatherworking tools from London (Top row, leatherworking knives; half-moon knife, LEA01; angled 'bridle' knife LEA04; double-ended knife, LEA07. Middle row, left-right; awls, AWL033, AWL032, AWL045; hammer, HAM08. Bottom row, left-right; awls, AWL056, AWL072, AWL093, AWL094; ?creaser, CRE01).

Assembly

The primary means by which leather objects were assembled in the Roman period were by stitching, thonging, and nailing. Whilst glue was almost certainly used, it does not survive archaeologically (Rhodes, 1980, p. 117). These attachment methods may indicate distinct manufacturing traditions in Roman London. Rhodes (1980, p. 109) has observed that shoes with different patterns of nailing have different methods of attaching the sole to the upper. Over half of the Type B nailed soles at Billingsgate Buildings had tunnel stitching, whilst all but one of the type C shoes was held together with thonging. This demonstrates different craft traditions using different toolkits; Type B shoemakers relied more on awl and needle skills, whereas Type C shoes could have been constructed with more knife work.

Stitching

Stitching appears to have been used on the widest range of leather objects, and Roman shoes and sheet leather objects were sewn with a great diversity of different seam types. The simplest seams were made by piercing directly through a piece of leather (plain/through stitching). Others required the needle to enter one side of the leather and exit through the side of a cut edge (edge/flesh stitching), or to pierce and exit the same surface without going all the way through (tunnel stitching) (Winterbottom, 2009, fig. 496). Some seams had very specific purposes, such as the 'waterproof' seams used for tent panels (Figure 122). These extremely complex seams could require three or four pieces to be sewn together, with different types of stitch used in different places (Winterbottom, 2009, fig. 497).

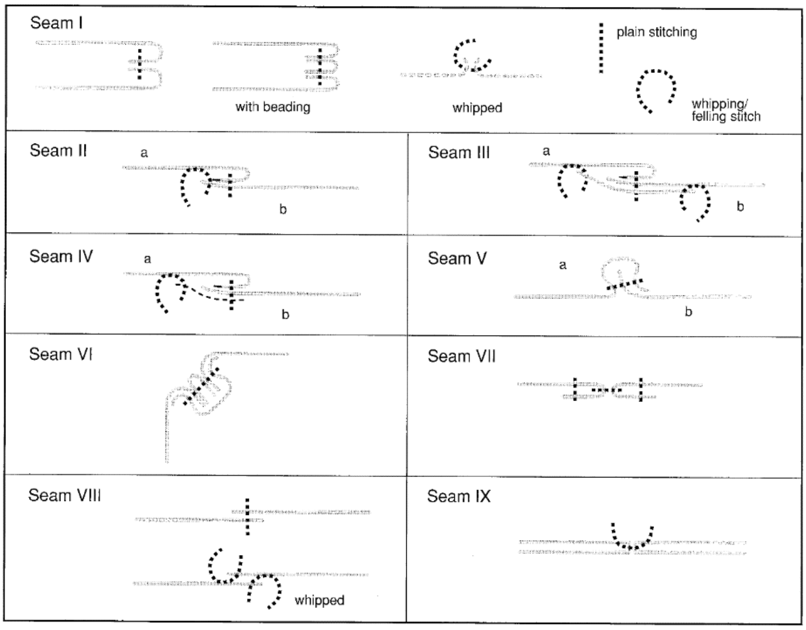


Figure 122 Complex seams used on the tent panels from Carlisle (Winterbottom, 2009, fig. 497).

Whilst thin leathers can be sewn with a needle in the same way as textiles, most leathers require a hole to be made with an awl, through with the thread could then be passed. Needles are not within the scope of this project, but a large number of possible stitching awls have been found. These can be related to the stitch holes found on surviving artefacts.

Modern awls can have S-curved shapes to enable them to pierce curved paths (Salaman, 1986, p. 83), such as those required in tunnel stitching. Tunnel stitches on the shoes from Billingsgate Buildings were made with a round awl (Rhodes, 1980, p. 115). One object from London, AWL033 (Figure 121), fits this profile perfectly, having a round-sectioned blade bent into an S-curve. However, whilst round-sectioned awl blades are the most common type in London, no others have heavily curved blades like AWL033. Four awls (AWL058, 67, 83, and 103) have less dramatically curved blades, which may have been deliberately shaped. Other awls (AWL045, 55, 62, 99 and 103) appear to be bent rather than deliberately curved. This may indicate that the majority of craftsmen used straight awls for tunnel stitching rather than relying on specialist tools.

Other awl holes are elongated rather than round, indicating the use of a flat, oval, or diamond-sectioned awl. The ability to create elongated stitching holes opens up the opportunity for them to be orientated in different directions for different purposes. Although it is not clear to what extent this was routinely practiced in the Roman period, certain objects, such as the stitched panel from the Blackfriars ship (Waterer, 1976, fig. 305), and garment fragments from Regis House (Rhodes, 1986, fig. 7.6-7) clearly show that stitch holes could be angled in a consistent manner. When we look at the 44 possible leatherworking awls from London with surviving tips (Figure 123), we can see that round-sectioned tips are by far the most common. Only eight tools had flat- or diamond-sectioned tips, which would be necessary to produce elongated stitching holes. This may suggest that the majority of the tools from London are scratch awls or scribers rather than stitching awls. However, it is also possible that some of the tools identified as chisel-tipped bradawls are in fact flat-tipped stitching awls with broken points.

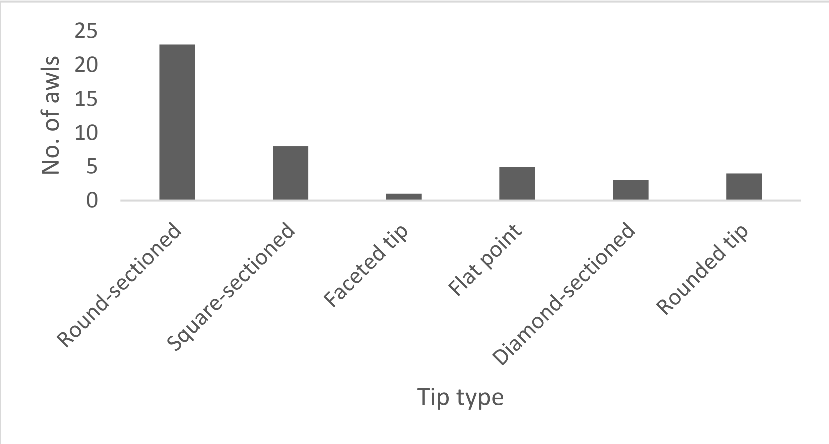


Figure 123 Tip form of the possible leatherworking awls from London.

Stitching can also be used for decorative effect, in the form of stitched-on appliques or embroidered designs (Waterer, 1976, p. 186). Elaborate stitched decoration of this sort can be seen on a mysterious object from Bloomberg (BZY10, Marshall and Wardle, forthcoming), and a possible wallet fragment from the Blackfriars ship (Waterer, 1976, fig. 305). No thread survives in the London objects, although a shoe from Southfleet was embroidered with gold (Rhodes, 1980, p. 117). These pieces of embroidery are particularly interesting as the art depicted is heavily 'Roman' in style, with mythical beasts and palmate leaves. Both the Bloomberg and Blackfriars objects have elongated stitching holes, indicating the use of flat or diamond-sectioned awls, rather than the more common round-sectioned awls.

Figure 124 Unidentified leather object with embroidered decoration from Bloomberg, London (http://news.nationalpost.com/news/archeological-dig-beneath-bloombergs-future-london-headquarters-reveals-ancient-roman-ruins-dubbed-pompeii-of-the-north).

The Bloomberg object is made from six layers of leather, with the stitched design piercing through the entire object. As this object is made from recycled tent panels with reinforced 'waterproof' seams, the stitches which pass through the reinforced sections may be passing through seven layers of leather or more. This is surely too many layers to have been pierced by hand, and may imply that awls were hammered into the leather. Type 5 awls would be particularly well suited to this, being made of nails with wide striking heads. Tanged awls (Types 7-9) may have been used in this way, although this would risk splitting the handle. Nevertheless, a tanged awl from Vindolanda is set into a bone handle with signs of 'heavy battering' (Blake, 1999, p. 39). Whilst several of the Type 1.3 awls show signs of hammering at the butt, only one of these, AWL008, had a sharp tip and is likely to have been used in leatherwork. Others have chisel-like tips, indicating that this type primarily functioned as bradawls. However, it is not impossible that narrow-tipped bradawls, such as AWL012, were used with a hammer to punch elongated holes in leather.

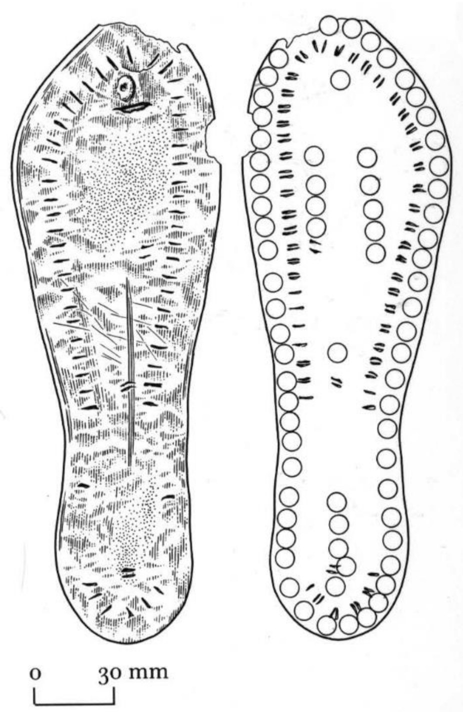


Figure 125 Sandal sole from St Magnus House, showing lines of parallel thonging slits (MacConnoran, 1986, fig. 8.15).

A thonging iron, THO01, is perhaps unlikely to be Roman. This tool would produce three thonging slits in line. However, thonging holes on preserved Roman footwear (Figure 125, Figure 128) run parallel to each other, and cannot have been produced with a tool of this type.

Nailing

The application of hobnails to shoes would have required the use of hammers and shoemakers' anvils. An object from New Fresh Wharf (NFW74[166]<285>) interpreted by Leguilloux (2004, p. 70) as a last or anvil is actually an unusual hoe of probable post-Roman date. The absence of iron shoemakers' anvils from London probably reflects disposal practice rather than use, as these tools have only been found in Britain in ironwork hoards (Evans, 1894, fig. 4; Manning, 1964a, fig. 3.9). Pincers, such as TON08, may have been used to pull the leather into position for nailing. Any small hammer would suffice for shoemaking, although Hanemann (2014, p. 430) tentatively identifies Type 7 hammers, such as HAM08, as specialised leatherworkers' tools.

Cut and Punched Decoration

A number of shoe uppers from London are decorated with elaborate geometric patterns of openwork holes (Rhodes, 1980, p. 115). These appear to have been made in two ways; punching and cutting. Some have extremely regular holes, which must have been made with shaped punches. Three punches of the type needed for this sort of work come from London (HOL01-03), although none are as fine as some of the punched leatherwork. The smallest punch, HOL03, has a 4mm wide tip, whilst a fragment of leather from London has 1mm wide square punched holes (Waterer, 1976, fig. 304). Punches of this type were a new technology in the Roman period (Waterer, 1976, p. 182), and must have been introduced to London at an early date. The only stratified example, HOL03, was associated with mid-1st century demolition debris, possibly from a building destroyed in the Boudican revolt. Gouges with U- or crescent-shaped tips (GOU04-13, Figure 44) may also have been used in leatherwork to cut holes for laces, such as those seen on the 'bikini briefs' from Queen Street (Wilmott, 1982, fig. 35).

Figure 126 Shoes from London with fine punched or cut geometric decoration (left, http://collections.museumoflondon.org.uk/online/object/9017.html) and cut openwork decoration (right, http://collections.museumoflondon.org.uk/online/object/8681.html). Not to scale.

Other shoes with openwork decoration appear to have been made by cutting the holes individually with a knife or chisel (Waterer, 1976, figs 182-4; Rhodes, 1980, p. 123). The larger openwork shapes of one-piece sandals could be made either by cutting the shape out with a knife, or by slicing the leather with a knife, wetting it, and stretching the loop out (Rhodes, 1980, p. 123). Fine decoration could also be made with a knife, with Waterer (1976, fig. 303) highlighting an intricate, possibly knife-cut shoe from the Walbrook valley.

The knives needed for this type of work are different to the large knives used to cut out larger pieces of leather. They will have needed extremely sharp, slender tips to cut small shapes accurately. The small knives LEA06-08 may have been used in these operations, although useable tools could probably have been drawn from the larger pool of knives available in the

Roman world (Manning, 1985a, pp. 108–23), which are not part of this study. Any appropriately sized chisel of Types A-C (Figure 31) could have been used in leatherwork, although CHI17-18 in particular may have been mounted in short handles, which could have made them more suitable to leatherwork than most types of woodwork.

Impressed and Stamped Decoration

As vegetable tanned leather becomes pliable when wet, it is possible to impress designs onto the surface of damp leather with special tools. It is also possible to impress designs onto dry leather with heated metal tools (Waterer, 1976, p. 185).

The simplest form of impressed decoration takes the form of lines, which are made by pressing a tool into the leather and dragging it across the surface. Very narrow examples, such as those seen on the sole of a sandal from 1 Poultry (Hill and Rowsome, 2011, fig. 401, <L1>), can be made with an awl. Wider lines, such as those seen on furniture covers also from 1 Poultry (Hill and Rowsome, 2011, fig. 342, <L22>), will have required a blunt tool, such as a creasing iron (Salaman, 1986, p. 247). No creasers have been identified with certainty in London, although possible examples come from Bloomberg (BZY10, CRE03) and the Bank of England (CRE01-02, Figure 121). These designs were both made with the aid or a ruler or straight edge of some kind, but this technique can also be used to produce figurative design, as seen on a horse mask from Newstead (Waterer, 1976, fig. 294).

Figure 127 Fragments of a leather wall or furniture covering with linear incised decoration from 1 Poultry (Hill and Rowsome 2000, fig. 342, <L22>).

More complex repeated designs will have been made with specially formed dies, which are hammered into the wet leather. Stamps of this kind are seen on the soles of toe sandals (Figure 128), although only from the 1st to mid-2nd century (Rhodes, 1980, p. 119), and are otherwise rare. Some appear to be purely decorative, but others may be maker's marks, and might represent guarantees of quality for products made in quantity in specialised workshops and exported to regional markets (van Driel-Murray, 1977, p. 162; Collingwood and Wright, 1991, p. 28). Repeated stamped designs were also used on sandal uppers, such as the gilded upper from St Magnus House (Figure 129). No dies suitable for making marks of this kind were found in London. The only figurative die from London, DIE05, is too large to have been used in this way.

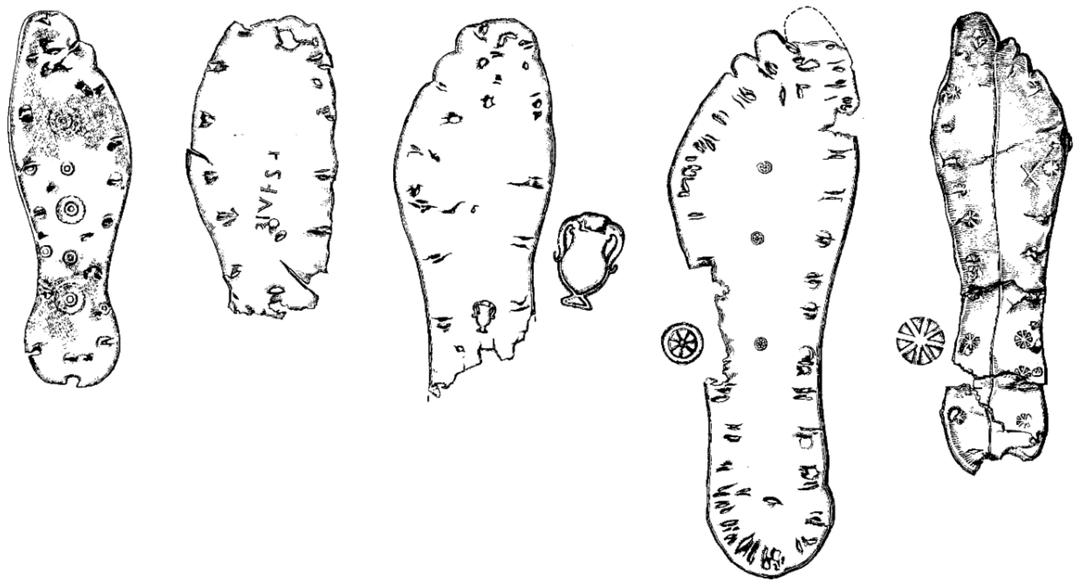


Figure 128 Shoe and sandal soles with stamped designs from Billingsgate Buildings (Rhodes, 1980, fig. 66, (from left-right) 614, 619, 623, 628, 631).

Vegetable tanned leather can also be elaborately 'carved' by wetting the surface and creating freehand designs with flat and textured punches. Leatherwork of this type was widely practiced from the middle ages, but is not common on Roman period leatherwork. An unusual example on the upper of a slipper from St Magnus House has been embossed from the reverse side with two small busts (MacConnoran, 1986, fig. 8.27). It is possible that this was carried out using tools similar to those interpreted as tracing tools (FIN01-23, Figure 100).

Colouring and Gilding

Although surviving Roman leather artefacts are always dark brown or black, this is purely a result of the taphonomic conditions that allow them to survive. Vegetable tanned leather is naturally light buff or tan in colour, and can be coloured by painting or dying. Some shoes may have been dyed black with copper-vitriol (Rhodes, 1980, p. 101), as described by Pliny (*The*

Natural History, 34.32), and a shoe from Southfleet may have been dyed purple (Rhodes, 1980, p. 117). Unfortunately, dying and painting can rarely be identified on Roman leatherwork due to poor preservation (Waterer, 1976, p. 186; Rhodes, 1986, p. 211).

Gilding, although almost certainly rarer than dying or painting, does survive, with examples of elaborately patterned gilded footwear coming from London (Hawkins, 2009b, fig. 14; Pre-Construct Archaeology, 2009, p. 34) and Egypt (Philipp, 1968; Pre-Construct Archaeology, 2009, p. 34). Gilded patches on a statue of Venus from Pompeii may imply that gilding was also applied to leather clothing (van Driel-Murray, 2015, p. 208), although none has been found.

Figure 129 Fragment of gilded footwear from New Fresh Wharf (Museum of London).

Mercury gilding requires the object to be heated, and is therefore unsuitable for use on leather. Instead, gold can be applied to leather in the form of gold leaf applied with a brush to an area of adhesive on the leather surface. Egg white has been used for leather gilding since at least the 10th century (Waterer, 1956, p. 174; Cherry, 1991, p. 304; Jervis *et al.*, 2010, p. 116), and is recommended as an adhesive for gilding stone by Pliny (*The Natural History*, 30.20) (Oddy, 1981, p. 77), although a more complicated recipe is recommended for wood (Pliny, *The Natural History*, 35.17). Adhesives do not survive archaeologically (Oddy, 1981, p. 76), and so it is unknown exactly how leaf was applied to the shoes from London. A suite of brush holders and dull copper alloy knives (BRU01-07, Figure 130) have been interpreted by Raux (2015, pp. 687–95) as gilding tools, and as such may have been involved in the production of gilded footwear. These tools are clustered along the Walbrook and Thames waterfront, although as all derive from dumped deposits it is unclear whether they were used here.

Figure 130 Copper alloy brush holders from London (Top, brush handle/knife, BRU0. Bottom, double-ended brush handle, BRU07).

6.5.6 Discussion

The tools from London show an expanding tool kit, with new objects appearing with the conquest to support new technologies and social structures relating to both leather making and leather working.

Although it has not been proven without doubt that all stages of the tanning process took place in London, there are tools within the city that indicate de-hairing and fleshing of hides, marking them for immersion in tanning baths, and possibly tools for dressing the hides after processing. These objects tentatively suggest that tanning did take place within the city. These tools are also consistent with the tanning of hides by professional tanners; possibly a new social class introduced during the Roman period. Most suggestive of the changing social dynamics of tanning is DIE03, which indicates control of aspects of this industry by Roman citizens, as well as highlighting the scale of the possibly communal tanneries of the Roman world. These objects stand in contrast to the suggested picture of Iron Age tanning, based around domestic work by women.

A larger number of tools are related to leatherworking, however. These objects indicate a wide variety of practices, from simple laying out of patterns and cutting, to elaborate stitching and possibly gilding. The toolkit is basic, and even where specialisation can be seen, for example in awl form, this is not seen on the vast majority of the tools. This craft will also have used easily available domestic tools not studied here, such as needles and shears. As such, there may have been a comparatively low barrier to amateurs and newcomers entering the leather trades (van Driel-Murray, 2016, p. 139), and this may explain the ubiquity of leather scraps in the waterlogged parts of London. The relative simplicity of the tools involved does not diminish the level of technical knowledge required to make the types of leather objects found in London, however; types which demonstrate an awareness of classical art conventions and Empire-wide fashions.

6.6 Masonry and Stonework

This section will examine the evidence for construction and sculpture in stone, mortar and ceramic building materials (CBM). Twenty-two tools possibly associated with masonry and stonework come from London, including trowels, picks, chisels, and a crowbar. The Roman period sees a massive expansion in the use of stone, mortar and CBM, which were not widely used in the pre-Roman Iron Age (Blagg, 1990, p. 33). These new industries required new skills and tools (Scott, 2017, pp. 309–10), and many of the earliest people working with masonry in Britain may have been immigrants.

6.6.1 Masons and Stoneworkers in Roman London

Sculptors are thought to have travelled widely in the course of their work, and some monuments in Britain are thought to be the work of migrant craftsmen from the Continent (Scott, 2017, p. 309). A Gaulish sculptor from Chartres is recorded on an inscription at Bath (Henig, 2012, p. 120). In London the earliest stone sculpture is thought to have been the work of Continental craftsmen. The Screen of Gods and London Arch share more stylistic traits with monuments in the Rhineland and eastern Gaul than others from Britain (Henig, 2012, p. 122; Coombe *et al.*, 2015, pp. xxix–xxx). The use of stone from military-controlled sources indicates that early sculptors in London may have been part of the Roman military (Coombe *et al.*, 2015, p. xlii). Nevertheless, schools of stonemasons existed in Britain by at least the late 2nd or early 3rd century, by which time the proliferation of stonework indicates a degree of local production (Pritchard, 1986, p. 176; Scott, 2017, pp. 309–10).

Sculptors continued to be mobile within Britain (Henig, 2012, p. 121). Henig (1996) has suggested, on the basis of style, that much of the limestone carving in London was carried out by sculptors from the Cotswold region. This is supported by petrological analysis, which shows that the stone for these sculptures also came from the South Cotswolds (Coombe *et al.*, 2015, p. xxii). Another explanation for this may be that the sculptures were carved in the Cotswolds and brought to London as complete objects, although this is considered unlikely for fragile limestone carvings (Henig, 1996, p. 98). The movement of sculptors within Britain is also suggested by a carved *genius* from Southwark, executed in a style from the Carlisle region but made of sandstone quarried in Surrey (Henig, 2012, p. 122; Coombe *et al.*, 2015, p. xxii). Mosaicists of the 'saltire school', based in Bath, also operated in London (Henig, 1996). No stonemason's workshops have been excavated in Britain, however (Pritchard, 1986, p. 175).

Plasterers are also thought to initially have been immigrants, with early wall paintings from London showing similarities with the Cologne region (Henig, 2012, p. 118). However, styles unique to Britain soon emerge, indicating that local workshops were established quickly (Davey and Ling, 1981, p. 48). Regional schools of plaster painting are not easily discernible, indicating that this craft was practiced by a wider number of less specialised craftsmen than sculpture or mosaic making (Davey and Ling, 1981, pp. 48–51).

6.6.2 Raw Materials Supply to London

6.6.2.1 Stone

Stone was not widely used in pre-Roman Britain, necessitating the establishment of new quarries and supply lines after the conquest. The early exploitation of fine stones from quarries near Roman military establishments, coupled with the importation of Continental stones from quarries linked to the military, indicates that London's 1st century stone supply was controlled by the army (Coombe *et al.*, 2015, pp. xlii–xliii). Some quarries may have been opened specifically to supply London with stone (Hayward, 2009, p. 106). It is not clear to what extent this continued into the 2nd and early 3rd centuries, which are characterised by a diversification in stone sources and the rise of the use of Jurassic Ridge stones. The importation of stone from northern Gaul in this period may indicate the continued importance of the army through the *Classis Britannica*; a suggestion supported by the lack of imported stone after the *Classis Britannica* ceases to operate (Coombe *et al.*, 2015, pp. xliii–xliv).

Sculpture in London was carried out predominantly in oolitic limestone from the Jurassic Ridge, mostly from the Cotswolds and Lincolnshire (Henig, 1996, pp. 97–8; Hayward, 2009, p. 103; Coombe *et al.*, 2015, p. xxii). Other British stones used in decorative work include Purbeck marble (Isle of Purbeck, Dorset), 'Forest' marble (Alwalton, Northamptonshire), sandstones from Kent and Surrey, limestone and shale from Somerset and the Weald, and chalk from Southern Britain (Pritchard, 1986, p. 175; Coombe *et al.*, 2015, pp. xl–xli). Kentish ragstone, a hard sandstone, was widely used for construction in London, for example in the city walls (Blagg, 1990, p. 39). Recycling would also have supplied some of the stone used in London; for example, elements of a monumental arch and screen were later incorporated into the city wall (Hill, Millett and Blagg, 1980; Blagg, 1990, p. 40; Fulford, 2008, p. 41).

Figure 131 The 'Minories Eagle' sculpture in oolitic Cotswold limestone, late 1st or early 2nd century (Lerz, Henig and Hayward, 2017, figs 4-5).

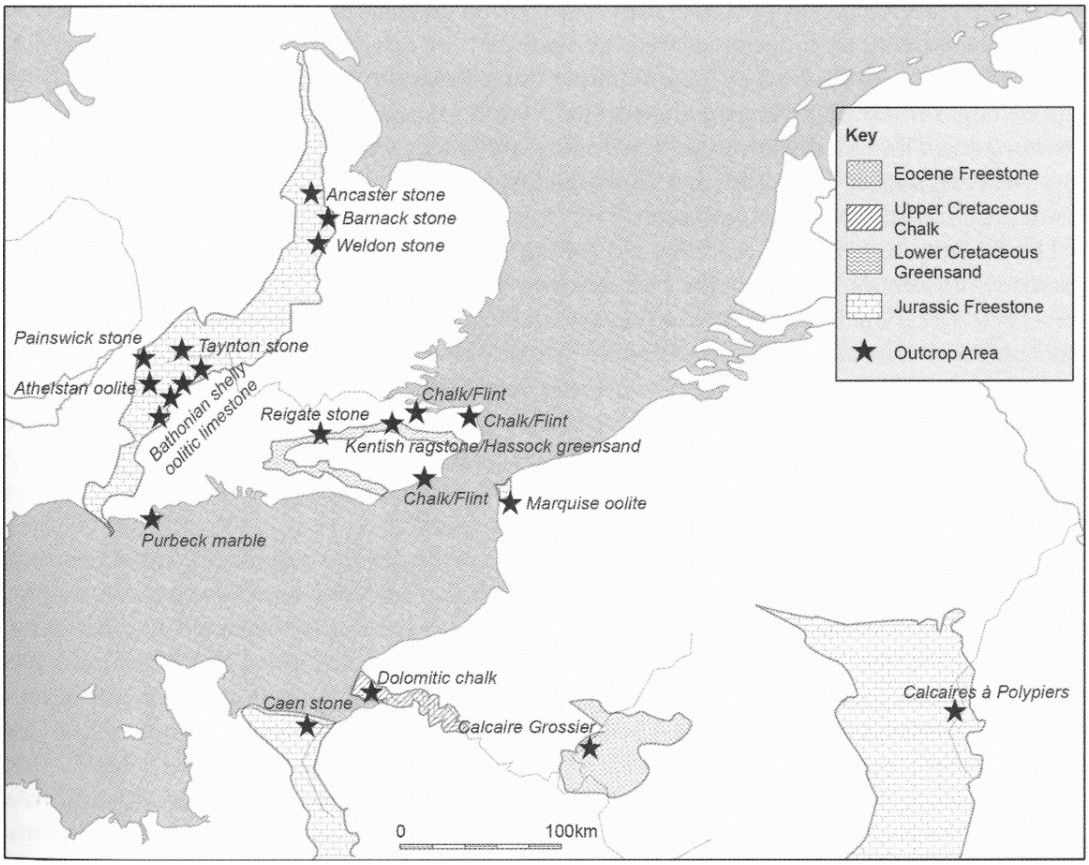


Figure 132 Sources of freestone used in south-eastern England (Coombe *et al.*, 2015, fig. 1).

Imported stones were also used in London. Limestone was imported from northern Gaul for use in sculpture (Pritchard, 1986, p. 175; Coombe *et al.*, 2015, pp. xxii, xxxix–xl), and the London area displays the widest use of marble for decorative inlay and sculpture in Britain (Coombe *et al.*, 2015, p. xxxiv). Fourteen types of marble have been identified in London, most of them originating in the eastern Mediterranean (Pritchard, 1986, pp. 171–5). The majority of this marble is thought to have been brought to London as ready-carved finished products (Henig, 1996, p. 98; Coombe *et al.*, 2015, pp. xxii, xxxiv–xxxv), although shipwrecks of only partially carved marble have also been found in the Roman world (Strong and Claridge, 1976, pp. 196–7; Pritchard, 1986, p. 175), and some amount of assembly and inscription carving must have taken place in London (Coombe *et al.*, 2015, pp. xxiii–xxiii).

Most of the stone used in London is likely to have arrived by ship. The Blackfriars shipwreck contained a cargo of Kentish ragstone, with marine barnacles on the hull showing that it had been brought along the coast from Kent (Henig, 1996, p. 97; Coombe *et al.*, 2015, p. xxii). Whilst some of the imported stone may have arrived as ballast (Buckland and Sadler, 1990, pp. 115–8), this cannot have accounted for the larger pieces. Although much of the diversity in marble use may result from London's place as a redistributive centre, some marble products are not found elsewhere along the coast, and may have been direct orders from Italy (Blagg, 1990, p. 47).

Quern Stones

Querns are one of the few stone products to have been widely manufactured and used in the pre-Roman Iron Age in Britain. Despite this, the Roman period saw the exploitation of new stone sources for quern production in the London region (Green, 2017, p. 157). The closest sources of millstones to London are in Hertfordshire and Worms Heath, Surrey, where Puddingstone querns were quarried in the 1st century (Green, 2011, 2017, pp. 169–71; Peacock, 2013, p. 73). Other British stones used for milling include Monmouthshire Old Red Sandstone (Shaffrey, 2006; Peacock, 2013, p. 72; Green, 2017, p. 171), and greensand stones from Sussex and Folkestone (Peacock, 2013, p. 73; Green, 2017, pp. 160–6). Large amounts of Mayen lava stone, from the Eifel region of Germany, were also imported for use in querns (Watts, 2002, p. 33; Peacock, 2013, p. 72; Green, 2017, pp. 171–4), as were smaller amounts of French *poudingue* (Green, 2017, pp. 167–9). London is thought to have been the main port into which these stones were imported (Green, 2017, p. 173).

6.6.2.2 Ceramic Building Materials (CBM)

Whilst it is thought that the majority of the CBM used in London was made locally, brick and tile-making sites are underrepresented in the London area (Betts, 2017, p. 368). Where it has been located, CBM manufacture is unsurprisingly related to pottery manufacture (Seeley and

Drummond-Murray, 2005, p. 143). Kilns and wasters have been found at Paternoster Square (SLY00) and 120 Cheapside (CDP04) (Betts, 2017, p. 369), where pottery production also took place (see p.249). There is also a growing recognition that CBM could be transported long distances, with tile in London coming from Kent and the Verulamium region (Betts, 2017, pp. 371–6); areas of the country which also supplied London with pottery (see p.249) and building stone.

Procuratorial stamps on tile wasters from 120 Cheapside (CDP04), and on CBM from public buildings in London (Figure 133), indicate that some of the tile production in London was controlled by the state until c. AD 120-215. A small number of tiles stamped by the *Classis Britannica* are also evidence of official control of aspects of the CBM supply. However, a large number of civilian tile makers' stamps are also known from the late 1st and mid-2nd centuries (Figure 134), probably relating to commercial production for the civilian construction trade (Betts, 1995, 2017, pp. 369–70, 378–9).

Figure 133 Procuratorial tile stamp from Die 1, London. Read as 'p(rocuratores) p(rovinciae) Br(itanniae) Lon(dini)' - 'The procurators of the province of Britain at London' (Betts, 1995, fig. 1, 1).

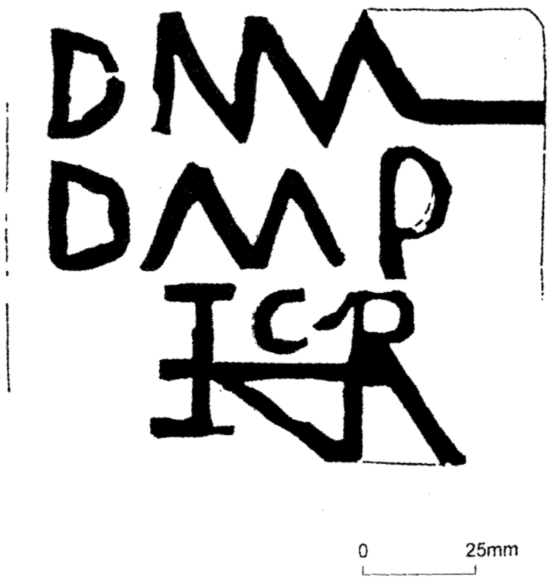


Figure 134 Civilian tile stamp from London. Read as 'D(ecimi) M(...) Val (...) /D(ecimi) M(...) P(...) / (figlinae) tegul(arinae)' - 'Tile (kilns) of Decimus M... Val... (and) Decimus M... P...' (Betts, 2017, fig. 17.2).

6.6.2.3 Plaster and Mortar

Plaster and mortar are both produced by burning and rehydrating (slaking) lime (Dix, 1979, 1982; Davey and Ling, 1981, p. 52; Adam, 1994, pp. 65–73) Chalks available in the Thames basin would be suitable for lime production (Davey and Ling, 1981, p. 52; Bird, 2017b, pp. 42–4), although the recycling of imported limestone masonry and statuary may also have provided some of the raw materials. Although the scale of lime burning in the Roman period is not well understood, lime would presumably have been widely available due to its possible use in other industries as well as construction (Dix, 1979, 1982; although van Driel-Murray, 2001, p. 60 disputes the use of lime in Roman tanning).

The majority of the pigments used in wall paintings in London (ochre, soot, and green earth) were naturally occurring, although some chemically manufactured pigments, such as Egyptian blue, were used to a lesser extent. Imported pigments, such as cinnabar, were also used sparingly, although more frequently in London than elsewhere in Britain (Goffin, 2011, p. 488).

6.6.3 Masonry Practice in London

The tools and techniques discussed here can be broken into four groups; those used in shaping and carving stone, those used specifically in quernstone maintenance, those used in moving stone blocks on a construction site, and those used in making and applying mortar and plaster. In addition to these, stone masonry and construction in London will have drawn on a wide variety of other tools and techniques; primarily those discussed elsewhere amongst woodworking (see p.90) and metalworking tools (see p.178).

6.6.3.1 Stone Shaping and Carving

Rough Shaping

Three picks of the sort interpreted as ‘quarry picks’ (PIC01-03, Figure 135) have been found in London, despite London having no local stone suitable for building work. Although possibly used in digging or gravel extraction, these tools may have been used to break apart and roughly dress large stone blocks, such as those used in the construction of the city wall. Axes and adzes may also have been used in the rough shaping of blocks (Blagg, 1976, p. 156), such as those in the riverside wall (Hill, Millett and Blagg, 1980, p. 190), although most appear to have been used for woodworking. The double-bladed axe AXE28 (Figure 135) is similar to stoneworking axes depicted in sculpture (Blagg, 1976, p. 156), and has burred edges. This axe is unique in Britain, although its Roman date is not certain. The bearded AXE25 also has a heavily blunted edge, which could indicate its use in stonework. The large bolster chisel MAS03 (Figure 135) also probably relates to work of this kind, as it would be well suited to squaring smaller building blocks. CHI50, a possible stone-working chisel, was found in a layer behind a masonry wall in the Guildhall amphitheatre, although as this structure was mostly wooden it is not impossible that this is a woodworking tool.

Figure 135 Stone dressing tools from London (Left, bolster chisel, MAS03. Right, top-bottom; axe, AXE28; quarry picks, PIC03, PIC01).

Stone Carving

A small number of chisels from London are likely to be related to stone carving (Figure 136). Surviving decorative stonework suggests that most of the shaping in London was carried out with a point (MAS01, Figure 136) or chisel (MAS02, Figure 136) (Hill, Millett and Blagg, 1980, p. 190; Pritchard, 1986, p. 177). There is a small body of work devoted to the specifics of chisel use in Greek and Roman stone carving (Rockwell, 1990; Durnan, 2000, pp. 26–34; Wooton, Russell and Rockwell, 2013). However, much of this literature relates to differences in technique, such as the angle that a chisel is held, which are not readily addressed through the tools alone. No differences in technique could be seen between the different styles of sculpture in London (Pritchard, 1986, p. 177). The London tools nevertheless provide some potentially interesting additions to this picture. The small bolster chisel (MAS04, Figure 136) may have been used for lettering. This chisel can be paralleled in Avenches (Duvauchelle, 1990, No. 82), potentially indicating the presence of specialised Continental-type inscription-carving tools in London. Although marble panels were probably imported to London ready-carved, it is likely that some inscriptions were added on arrival (Coombe *et al.*, 2015, p. xxiii). The fact that many inscriptions from London are executed well and 'betray no local factors in their carving style' (Coombe *et al.*, 2015, p. xxiii) may support the identification of MAS04 as indicating the presence of trained masons.

The sculptor's pick (PIC05, Figure 136) is not widely recognised in Roman sculpture. It is possible that marks from tools such as this have been misidentified as marks from a point chisel, and this tool may have been used in the initial shaping of stone sculpture. Drills were also used in stone carving, both to drill holes and to cut running channels (Durnan, 2000, p. 32), and some of the Type 1 and 2 drill bits from London could have been used in this way, although drilling was not common in London (Hill, Millett and Blagg, 1980, p. 190).

The toothed chisel is absent from London. This is not surprising, as this tool was used much less widely in Roman sculpture than in Renaissance or modern practice, and was not used on small statuary (Rockwell, 1990, p. 216) or any of the stones from the riverside wall (Hill, Millett and Blagg, 1980, p. 190). Two objects, SCR05 and SCR06, may be toothed scrapers, although neither of them is certainly Roman, and these tools have uses outside of stonework. Rasps, such as FIL11 were also used to smooth stonework in London (Hill, Millett and Blagg, 1980, p. 190).

Figure 136 Stone carving tools from London (Top row, left-right; sculptor's pick, PIC05; bolster chisel, MAS04. Bottom row, left-right; point, MAS01; chisel, MAS02; mortice chisel/lewising tool CHI42).

Stone Sawing

A number of pieces of stone veneer have been found in London, dating from the AD 60s onwards (Pritchard, 1986, pp. 177–82). These would have been used as wall or floor coverings, and were held in place with iron clamps rather than mortar (Pritchard, 1986, p. 182; contra Adam, 1994, p. 228), necessitating the cooperation of mason's and metalworkers. Veneers are too thin to be produced with percussion tools, and were instead cut with abrasive saws. Some types of whetstone were also produced by sawing, although others were carved with chisels (Allen, 2014, p. 9).

The stone saws used in veneer cutting were large pieces of machinery, some of which had multiple parallel blades working at once (Figure 137). Those used for hard stones would have had no teeth, instead cutting with an abrasive paste. Softer stones could be cut with toothed saws (Seigne, 2000, pp. 224–5). Whilst it is likely that these veneers were cut at the quarry (Blagg, 1990, p. 46), saw marks on the floor of a bathhouse at Vieil-Eveux (Seigne, 2000) show that this could also take place on site. No saws obviously used in stone-cutting were found in London, although it is not impossible that some of the larger toothed saw blades could have been used to cut soft stones, such as limestone. Little is known about the saws used to cut whetstones (Allen, 2014, p. 9).

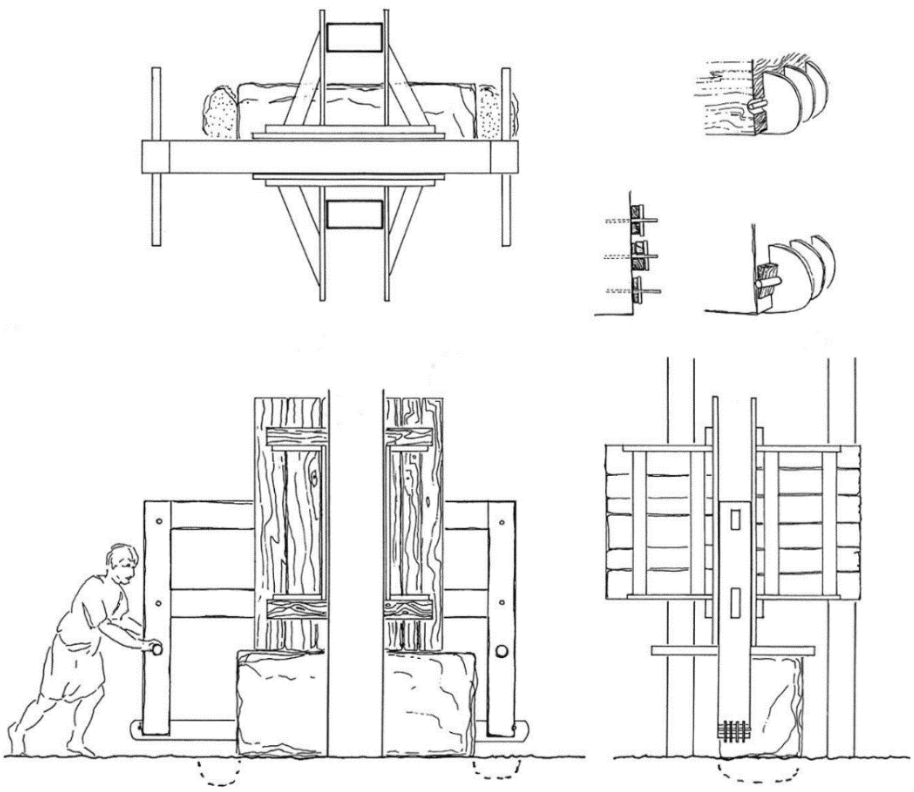


Figure 137 Reconstruction of the multi-bladed stone-cutting saw from Vieil-Evreux (Seigne, 2000, fig. 7).

Other Stone Shaping Practices

Stone shaping can also make use of the lathe, for example when turning shale furniture legs (Scott, 2017, p. 309), armlets (Liversidge, 1976, p. 162), or columns (Blagg, 1976, pp. 165–8). This potentially brings the lathe-turning chisel CHI45 into the realm of stoneworking. However, I am aware of no direct evidence for the production of lathe-turned stonework in London. No mosaicists' tools were found in London, although a dump of chalk chippings at the General Post Office site (GPO75) may indicate the location of mosaicist's workshop on Ludagte Hill (Pritchard, 1986, p. 175).

6.6.3.2 Quernstone Maintenance

A group of tools from London (PIC06-09) have been tentatively identified as millstone picks, and may have been used in the manufacture or maintenance of quernstones or millstones. A number of quern- and millstone types were used in the Roman period, including hand-operated rotary querns, and larger animal or water powered mills. There is considerable typological, chronological and regional variation in quernstone form (Watts, 2002, pp. 33–8; Peacock, 2013, pp. 72–6, 80–2, 102–19), and a number of rotary quern types are known from London (Green, 2017). Fragments of 'Pompeiian' hourglass mills, which may have been animal or water powered, have also been found in the Walbrook valley (Williams and Peacock, 2011), along with wooden elements of possible mill machinery at Bloomberg (BZY10, Marshall and Wardle, forthcoming; Myers, 2016, p. 325). It is therefore possible that a water mill operated in the Walbrook valley (Wilmott, 1991, p. 177; Myers, 2016, pp. 325–6), although no structural evidence has been found.

It is not clear where quernstones were manufactured. Near the quarry is the obvious site, and Hertfordshire Puddingstone querns are thought to have been manufactured around Verulamium for a short period from 50-100 AD (Green, 2011; Peacock, 2013, p. 73). However, it has also been suggested that querns, including Continental lava querns, were traded as partially worked blanks and manufactured closer to the point of use, including in London (Watts, 2002, p. 33; Green, 2011, p. 130, 2017, p. 174). Manufacturing querns required a range of picks and wedges. Cutting the central holes probably required a large drilling machine and a series of large, tapered bits, none of which have been found archaeologically (Green, 2011, pp. 127–8). It seems unlikely that the small 'millstone picks' from London could have been used in manufacture.

Figure 139 Dressed millstones from 1 Poultry (Hill and Rowsome, 2011, fig. 316).

Millstones will also have required maintenance in order to remain effective grinding tools (Watts, 2014, pp. 39–40). Dressing the grinding surfaces of the stones with peck marks and grooves allows for more efficient cutting (Lepareux-Couturier, 2014; Watts, 2014, pp. 39–40), but this would need to be refreshed as the stones wore down. Quernstones from Bloomberg (BZY10) show clear evidence of having been re-dressed after heavy wear (Marshall and Wardle, forthcoming). Some of this work may have been carried out with small picks of the type identified in London. A funerary relief from Chieti, Italy (Figure 138), shows a man with a double-headed pick standing over a partially deconstructed 'Pompeiian' mill. This may be intended to show a mill in the process of being repaired, although it is also possible that it depicts the destruction of a mill to mark the death of the baker (Peacock, 2013, frontispiece). The tool in this image is not shown in detail. It may be a large millstone pick, although it more closely resembles the larger double-sided picks shown in quarrying scenes (Wooton, Russell and Rockwell, 2013, p. 2; Hanemann, 2014, Abb. 362, 11).

Figure 138 Relief from Chienti, showing the destruction or dressing of a Pomepeiian mill (Peacock, 2013, frontispiece).

6.6.3.3 Moving Stone Blocks

A small number of tools from London relate to the movement of masonry blocks on a construction site. The simplest is the crowbaw CBR01, which may have been used to lever large blocks into place (Adam, 1994, pp. 53–4). Carved spike/pry holes on surviving Roman masonry, including the riverside wall in London (Hill, Millett and Blagg, 1980, p. 186), show that they were used in this way (Figure 140).

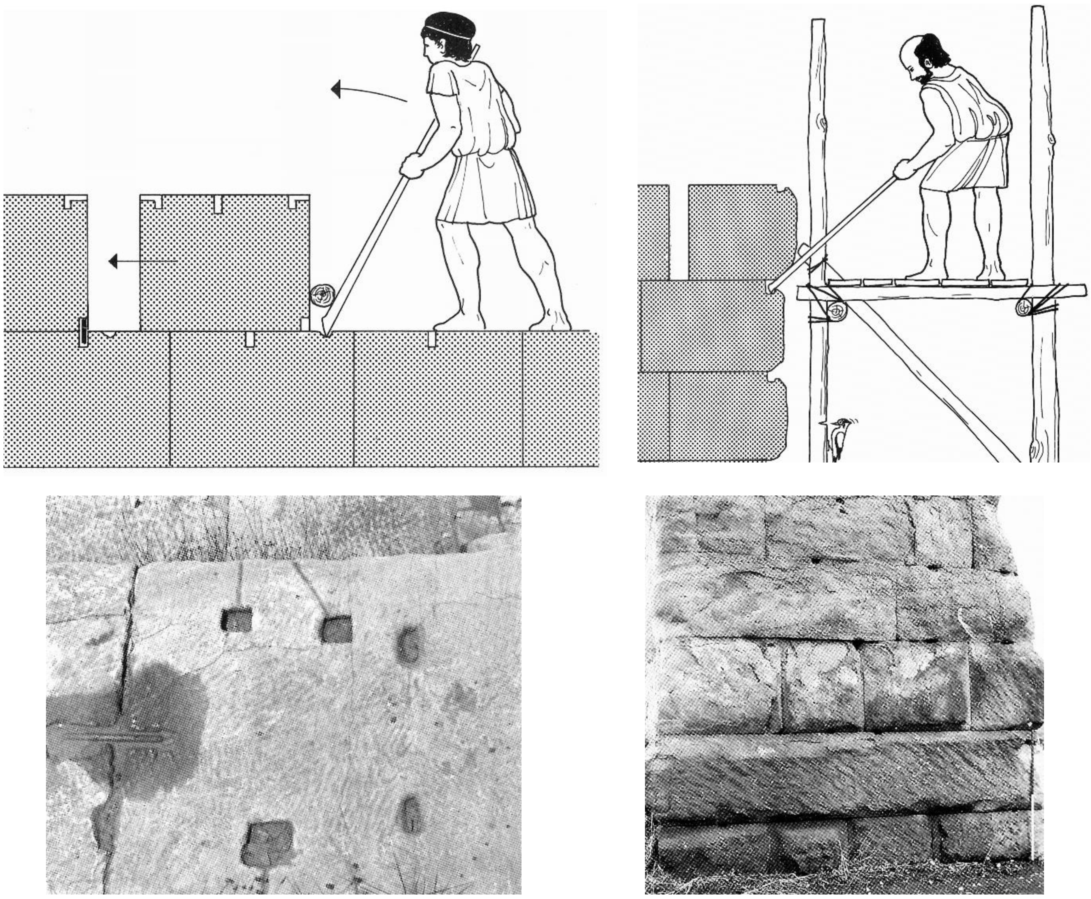


Figure 140 Diagrams showing the use of a crowbar to move stone blocks (top), and images of spike/pry holes in stone blocks from the Temple of Euromos (bottom left) and the aqueduct of Aqua Claudia (bottom right) (Adam, 1994, figs 119-21, 123).

CHI38 has been identified in the past as a lewising tool (Merrifield, 1983, p. 100); a type of mortising chisel used for cutting lewis holes in stone blocks (Warland, 1929, fig. 33). These holes are used to lift large stone blocks (Figure 141) and can be seen on surviving Roman stonework, including most of the stones in the riverside wall (Hill, Millett and Blagg, 1980, p. 188). Modern lewising tools are distinguished from other mortice chisels by their flaring tips (Warland, 1929, fig. 33), which CHI38 demonstrates. However, flaring tips are present on almost all of the Roman mortice chisels from London; something which may reflect the displacement of metal as the tip is forged. There is therefore no reason to suppose that CHI38 was not a normal woodworking chisel. A more likely candidate for a lewising chisel is CHI42 (Figure 136), which has the same solid shaft and truncated cone head as the mason's point chisel MAS01 and flat chisel MAS02. This may indicate that CHI42, which has a flared tip, was used in the construction of stone buildings, although such a robust tool would also have uses in structural carpentry.

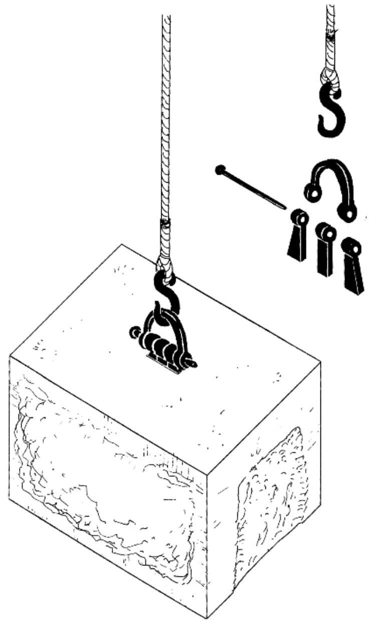


Figure 141 Stone block being lifted with a lewis mechanism. A lewising tool would be used to cut the mortice into which the iron hook is inserted (Adam, 1994, fig. 114).

6.6.3.4 Plastering and Mortaring

Mixing

Mortar and plaster are both made from a mixture of lime, aggregate and water (Davey and Ling, 1981, pp. 53–5; Adam, 1994, p. 75), which needs to be applied soon after mixing. Reliefs on Trajan's Column (Davey and Ling, 1981, p. 54) and from Sens (Adam, 1994, p. 222) have both been interpreted as showing mortar being mixed with a hoe. In the case of Sens this has been seen as an angled broad-bladed hoe, which would correspond to Hanemann's (2014, Abb. 160) Type 2. Hoes of this type are thought to have been used as the broad blade allows lumps in the mortar to be crushed and mixed in (Adam, 1994, p. 75). However, the Sens relief is damaged particularly around the hoe's head (Figure 142), whilst the interpretation of the Trajan's Column scene is ambiguous given that the surrounding figures are engaged in woodwork (Figure 143). Two tools of this type, HOE02 and HOE03, come from London, but they have been seen as agricultural rather than mason's tools. Other artistic sources depict the use of spades, but an excavated mixing pit at Chelmsford contained the impression of a simple pointed wooden stirring rod (Davey and Ling, 1981, p. 54).

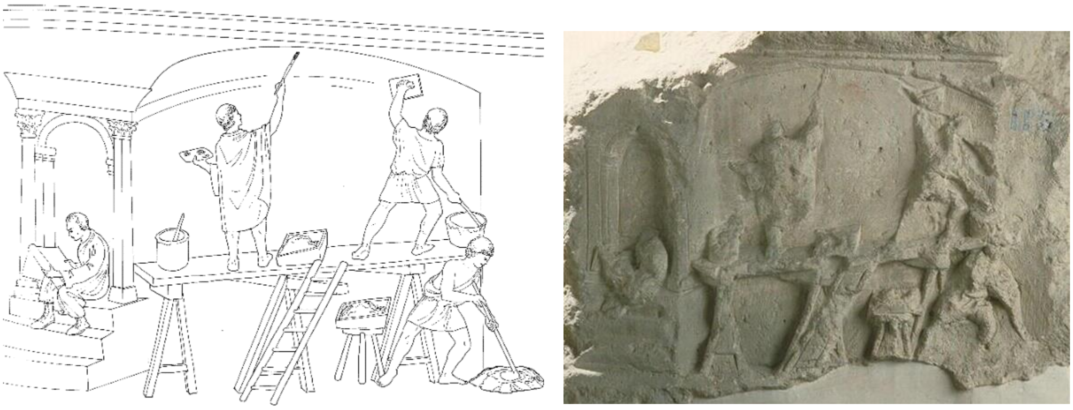


Figure 142 The relief of plasterers at work from Sens. Left, reconstruction showing plaster mixing in the lower right (Adam, 1994, p. 522). *Right, as it appears today (https://s-media-cache-ak0.pinimg.com/736x/4f/7d/4e/4f7d4e790e9e9cd3e75d248b9bbdd05a.jpg).*

Figure 143 Possible mortar mixing (far left) displayed on Trajan's column, scene XCIV (Cichorius, 1900, Pl. LIX).

Keying

Before wall plaster is applied, surfaces first need to be 'keyed', although not all keyed surfaces in London appear to have been plastered (Betts, 2013, p. 35). Flue tiles can have rollered or combed keying applied before firing, and do not need further keying on-site. Keying can be applied to daub whilst it is wet, and does not require special tools. Keying on timber beams takes the form of triangular nicks cut with the corner of an axe or adze (Goodburn, 2000, p. 7). It is not clear whether this would have been carried out by carpenters or plasterers, but indicates that heavy woodworking tools could be part of a plasterer's toolkit.

Applying

The most obvious tools for spreading and smoothing mortar and plaster are trowels and floats (Davey and Ling, 1981, p. 55). Several trowels come from London (TRO01-06). Some of these, particularly the wide-bladed Type C (TRO02-03), may have been used in plastering, although most were probably used for spreading mortar between courses of stone or brick. The two dated examples (TRO03, TRO06) indicate masonry construction spanning the whole Roman period. No floats come from London. These will normally have been made of wood (Howard-Davis, 2009, fig. 490), but iron examples come from Verulamium (Manning, 1972b, fig. 62, 18), *Vitudurum* (Hedinger and Leuzinger, 2003, p. 90, No. 2) and Vindolanda (Blake, 1999, No. 297).

Other tools in London may also have been used to spread plaster and mortar, such as the palette knife PLA01 (Figure 144). The trapezoidal scraper SCR04 (Figure 144) may have been used to spread daub or plaster, as it was found in a wattle wall (see p.301), although its function cannot be confirmed. Two small shovels (HEA09-10), were originally interpreted as plasterer's tools for shaping corners, although it seems more likely that they functioned as small hearth shovels (see p.502).

It has also been suggested that Type C spatulas may have been used as plasterer's tools (Manning, 1985a, p. 31; Obrecht, 2012, pp. 83–6) although this is disputed, with Feugère (1995) suggesting that they should be seen as wax tablet spatulas. Nevertheless, the appearance of plaster adhering to the blade of WXS44 (Manning, 1985a, C6) indicates that these tools were sometimes used in plastering. Due to their comparatively narrow blades, these objects could only have been used for smoothing small areas of plaster. Type C spatulas have small sockets at the butt, which are too small to have contained substantial wooden handles, and may instead have been used to pair them with extending rods, such as THR17 (Humphreys and Marshall, 2015). This would allow the reach of these tools to be extended, allowing the user to reach higher whilst plastering.

Figure 144 Tools possibly used for applying mortar and plaster (Top-bottom; trowel, TRO02; scraper, SCR04; palette knife, PAL01).

Painting

Painted wall plaster was widely used in Roman London, for both timber and masonry buildings. The degree of decoration ranges considerably, and schemes found in London include animals, garden scenes, plants, architectural elements, imitation marble, geometric designs, block colours and panels, and plain white plaster (Goffin, 2003, 2005, 2011; Betts, 2015). After the plaster was applied, designs could be laid out with the use of rulers, line irons and compasses (Davey and Ling, 1981, p. 59). Figurative work may have been sketched out freehand (Adam, 1994, p. 221), and as such awls or scribers can have formed part of the plasterer's toolkit.

Figure 145 First-century fresco showing animals, from 21 Lime Street (LME01) (http://www.mola.org.uk/blog/discovery-ornate-roman-fresco-revealed).

The most common method for applying coloured pigments to plaster, in London and elsewhere, seems to have been the fresco method, in which the paint was applied with a brush to wet plaster (Adam, 1994, p. 220; Goffin, 2005, pp. 109–11, 2011, p. 487). Other techniques, in which pigments were applied to dry plaster with an adhesive, or as a mixture with lime water, also appear to have been used in London to a lesser extent (Goffin, 2011, p. 487). Two types of copper alloy brush handle (BRU01-07, Figure 130) were found in London, although it is not clear whether these would have been used in plasterwork, with Raux (2015) interpreting them as gilding tools. Nevertheless, Type 2 brush holders (BRU01-03, Figure 130), which combine a scraper and one end and brush at the other, would have been useful to a fresco painter. Wider brushes, of which we have no evidence in London, must also have been used to apply larger areas of pigment (Davey and Ling, 1981, p. 60)

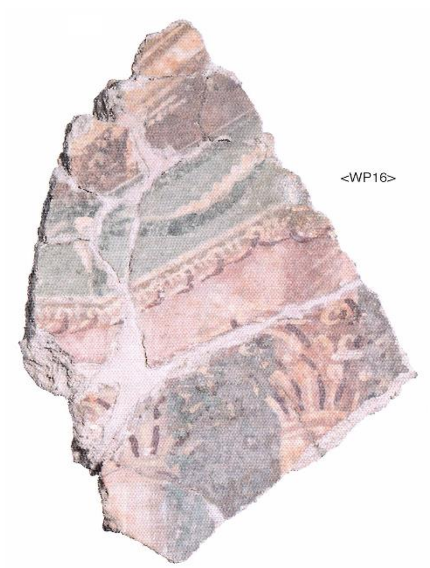


Figure 146 Fresco depicting architectural ornament, from 1 Poultry (ONE94) (Hill and Rowsome, 2011, fig. 328).

After painting, plaster can be finished with burnishing or polishing. Marble polishing stones, with an iron strap handle, have been found at Silchester and Caerleon (Davey and Ling, 1981, pp. 58–9), but have not been identified in London.

6.6.4 Discussion

It is clear from the London tools that a wide variety of practices were taking place under the umbrella of masonry and stonework. The stoneworking tools from London support the idea that trained masons lived and worked in the city. There is evidence for varied activities in stone, from the movement of large stone construction blocks, to fine carving. The London tools may also provide evidence for professional millstone dressers operating in the city. Plasterwork is more difficult to approach, as there are few tools that can be associated with certainty with this practice, although a large number of trowels do come from the city.

6.7 Pottery

Because of its durable, universally-used products, and the fact that waste and kilns survive well, pottery is one of the best understood Roman industries of the London area. However, only a small number of metal tools from London are potentially related to pottery making; ribs (SCR01-03, Figure 149) and spear-shaped spatulas (SPE01-12, Figure 149).

6.7.1 Raw Materials Supply to London

The two main raw materials required for pottery production are clay and fuel for the kiln. London clay can be extracted from anywhere in the city, and this clay appears to have been used by the potters on Cornhill (Rayner, 2017, p. 361). Other industries, particularly the upper Walbrook valley industry, used imported clay from the area around Brockley Hill, 12km to the north of the city (Seeley and Drummond-Murray, 2005, p. 137; Rayner, 2017, p. 363), although this was also mixed with London clay (Seeley and Drummond-Murray, 2005, pp. 135–7).

Potters' kilns are fired with wood (Seeley and Drummond-Murray, 2005, p. 137). As with other woodland crafts in London, the major wood used to fuel potters' kilns was oak, although a number of other species were also used (Seeley and Drummond-Murray, 2005, p. 138; Rayner, 2017, p. 363). Unlike in other high-temperature industries, the wood used in kilns was not predominantly from coppiced trees (Goodburn, 2005, p. 196; Rayner, 2017, p. 363). Potters appear to have used mainly 'cordwood'; small branches and the tops of trees. This material may have been left over from structural woodwork or crafts, but would have been in high demand for domestic fuel. Its use may reflect the fact that bundles of coppiced wood were too large to have been used in kilns with narrow stokeholes (Goodburn, 2005, p. 196). Wood chips may indicate the use of waste from craft activities as fuel (Seeley and Drummond-Murray, 2005, p. 138)

6.7.2 Potters and Pottery Making Sites in London

The evidence for pottery production sites in London has recently been summarised by Rayner (2017). The majority of London's pottery seems to have been supplied by workshops outside of the city. Local production centres included the Alice Holt/Farnham potteries in Hampshire and Surrey, the Eccles and Hoo Island potteries in Kent, and the Highgate Wood and Verulamium Region potteries to the north-west of London (Rayner, 2017, pp. 350–7). However, pottery was also manufactured at various locations within *Londinium*. Although always within the area of the later city walls, an emerging pattern in these sites is that they were located in areas of the city which at the time could be considered 'peripheral'. It is also likely that other pottery production sites in London have been lost to truncation and piecemeal excavation (Rayner, 2017, pp. 358, 364).

Pre-Roman pottery making traditions continued in the Highgate Wood potteries, 12km to the north of the city, possibly indicating the establishment of a production centre by 'native' potters (Rayner, 2017, pp. 351–5). These potteries appear to have only been occupied temporarily, perhaps by seasonal or itinerant workers (Rayner, 2017, p. 354), and may have been set up as a commercial enterprise to supply the new town at London (Rayner, 2017, pp. 351–5). The Verulamium Region production sites, however, began producing 'Romanised' pottery forms from the 50s AD, potentially indicating the presence of immigrant potters, some of whom may later have moved to London (Seeley and Drummond-Murray, 2005, p. 142; Rayner, 2017, pp. 355–7). The large numbers of Verulamium Region Ware (VRW) mortaria on northern military sites in the 1st century AD may indicate that they were established to fulfil military contracts (Rayner, 2017, pp. 355–7).

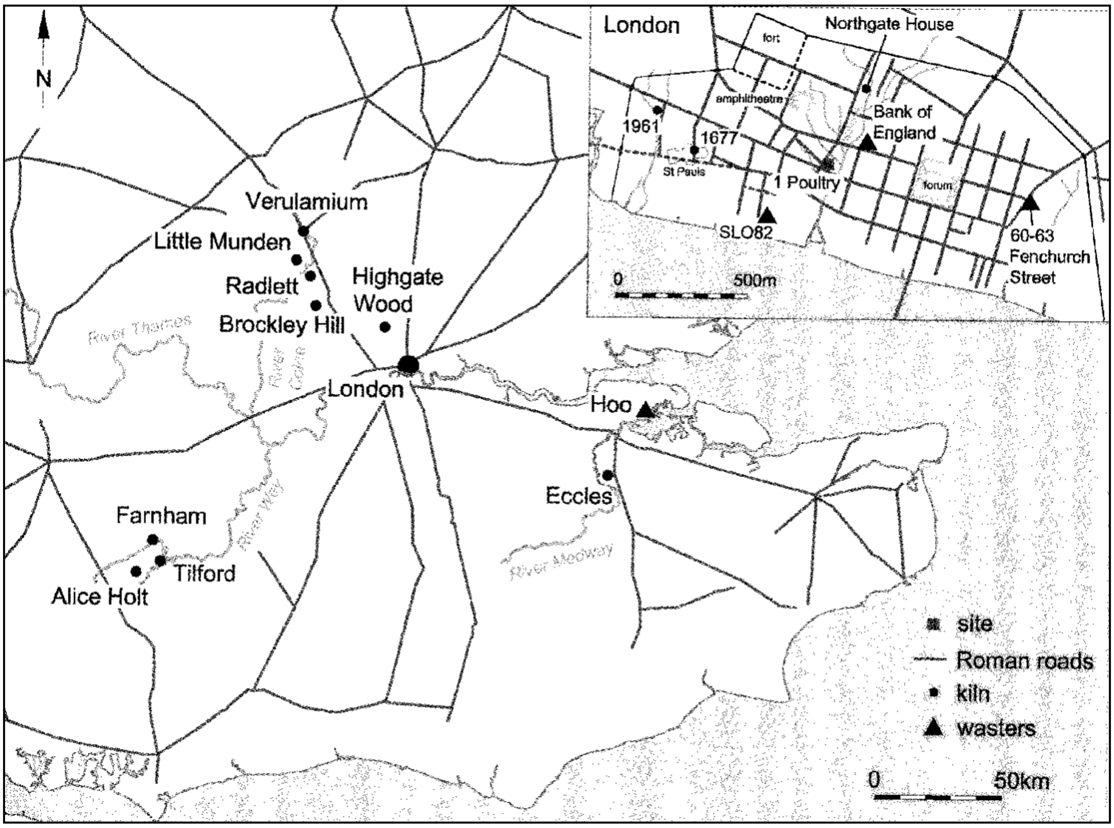


Figure 147 Pottery production sites in and around London (Rayner, 2017, fig. 16.1).

Pottery wasters and possible kilns excavated at 60-63 Fenchurch Street indicate the presence of a short-lived pottery production centre on eastern Cornhill, starting in the pre-Boudican period. This centre produced pottery similar to that produced by the Kent industries (Birbeck and Schuster, 2009, p. 34; Rayner, 2017, pp. 359–61). Another pre-Boudican pottery production centre was identified at Sugar Loaf Court (SLO82) on Ludgate Hill. Here, dumped kiln debris and wasters indicate the presence of a nearby kiln site, which has yet to be definitively located. The wares produced here are strongly associated with military pottery styles, potentially indicating production by veterans or soldiers (Rayner, 2017, pp. 358–9). A maker's stamp on a Sugar Loaf Court ware vessel may suggest an immigrant from northern Italy (Davies, Richardson and Tomber, 1994, p. 29), whilst the style of the pottery is similar to that produced in western Switzerland (Davies, Richardson and Tomber, 1994, p. 29). Later 1st and 2nd century pottery production is also evidenced on Ludgate Hill, around St Paul's Cathedral, where tile production also took place (Betts, 2017). Kilns were first excavated here in the 17th century during the rebuilding of the cathedral, and kilns were found in this area again in 1961 (Rayner, 2017, p. 358).

London's major pottery production zone appears to have been in the upper Walbrook valley, however. Evidence for pottery production had been found at the Bank of England, 1-4 Copthall Close and 20-28 Moorgate in the early 20th century (Rayner, 2017, p. 358), and recently a pottery making site with kilns and wasters was excavated at Northgate House, 20-28 Moorgate (Seeley and Drummond-Murray, 2005). This industry produced a range of wares from c.110 AD (Seeley and Drummond-Murray, 2005, p. 144; Rayner, 2017, p. 356), some of them very similar to VRW and using imported Verulamium region clays. Some of the potters operating here may have moved to London from the Verulamium region (Rayner, 2017, p. 357). Others used London clay, and showed influence from the eastern Mediterranean (Seeley and Drummond-Murray, 2005, p. 143). Incised decoration on some of these pots has been variously argued to show intentional imitation of imported samianware, or continuation of pre-Roman pottery traditions (Monteil, 2004, p. 2). The buildings excavated at Northgate House contained working features, but not hearths, indicating that these were dedicated workshops, and that potters did not stay here overnight (Seeley and Drummond-Murray, 2005, p. 14).

Pottery will also have been produced by metalworkers in specific circumstances; crucibles were made by reshaping VRW pots with additional outer layers of clay (Bayley, 2017, p. 337), a substance which they would be familiar with working due to the need to make hearth linings (Hammer, 2003).

Figure 148 Reconstruction of the pottery making workshops at Northgate House (Seeley and Drummond-Murray, 2005, fig. 163).

6.7.3 Pottery Practice in London

Pottery is one of the most extensively studied classes of artefact in Roman archaeology. The various methods by which it is produced are well understood, and do not need to be restated here. Seeley and Drummond-Murray (2005, pp. 137–42) have recently discussed the pottery making practices and structures from the upper Walbrook valley industry.

Moulds were used to produce lamps in London (Marshall and Wardle, forthcoming), although a single waster from Aldgate and the possible discovery of pottery moulds at St Paul's cathedral in the 17th century are the only evidence of mould-made pottery being produced in London. The mould-made pots produced in the Southeast of England, whether made in London or in Sussex, appear to have been made by copying imported vessels, and will not have required specialised dies (Tyers, 1996, p. 69). Dies were used to impress makers' marks onto wheel-thrown pottery made in London (Hartley, 2005), although none have been found here. Rouletting was also practiced in London (Seeley and Drummond-Murray, 2005, pp. 107, 112, 128), but is not represented amongst the metal tools from London.

Less readily identifiable than dies and moulds are the tools used in shaping and decorating wheel-thrown vessels. By analogy to modern practice, Roman potters' tools are often thought to have been improvised objects which would not be easily recognisable in a collection of small finds (Peacock, 1982, p. 59; Tyers, 1996, p. 28). That this was predominantly the case is demonstrated by excavated potters' workshops, which produce a range of objects likely employed in shaping and marking vessels, which vary from repurposed domestic items to pieces of broken pottery and bone (Hartley and Dickinson, 2008, p. 10; Handberg, 2011; Murphy and Poblome, 2012). Nevertheless, purposefully made potters' tools have also been recognised (Peacock, 1982, p. 61; Desbat, 2004, pp. 150–1; Hartley and Dickinson, 2008, p. 11; Murphy and Poblome, 2012; Obrecht, 2012, Abb. 78), and there are two classes of manufactured metal object from London which may have been used in pottery production: ribs and spear-shaped spatulas (Figure 149).

Figure 149 Possible potter's tools from London (Top; rib, SCR01. Middle, rib; SCR02. Bottom row; spear-shaped spatulas, left-right; Type 1, SPE01; Type 2, SPE08; Type 3, SPE09; Type 4, SPE11).

Ribs are a type of scraper used to shape pottery vessels on a wheel (Figure 150). Three possible ribs, SCR01-03, come from London, all of them unstratified. SCR01 has a section of very fine teeth on one side, as does another probable example from Drapers' Gardens (Pre-Construct Archaeology, 2009, p. 32) which is not included here. These may have been used to produce a combed effect on the surface of a pot. Whilst combing is also seen on CBM, production of brick and tile does not require the use of a rib.

Figure 150 Shaping a pottery vessel with a rib (left) and shaver (right) (http://www.glynnislessing.com/blog/?cat=5&paged=2).

Combed decoration is common on Alice Holt/Farnham wares in London (James Gerrard pers. comm ; Tyres, 2014), but combing is rare on pottery produced in London. Combing was applied to shallow bowls in Sugar Loaf Court ware (Davies, Richardson and Tomber, 1994, p. 34), and to bowls and dishes in fine micaceous ware (FMIC) 2488 (Davies, Richardson and Tomber, 1994, p. 161), but neither of these are particularly common. Given their provenance, both of the serrated ribs are likely to have been associated with the upper Walbrook valley industries, although these were only established after the main phases of artefact deposition in the Walbrook valley. Combed designs are not found on most of the types of pottery produced here, however. Strands of three or four parallel lines on London ware (LOW) pottery produced here (Seeley and Drummond-Murray, 2005, p. 128) would have been produced by a comb-like tool, but one which was much narrower than the ribs from London. Combing can be seen on FMIC-1659 beakers (Davies, Richardson and Tomber, 1994, p. 159), which may have been produced in the upper Walbrook valley (Seeley and Drummond-Murray, 2005, p. 130), although these are again not common.

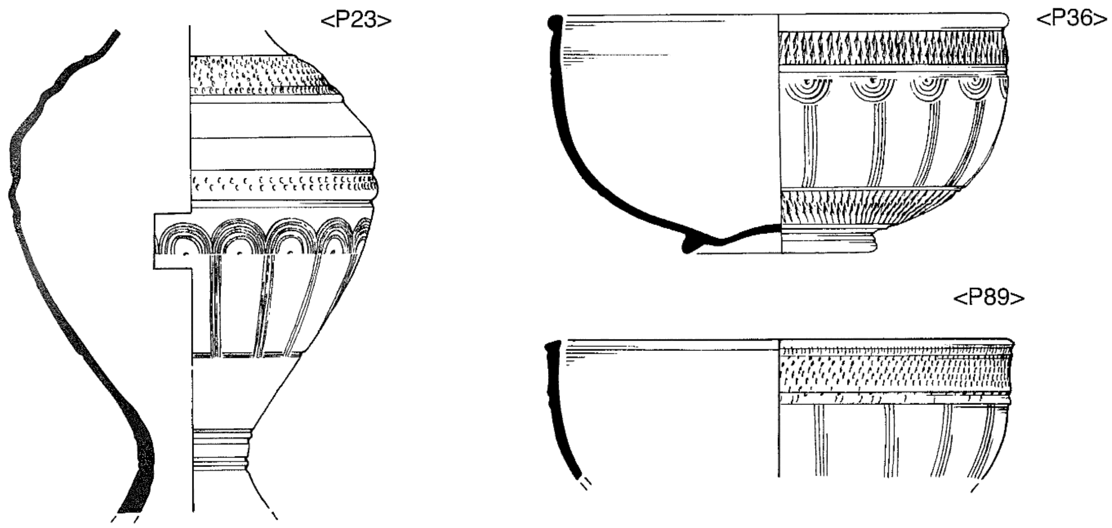


Figure 151 LOW pottery with combed decoration (Seeley and Drummond-Murray, 2005, fig. 159).

Whilst the function of spear-shaped spatulas is debated, the most likely interpretation suggested so far is that these objects are potters' tools. They are thought to have been primarily trimming tools with their spear-shaped blades acting as fettling knives. The bent panels at the butts of Types 2 and 3 may have acted as shavers (Peacock, 1982, p. 59). Whilst Types 1 and 3 appear to have been used on a range of sites across northern Gaul throughout the Roman period, Type 2 has a very restricted distribution and chronology. Outside of London this type appears only on military sites along the Rhine in the Augustan-Tiberian period. The appearance of a Type 2 spear-shaped spatula (SPE07) in an immediately post-Boudican (AD 65/70-80) dump at Bloomberg is therefore intriguing. This object may be related to the nearby pre-Boudican Sugar Loaf Court pottery industry (Humphreys in Marshall and Wardle, forthcoming), reinforcing the idea of immigrant potters with a military background living and working in London.

Only a small number of tools can therefore potentially be associated with pottery production in London, and none of them with absolute certainty. It is difficult to reconcile these few iron objects with the wealth of evidence which already exists for pottery production in the city, and it is likely that a large number of non-metal tools were used in pottery production instead. Nevertheless, SPE08 may support and enhance the existing picture of the cultural origins of potters operating in early Roman London.

6.8 Glass-Work

The evidence for glass-working in Roman London has recently been synthesised by Wardle (2015, pp. 97–107), and only a short summary is needed here. As with other industries, early glass-working in the city was scattered and carried out on a very small scale, with a number of sites across the city (GM160, GM213, WFG44, WFG45) providing evidence of glass-working in the 1st century. These sites provide evidence of glassworkers from a range of cultural backgrounds. Pre-Boudican glass-working debris associated with the roundhouses at 2-12 Gresham Street (GSM97) is thought to represent local Britons refashioning Roman vessel fragments into native style beads, whilst an early glass-blowing workshop, operating for perhaps only a few months in the late 60s AD on the Cornhill waterfront (KWS94), may indicate immigrant craftsmen.

The glass-making industry began to coalesce around the Fleet River in the early 2nd century, and a number of furnaces have been found at 18-25 Old Bailey (OBA88). In the 2nd century, glass-working also begins to take place in the upper Walbrook valley, with a major site excavated at 35 Basinghall Street (BAZ05, Wardle, 2015). Glassworking evidence also comes from the nearby Northgate House (Keily and Shepherd, 2005) and Guildhall sites (Perez Sala and Shepherd, 2008). This area became a key production zone for glass, possibly utilising the presence of the nearby Cripplegate Fort to build an export industry along military supply lines. This industry lasted until c. AD 200, after which the location of glassworking in London is uncertain, but possibly taking place around the Tower of London. Large amounts of glass waste were also found in the smithing centre in Southwark, where it may have been used in enamelling, or in abraisives (Hammer, 2003, p. 120).

The frequency with which the glass industry moved around London, the presence of dumps of cullet, and the design of the furnaces have been taken as evidence that the glassworkers of London were itinerant. They may have left the city periodically, setting up temporary workshops around the edges of the settlement (Perez Sala and Shepherd, 2008, p. 145), although the upper Walbrook valley industry may have been more permanent.

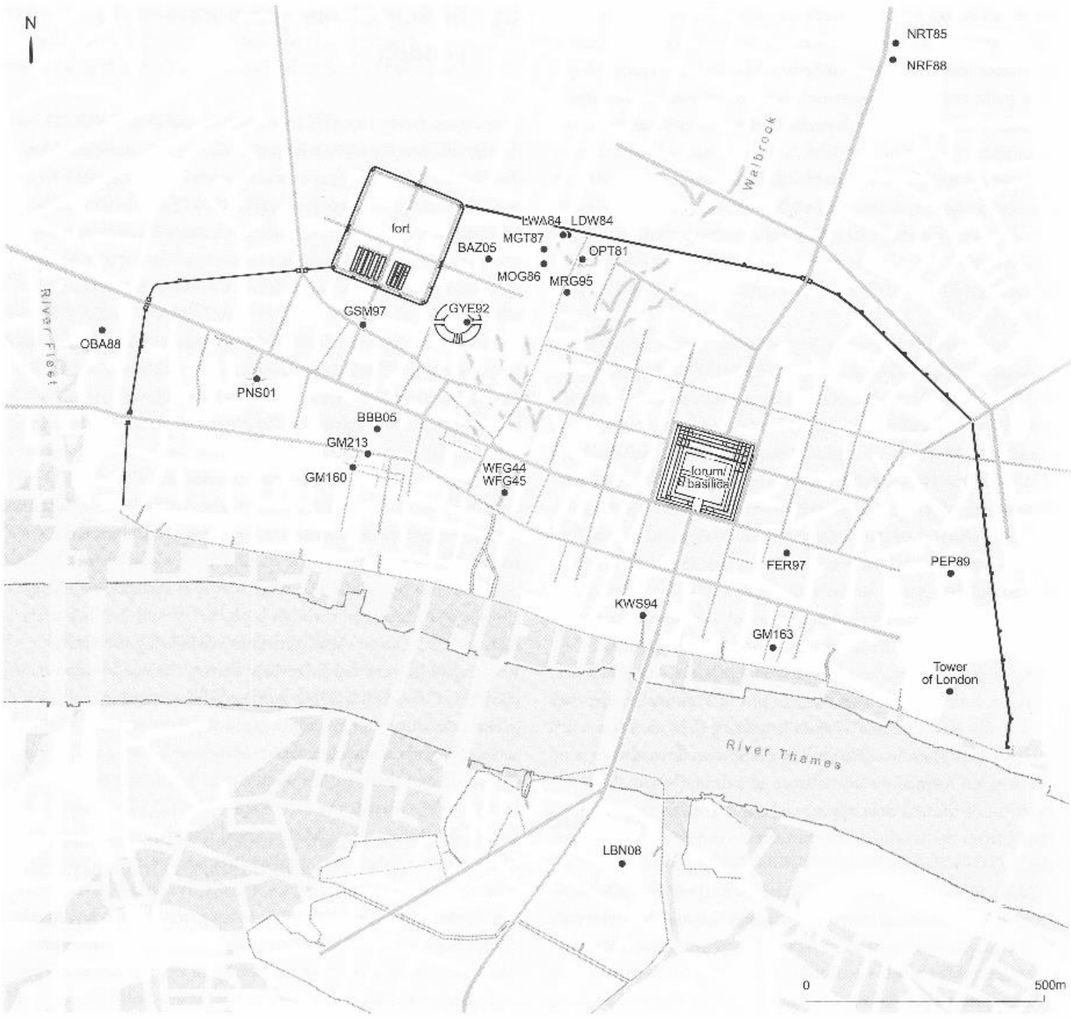


Figure 152 Map of sites in London with evidence of glass-working (Wardle 2015, fig. 121).

Glass-blowing practice in London has recently been studied in detail by Wardle (2015, pp. 37–69) using the waste from the 35 Basinghall Street site (BAZ05). Whilst glass-working has its own suite of tools, including blowing irons, pontil irons, tongs, shears and pincers, only blowing irons are unique to glass-working (Wardle, 2015, pp. 73–4; Scott, 2017, p. 309). Analysis of the waste from 35 Basinghall Street indicates that at least three different sizes of blowing iron were in use in London (Wardle, 2015, p. 73), but no blowing irons have been found. Possible blowing irons made of rolled sheet metal are known from France (Foy and Nenna, 2001, p. 77, no. 59) and Spain (Lang and Price, 1975), but not from Britain. Whilst shears (SHE01-26) and tongs (TON01-10) suitable for glass-working have been found in London, none of these can be associated specifically with this craft, and as such they can add little to our picture of glass-working practice.

6.9 Animal Husbandry

The only tools from London which can be unambiguously attributed to the keeping of animals are curry combs (CURR01-03) and a twitch (TWI01). Both types of object are related to the care of horses. Ox goads, which were found in large numbers in London, have often been identified as tools associated with animal movement. However, these objects cannot be satisfactorily tied to any particular function (see p.519), and will not be discussed here. Other tools from London, particularly plough furniture and leatherworking tools, indicate the various uses of animals in the Roman city, although they are not directly related to animal care.

6.9.1 Equids and Grooms in the Roman World

Horses, ponies, donkeys and mules were used primarily for riding in the Roman world; both by civilians and mounted cavalry (Toynbee, 1973, pp. 167–75; Grant, 1989, p. 145; Hyland, 1990; Crummy, 2011, pp. 57–62; Maltby, 2017, p. 201). They were also used to pull a wide variety of carts for transport of people and goods (Crummy, 2011, pp. 50–7), as well as chariots for racing and (in the Iron Age) war (Toynbee, 1973, pp. 169, 177–83). Mules were used as pack animals (Toynbee, 1973, pp. 191–2; Todd, 2007, pp. 67–8), and to move artillery on the battle field (Toynbee, 1973, p. 190). Horses and donkeys were also used to drive flour mills (Toynbee, 1973, figs 184-5; Williams and Peacock, 2011, p. 117) and to thresh wheat (Toynbee, 1973, p. 168), but do not appear to have been used as draught animals for ploughs (Maltby, 2017, p. 201). Horses were also used in amphitheatre performances (Grant, 1989, p. 145; Hyland, 1990, pp. 248–9), and wild horses could be hunted (Toynbee, 1973, p. 167). Any one horse may have been involved in many different activities over its life (Grant, 1989, p. 145). At death, Roman horses appear to have been widely used for their skin and hair (Toynbee, 1973, p. 185; Grant, 1989, p. 145; Hyland, 1990, p. 249; Reilly, 2005, p. 165; Maltby, 2017, p. 201). They could also have been used for their meat, whilst their bones and hooves can be used to produce glue (Dixon and Southern, 1992, pp. 178–80), although there is less evidence for this in the Roman period.

Animals in these different situations might have been looked after by a range of different people. Civilian grooms (*equisones* or *agasones*) might be employed by the wealthy. The house of Popidius Secundus in Pompeii has rooms for grooms adjoining the stables (Toynbee, 1973, p. 172; Harward, Powers and Watson, 2015, p. 83). Military horses may have been cared for by specialist grooms, soldiers appointed to the task in lieu of normal duties (*immunes*), normal soldiers operating on a work rota, or servants and slaves owned by individual soldiers or military units (*calones*) (Dixon and Southern, 1992, pp. 203–4; Phang, 2005, pp. 205, 209). An inscription from Irchester (*RIB* 233) records a *strator*; an officer responsible for the horses of the provincial

Governor, and a tablet from Vindolana (*Tabl. Vindol.* 310) records a Governor's groom (*equisioni consularis*) based in London.

Horses could also be looked after by professional veterinarians. *Veterinarii* would have been employed by the army, and the discovery of a twitch in a rural community in the Netherlands suggests that professional horse doctors also operated in the civilian world (Heeren, 2009a, p. 94). An inscribed pot sherd from the Thames at Amerden may be evidence of a vet specialising in mules in the London area (Wright, 1977). That veterinarians operated in London is suggested by an intriguing writing tablet from Vindolanda (*Tabl. Vindol.* 310). How this letter, addressed to London, came to be in Vindolanda is unclear, but the implication is that the veretinarian Virilis was based in the city.

> Back (1st hand) *"(Deliver) at London. To Veldedeius, groom of the governor, from his brother Chrauttius."*
>
> Front (1st hand): *"Chrauttius to Veldeius his brother and old messmate, very many greetings. And I ask you, brother Veldeius - I am surprised that you have written nothing back to me for such a long time - whether you have heard anything from our elders, or about ... in which unit he is; and greet him from me in my words and Virilis the veterinary doctor. Ask him (sc. Virilis) whether you may send through one of our friends the pair of shears* (forfex) *which he promised me in exchange for money. And I ask you, brother Virilis, to greet from me our sister Thuttena. Write back to us how Velbuteius is* (?). (2nd hand?) *It is my wish that you enjoy the best of fortune. Farewell."* (Centre for the Study of Ancient Documents, 2017, *Tab. Vindol.* 310)

Equids also figure prominently in Roman religion. Horses and other equids are most strongly associated with the Celtic goddess Epona (Harward, Powers and Watson, 2015, p. 86); the patron of equids, their owners and grooms (Toynbee, 1973, p. 197). Although mainly worshipped on the Continent, inscriptions (*RIB* 967, 1777, 2177) and statuettes (Toynbee, 1973, p. 198; Durham, 2010, Pl. 180) show that Epona was known in Britain. Various Rider-gods are also known (Toynbee, 1973, p. 175). Equids featuring in myth and mythology include the winged horse Pegasus, shown in Roman art being groomed by nymphs (Toynbee, 1973, p. 175), and the donkeys used as mounts by the satyr Silenus and the Late Roman carpenter god Jesus Christ (Toynbee, 1973, p. 197). Real-life equids also featured in Roman ritual life. Horses and mules were kept by the state and used to draw carts in religious and state ceremonies (Toynbee, 1973, p. 186; Hyland, 1990, p. 238). Curse tablets were used to give bad luck to rival factions in chariot races (Toynbee, 1973, p. 178), whilst the actions of equids themselves could be taken as portents or omens (Hyland, 1990, pp. 239–40). Horse sacrifice was not a common part of Roman state religion, although the 'October Horse' ritual did involve the sacrifice of a race horse (Bennett Pascal, 1981). There are nevertheless several examples of probable horse sacrifices related to funeral rituals in Britain and Gaul (Harward, Powers and Watson, 2015, p. 86), and horse skulls were sometimes deposited in wells in Britain as ritual closure deposits (Merrifield, 1987, pp. 46–7; Grant, 1989, p. 145).

6.9.2 Equids in Roman London

A military cavalry presence in London is confirmed by writing tablets from Bloomberg, which indicate the presence of cavalry units in the post-Boudican period (Tomlin, 2016, p. 56), and cavalry will also have bee part of the Governor's retinue (Hassall, 2012). Equid bones have also been found on a large number of sites in London, although mostly in very low numbers (Maltby, 2017, Table 9.1). Most of these remains are thought to represent horses and ponies, although donkey and mule remains have also been identified (Armitage, 1980, pp. 150–1; Bendrey, 2002, pp. 58, 60; Maltby, 2017, p. 201). Cut marks on some bones indicate that they were skinned at death, although they do not appear to have been widely used for meat (Bendrey, 2002, p. 60; Reilly, 2005, p. 165; Maltby, 2017, p. 205).

Larger proportions of equid bones, including articulated and partially articulated skeletons, come from sites on the northern and eastern periphery of the city, primarily in the Northern and Eastern Cemeteries (Harward, Powers and Watson, 2015, p. 83; Maltby, 2017, p. 201), although a complete equid skeleton was recently found at Bloomberg (BZY10, Watson and Bryan, forthcoming). This matches the distribution of iron hipposandals, which also cluster in the upper Walbrook valley (Harward, Powers and Watson, 2015, p. 205, fig. 57). This may relate primarily to the disposal of horse carcasses in the ditches around the town (Maltby, 2017, p. 201), but may also indicate the stabling, breeding and grazing of animals in the waterlogged meadows to the north of the city (Harward, Powers and Watson, 2015, p. 83). It is possible that these animals were kept outside the city itself to reduce the noise, pollution and congestion they caused to city streets (Hyland, 1990, pp. 232–3), although animal dung from 1 Poultry (ONE94) and Bloomberg (BZY10) may indicate that equids were to be found within the town (Watson and Bryan, forthcoming; Hill and Rowsome, 2011, p. 276).

It is also possible that some of these horses were deposited in the cemeteries for ritual purposes, although the post-depositional mixing of deposits makes this difficult to substantiate (Harward, Powers and Watson, 2015, p. 86). The most obvious candidates for ritual deposits are the burial of a complete horse in a pit in the Eastern Cemetery (Rielly, 2000, p. 368; Harward, Powers and Watson, 2015, p. 84), a horse's head from a ditch in the upper Walbrook cemetery (Harward, Powers and Watson, 2015, p. 86), and horses heads from several wells in London (Merrifield, 1987, pp. 46–7; Harward, Powers and Watson, 2015, p. 86). Horses may also have been used in the amphitheatre, although London has no racing circus.

6.9.3 Equid Care in London

Columella (*Res Rustica*, VI, 30, 1) recommends that horses be cleaned every day (Toynbee, 1973, p. 172), and the curry combs from London may have formed part of the tool kit used for this. These combs can be damaging to horses, however, and their use may have been limited. Xenophon (*Art of Horsemanship*, 5.5) recommends that tools should not be used to clean the backs or faces of horses (Dixon and Southern, 1992, p. 205), whilst modern writers recommend that metal combs not be used on short-haired or recently clipped horses (J Clark, 1995, pp. 157–8). Their presence in London may indicate that Roman horses had longer coats than modern varieties, or were less closely groomed, with their longer coats offering protection from the elements (Dixon and Southern, 1992, pp. 194, 202–3) and allowing iron curry combs to be used without causing harm. That the treatment of Roman hoses was rougher than would be allowed today is also suggested by the twitch TWI01. Like other Roman twitches (Heeren, 2009a, fig. 5) this tool has serrated jaws, rather than the smooth arms of modern tools. Like the iron curry combs, this tool could indicate that Roman horses were hardier than modern varieties, or that the Romans held different attitudes towards animal cruelty. Nevertheless, Hyland (1990, p. 238) considered Roman horses to be 'much better protected than similar animals are today' under Roman law.

The care of horses will also have drawn on tools which are assigned to other practices in this analysis. Rakes, pitchforks and spades would have been used to move hay and straw for food and bedding, and in mucking out. Shears could have been used to clip horses' manes (Adams, 1990). No specialised farriers' tools were found in London, although they are known from elsewhere (Manning, 1985a, p. 61). Hipposandals will presumably have been made by local blacksmiths, using the ironworking tools discussed above (see p.183).

Whilst the curry combs are likely to have been everyday objects, the same is not true of the elaborately decorated twitch TWI01. This object is decorated with busts of gods and animals, and may have been used in religious rituals. Exactly what these rituals were is difficult to ascertain. The iconography of this tool has been identified with the cult of Attis-Cybele (Francis, 1926), although it is no longer possible to see TWI01 as a castration clamp. It is possible that this tool was used to calm horses before sacrifice, although this is perhaps an unlikely function for a tool which may have been imported from Italy, where horse sacrifice does not appear to have been as common as in the Northern provinces.

Rather than being directly associated with religious ritual, it is also possible to see this elaborate decoraiton as having been used in display, giving an indication of the prestige and status of its owner. Vindolanda Tablet 310 (above) details a transaction in which the Governor’s own groom in London (*Veldedeius*) was to acquire a tool (*forfex*) from a veterinarian (*Virilis*), who was also presumably based in London. Whilst the interpretation of *forfex* is disputed, and conventionally interpreted as ‘shears’ or ‘forceps’ (Adams, 1990), Heeren (2009a) has convincingly argued that it could be referring to a twitch. Whilst it is unlikely that the tablet refers to TWI01 specifically, it nevertheless indicates the circulation of high value veterinary tools, which may have been used on the Governor’s horses in important civic or social occasions. The addition of religious or cult imagery to functional tools may also be evidenced in the phallic handled sickle (Figure 66) from Blackburn Mill (Piggott, 1952, fig. 12, B34).

Despite only three tools being associated with animal husbandry in London, they add a considerable amount to our image of equid care in the city. These objects were used in a range of situations, from everyday animal care to high-status public display and potentially religion, illustrating the wide range of situations in which horses and their grooms worked in Roman London.

6.10 Skeletal Materials

The working of skeletal materials (antler, bone, ivory and horn) occupies a particularly difficult position in this thesis. Although these materials were certainly worked in Roman London, it is almost impossible to identify tools which were used in this kind of work. This is because the toolkit employed will have been broadly the same as that used in woodwork (see p.91).

6.10.1 Skeletal Material-Workers in the Roman World

The variable quality of bone objets suggests whilst some were professionally manufactured, others were home-made (Crummy, 2001, p. 102; Hall and Wardle, 2005; Marshall, 2017). Although large numbers of bone, antler and ivory objects are known from the Roman period, and workshops have been identified in Continental Europe (Deschler-Erb, 2005; Crummy, 2017, pp. 260–1), no boneworking sites have been identified in Roman Britain (Crummy, 2001, p. 101). Crummy (2001) relates this lack of evidence to the organisation of the trade, suggesting that the workers of skeletal materials were itinerant. The fact that boneworking waste is found in dumps may relate to the collection of waste from temporary market stalls by the authorities (Crummy, 2001, p. 101), although other types of waste are also found in dumps in London, and presumably originated in workshops. Some skeletal materials-working trades, such as the production of knife handles or furniture inlays, may have been settled and associated with wood- and ironworking workshops (Crummy, 2001, pp. 101–2, 2017, p. 261). Crummy (2001, p. 101) is wrong to suggest that the use of a lathe in these industries prevents itinerancy, however, as simple bow- or strap-driven lathes (Figure 56) could be easily taken down, transported and set up elsewhere. Possible furniture-making workshops at Gloucester and South Shields produced bone inlays but no waste, suggesting that they were bought in from other specialists, who may have been settled or itinerant (Crummy, 2001, pp. 97, 100, 2017, p. 261).

6.10.2 Skeletal Materials-Working Sites in London

Waste from the working of skeletal materials is widespread across the city (Figure 153), largely occurring in areas which Keily (2006, p. 146) characterises as 'marginal' to the core settlement on Cornhill. Major deposits of boneworking waste from Cornhill itself come from pits on the far eastern edge of the city at Lloyd's Register (FCC95), where needles, pins, dice and other artefacts were made presumably nearby in the 1st and 2nd centuries (Keily, 2006, pp. 142–6). Boneworking waste was also found on the Cornhill waterfront, in a 2nd century warehouse at Regis House (KWS94, Keily, 2006, p. 146).

There is a concentration of dumped material in the upper Walbrook valley, including waste and part-made objects indicating the manufacture of needles or pins at 8-10 Moorgate (MOQ10, Marshall pers comm.), weaving tablets at Cross Keys Court, and hair pins or hinges at Coleman Street in the 1st-2nd centuries (Groves, 1990, pp. 82–3; Crummy, 2001, pp. 98–9, 2017, p. 262). This may be related to tanning in the area, although the evidence for this ambiguous (see p.210). These dumps may represent the short-lived activities of itinerant producers manufacturing a single item type (Crummy, 2001, p. 99). Waste was also found at Bloomberg (BZY10, Marshall and Wardle, forthcoming) and 1 Poultry (ONE94, Pipe, 2011a) in the middle Walbrook valley, in ditches and demolition deposits, possibly indicating that antler, bone and horn working took place here.

Late Roman dumps of processed cattle bone, antler- and horn-working waste have been found on many sites in Southwark (Cowan *et al.*, 2009, pp. 111–2; Crummy, 2017, p. 262), including antler-working waste contemporary with the later Roman metalworking industry there (Pipe, 2003). Whilst this has been taken as evidence for the fitting of handles onto iron products at the point of manufacture (Sim, 2003, p. 23), the waste was not mainly from the sites which produced metalworking evidence. As this material was dumped, the location of its origin is unknown (Pipe, 2003). Bone pin making waste was also associated with the latest phase of occupation at the Winchester Palace site, when the structure was possibly already a ruin (Yule, 2005, pp. 76–9; Rogers, 2011, pp. 138–40).

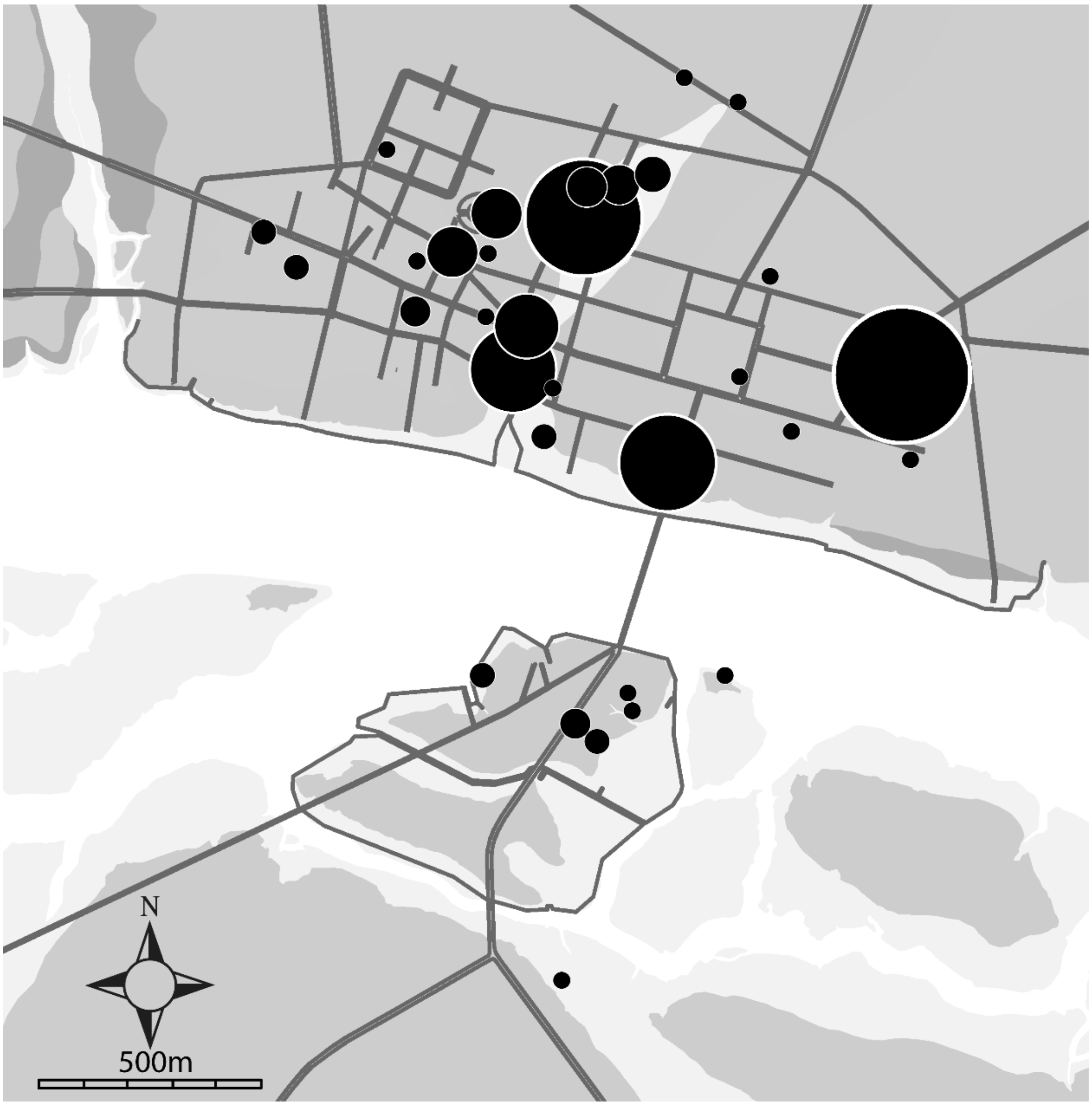


Figure 153 The distribution of bone-working waste on MOLA's Oracle database (base map © MOLA).

6.10.3 Skeletal Material-Working Practice in London

The working of skeletal materials would have used many of the same tools as woodwork, and as such it is extremely difficult to isolate skeletal material-working tools. Some artefacts, such as bracelets, may also have had metal components (Deschler-Erb, 2005, p. 210), requiring the use of metalworking tools and skills.

The majority of work required only a knife and saw (Crummy, 2017, p. 260), although marks from adzes (Deschler-Erb, 1998, Abb.156), drills (Deschler-Erb, 1998,Abb. 163) and files (MacGregor, 1985, p. 58; Deschler-Erb, 1998, Abb. 154) Figure 108can also be seen on bone objects. Initial removal of horns or antlers could have used axes, wedges or large chisels (MacGregor, 1985, pp. 55–7), whilst drawknives may have been used to shape blanks (MacGregor, 1985, p. 58). Some objects, such as hinges and knife handles (MacGregor, 1985, p.

58; Deschler-Erb, 1998, Abb. 157), were made on a lathe, potentially employing tools such as CHI45-46 (Figure 59) and GOU02 (Figure 44).

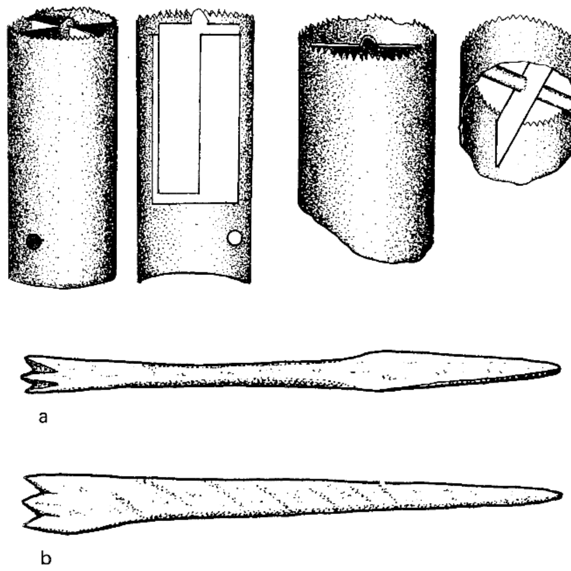


Figure 155 Top; Roman bronze trepanning saws fom Bingen. Below; Slavic centre-bits from Staré Město and Levy Hradec (MacGregor, 1985, figs 37-8). *Not to scale.*

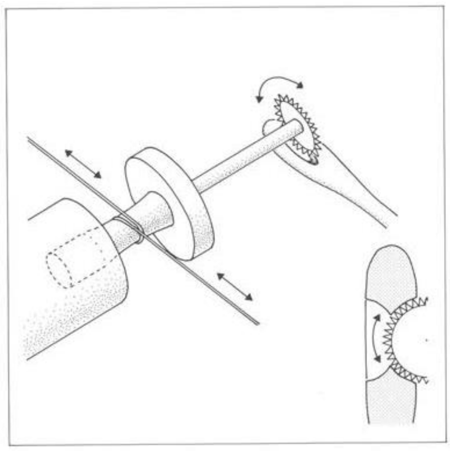


Figure 154 The method for cutting bone needle eyes (Deschler-Erb, 1998, Abb. 162).

More specialised tools were used, although none can be identified amongst the London tool assemblage. A cattle scapula from Southwark, which has a series of 15mm holes cut through it, indicates the use of a centre bit or trepanning saw to produce bone counters (Wardle, 2003b, p. 174). These types of drill bits cut a ring around a central point (see MacGregor, 1985, fig. 38 for Medieval examples), producing round counters with a small central depression (St. Clair, 2003, p. 65). No drill bits of this kind were found in London. Needle eyes may have been cut with a rotating disc (Figure 154). The same type of tool will have been used to cut gemstones (Ogden, 1992, p. 54), but while both activities are likely to have taken place in London (Hall, 2005, p. 133), no tools of this type have been identified.

As saws were not used in Roman butchery (Pipe, 2011a, p. 400), saw marks on antler and bone are likely to be related to craft processing. Saws were used in the processing of antler to cut the tines transversely to length, to cut them longitudinally to create flat blanks (Pipe, 2003, p. 150), and to cut the teeth of combs. The widths of these cuts can be used as evidence for the types of saws used. With the exception of comb teeth, only failed cuts are suitable for this analysis, as they preserve the full width of the cut (Pipe, 2011a, p. 400). Four antler pieces from London with failed saw cuts have been published. One from 1 Poultry had a 1mm wide cut (Pipe, 2011a,

p. 400), whilst three from Southwark had 3mm, 1.9mm and 1.5mm wide saw cuts (Pipe, 2003, p. 149). This range of measurements implies the use of a number of different saw types. The 3mm wide longitudinal cut from Southwark is especially interesting as the majority of saw blades from London are only 1mm thick or less. Only two true saws from London (SAW11 and SAW14) have 3mm thick blades. Serrated knives (SAW16-23) can also have thick blades, although the wedge-shaped sections of these tools would make them unsuitable for longitudinal cutting. This may imply that the saw used to make the 3mm wide cut was set, whilst those used to make the narrower cuts were not. Antler combs from London (Hill and Rowsome, 2011, fig. 218) can have extremely fine teeth, indicating the use of similar saws as those used to make wooden combs (see p.91). This indicates that the saws used in antler-working were taken from the same pool of tools as woodwork, and as such they cannot be identified with certainty.

The working of skeletal materials therefore highlights a major issue with simple functional breakdowns in tool studies. Despite considerable evidence from craft waste for these industries taking place in London, a conventional breakdown of London's tools would not highlight this industry as having taken place within the city.

6.11 Conclusions

The key aims of this chapter were to critically consider what activities were taking place in London, how they were carried out technically, which social groups were involved, and what activities constituted 'professions' in the city. Each section of this chapter contains its own discussion of these issues, and it is not necessary to repeat the details of those conclusions here. The wider implications of these themes for our understanding of the city are discussed further in Chapter 8.

The London tools have produced evidence for a wide variety of practices taking place in and around the city. These industries range from the supply of raw materials, the manufacture of goods and structures to maintain the fabric of the city, the production of food, to activities related to the production of fine decorative objects. Tools provide an insight into stages of these activities that other types of evidence cannot. Woodworking and leatherworking are prime examples of industries in which the lack of preserved organic products makes tools particularly important for reconstructing working practice. In metalwork, tools add detail to our understanding of wrought and forging processes, complementing the evidence from hearth debris and crucibles for casting. In agriculture, tools provide evidence of cultivation and harvesting practices which are otherwise difficult to examine in London owing to the small number of excavated garden plots. The tools also suggest that craft and agricultural activities in London were undertaken using more Continental-type technologies than was common elsewhere in Britain.

This thesis has focussed on industry and agriculture, but the London tools were used in professional practices beyond this. Trade is an obvious omission. Some tools clearly relate to the movement and sale of goods; dies for marking products, coopers' tools and claw bars for making and using packaging, and bailing forks for moving goods. In future, these objects could be contextualised against other evidence of trade, including hooks (not included in this project), vehicle parts, and the more obvious evidence of dockside structures and pottery. Wallace's (2010, 2013, 2014) recent work has also highlighted how much of the early archaeology of the city is characterised by cut features and landscaping, and the London tools could potentially be used as an insight into the practices involved in something as simultaneously simple and fundamental as digging holes.

This analysis has found a close correlation between the archaeological evidence for technical specialisation in tool function and the evidence from classical sources and epigraphy for high levels of specialisation in professions in the Roman period. These sources suggest that, in multiple industries, workers could be defined based on the production of a small range of objects (e.g. combs, chests, barrels, jewellery). Similarly, some of the tools from London can be associated with the manufacture of specific objects (e.g. barrels (CRO01), jewellery (ANV02, HAM07, HAM11), or wooden mouldings (PLA02)). Whilst we should not assume that certain types of technologies automatically demonstrate the presence of certain professions, the two do seem to be strongly correlated.

There was, however, extreme diversity in the lived experience of working life, and it would be inappropriate to propose a single model for what it was like to be a 'craftsman'. There is much that we still do not understand about the organisation of production, particularly regarding the production of composite objects. In some cases, tools can directly enhance our picture of lived experience, as demonstrated through the use of saws and axes in different styles of carpentry (see p.96). There are nevertheless limitations to using tools in this way. It is difficult, even when bringing large amounts of data together in this holistic manner, to reconstruct different working practices amongst different social groups. This is possible in some instances, as demonstrated by the analysis of axe marks on timber structures from London (see p.99), but in others the working practices of entire social groups are invisible to us. This is particularly the case when attempting to identify a 'native' element to woodworking or leatherworking in the city (see p.77, 204).

This discussion has also highlighted a number of issues with using tools as data in a functional discussion. The tool record is demonstrably incomplete. This is most clearly seen in skeletal-materials working, where several tools known to have been used in the city were not found (see p.265). This apparent incompleteness of the material record makes it very difficult to make inferences about London's productive economy based on the *absence* of expected tool types, as can be seen in the discussion of the restricted repertoire of smithing tools found in the city (see p.183).

It would be highly inappropriate to attempt to rank the importance of different industries to the economy of a site based on the proportions of different tools in an assemblage. It is clear that different industries used iron tools to differing degrees; woodworking, agriculture, metalworking and leatherworking in particular relied on large suites of iron objects in almost every stage of production. As such, a study of tools can contribute a large amount to our understanding of these industries. Other industries, such as glass working and pottery production, did not use iron tools in this way, and are therefore difficult to approach despite their well-documented place in London's economy. Even when tools from these industries are identified, their significance easily becomes lost amongst the large amounts of data from other sources. However some industries, particularly the working of skeletal materials, are only absent from the tool record because we traditionally assign the objects used there to other industries.

This research has also highlighted the ambiguity of function of many tool types. Some have forms which would have afforded them a use in multiple industries, where they may have been used for very different purposes. The card scraper SCR04 is a good example of this; it could have been used to scrape hides or timber beams, or to spread plaster or dough. However, ambiguity of function is also an issue for the interpretation of objects which have a clear purpose. Axes are a prime example of this. Axes are used to chop robust materials, but even if we set aside their uses in masonry (see p.235) or skeletal-materials working (see p.265) and assume that they were always used to chop wood, we are left with a wide range of possible functions; felling trees (see p.90), shaping beams (see p.99), chopping firewood for hearths and furnaces (for axes in pottery workshops, see Murphy and Poblome, 2012), and even preparing surfaces for plaster (see p.243). Axes would therefore have been used in a range of industries, even if they were almost exclusively used to chop wood. Rather than attempting to divide tools into functional groups by material type, it may be fruitful for future work to divide them based on mechanical function (e.g. chopping, chiselling, moulding). Nevertheless, the ambiguity (or otherwise) of function in some tool types can be used to explore the society of industrial work in the city, and is discussed further in Chapter 8.

Chapter 7- Disposal

Distribution, Context, and Chronology

7.1 Introduction

This section will look at the depositional practices involved in the disposal of London's tools through a study of distribution, archaeological context, and date of deposition. The degree to which these can be determined is extremely variable given the nature of the collection. The depositional contexts of tools may be used as an indication of the organisation of craft practices through the identification of workshops or working areas, periods of activity, etc. We have already seen how the distribution of tools within sites has been fruitfully exploited in this way in previous tool studies (Chapter 3), and this was a key aim of this project from the outset. Understanding depositional processes also gives insights into the cultural significance of material culture and its consumption (Smith, 2011). The disposal of artefacts is rarely given prominence in archaeological discussions of identity, except where 'ritual' behaviour is invoked (Ross and Feachem, 1976; Hill, 1995; Merrifield, 1995; Clarke, 1997; Garrow, 2012), but this will form a key component of the following chapter. As such this section will seek to answer two questions:

- Where were tools deposited and why?
- What evidence is there for 'zones' of craft practice in London?

This section will look first at the overall distribution of tools in London, considering the evidence for changes over time and qualitative differences between London's topographical zones. This will be followed by a detailed analysis of the contexts in which tools were deposited in these different zones.

7.2 Distribution of Tools in London

Figure 156 shows the distribution of all tools (excluding spatulas) in the city of London and Southwark. From this map it is immediately clear that the deposition of tools was not focussed on any of the three conventionally discussed 'zones' of London (Cornhill, Ludgate Hill and Southwark). Instead, the vast majority of provenanced tools were found between Cornhill and Ludgate Hill, in the Walbrook valley. Because of this extreme bias towards deposition in the

Walbrook valley, it is impossible to make meaningful comparisons of the functional makeup of the assemblages from London's topographic 'zones'.

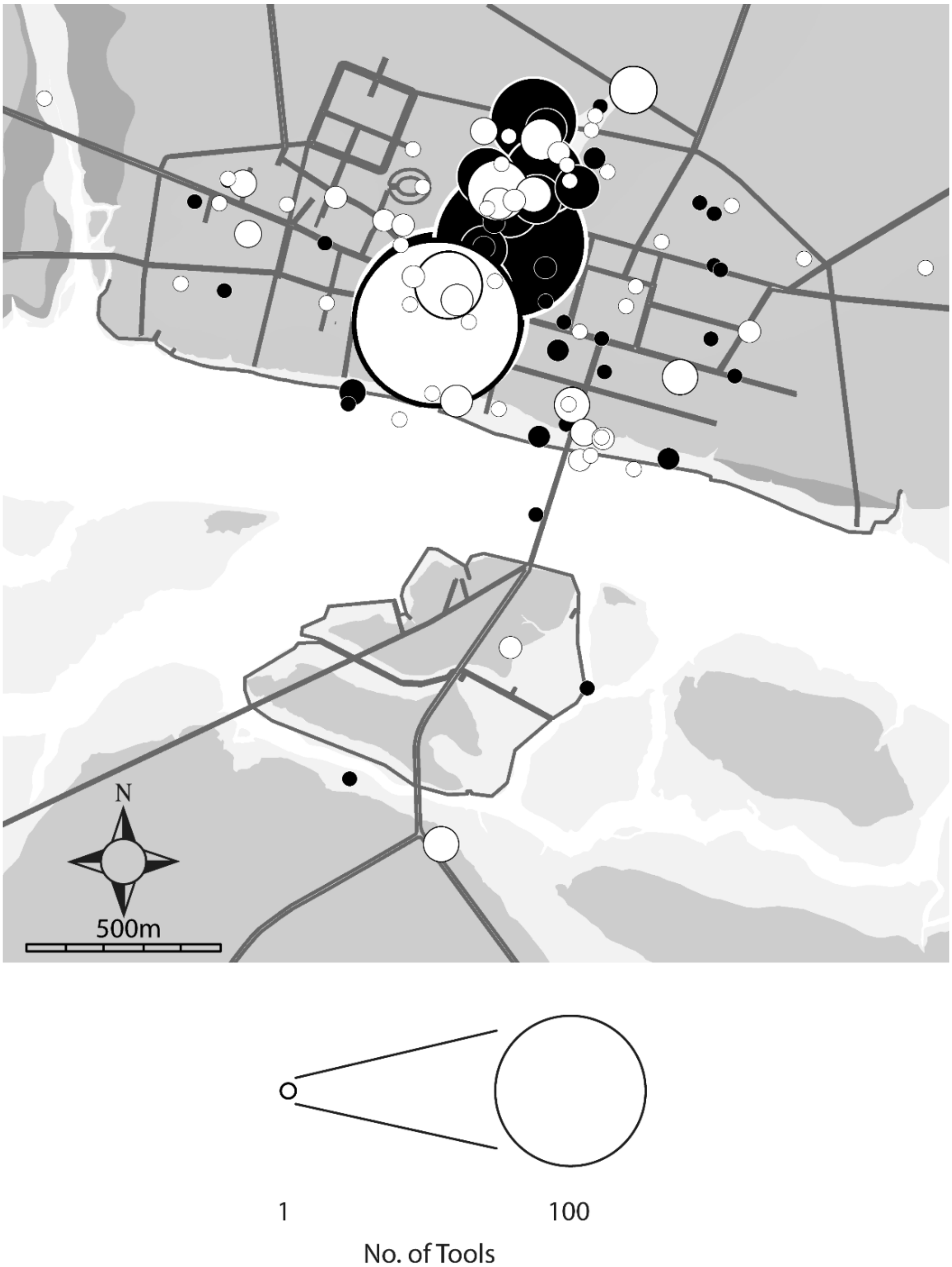


Figure 156 Distribution of all tools in the city of London and Southwark (Black dots = sites with street addresses, White dots = sites with sitecodes).

This pattern can, however, be compared with that seen for other artefact types. A number of artefact types from London have been mapped in recent years, including glass bath flasks (Wardle, 2008, fig. 4.5.8) and colourless glass vessels (Shepherd, 2008), bronze (Durham, 2010, fig. 115) and pipeclay (Fittock, 2015, fig. 6) figurines, hair pins (Rangel de Lima, 2014), keys (Rimmel, 2015, fig. 89), inkwells (Monteil, 2008), lighting equipment (Eckardt, 2002, pp. 31, 32), samian ware (Monteil, 2004, figs 4-9), toilet instruments (Crummy, 2008), and weighing equipment (Smither, 2016, fig. 78). In many instances a concentration of finds has been observed in the Walbrook valley (Crummy, 2008, p. 218; Rangel de Lima, 2014; Fittock, 2015, p. 9; Rimmel, 2015, pp. 122–4; Smither, 2016, p. 107), although this is not always the case, especially for non-metal artefacts. However, nowhere is this concentration as extreme as it is for the London tools. This may be partially due to material type, as it is noticeable that the concentration of keys in the Walbrook is much more extreme for iron than copper alloy examples (Rimmel, 2015, figs 91, 92).

This distribution pattern is not static, however. 260 tools from London can be assigned specific depositional dates, and these can be mapped (Figure 158) to show the changing distribution of tools in London. Of these dateable tools, 108 (41.5%) come from recent excavations at Bloomberg (BZY10). As such, it is not surprising that the largest numbers of tools were deposited in the late 1st century, when the dumping of waste at Bloomberg (BZY10) and other Walbrook valley sites was at its height (see p.298). It should be noted that much of the material from the Bloomberg dumps appeared to have been redeposited from middens, and some objects may originally have been discarded a few decades earlier than the date of final redeposition (Watson and Bryan, forthcoming).

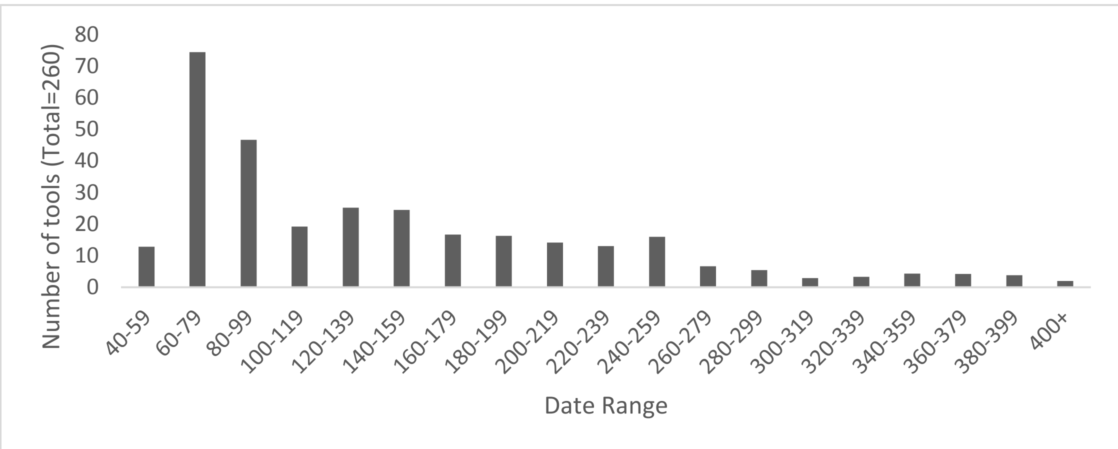


Figure 157 Graph showing the dates of deposition of the tools from London.

The changing distribution of tools (Figure 158) does not show any obvious correlation with the establishment of craft zones in London. The earliest tools are deposited on Cornhill, in the middle Walbrook valley, and on the eastern edges of Ludgate Hill. This distribution expands further onto Ludgate Hill in the later 1st century, and into the upper Walbrook valley and Southwark in the 2nd century. In all periods there is a concentration of tools in the Walbrook valley, although this diminishes over time. This distribution follows the expansion of the city itself (Chapter 2), although there is no evidence in the tools for a Late Roman contraction. This indicates that, in the broadest terms, changes to the distribution of tools follow the pattern for the development of the city as a whole, and are not reflective of changing craft organisation specifically.

Figure 158 Distribution of the dated tools from the City of London and Southwark.

7.2.3 Distribution is Rubbish

We can therefore say that the distribution of tools does not match closely with the picture of craft organisation gained through studying the distribution of craft waste (Chapter 6), or the notion that London was defined as a number of topographic 'zones'. The distribution of tools is instead heavily skewed towards the Walbrook valley; more so than for other artefact types. The reasons for this are complex, and cannot simply be reduced to defining the Walbrook valley as a 'craft zone'. It must be appreciated that the link between the distribution of artefacts and the spatial organisation of ancient practices is not direct. Any distribution map of archaeological artefacts shows only the distribution of disposal features, heavily influenced by taphonomic factors such as preservation and recovery. In order to truly understand the distribution of tools as evidence of practice, we need to look more closely at the formation processes of the archaeological record in London. How did the material record form, and why is it different in the different 'zones' of London? This discussion will begin with the most productive area for Roman tools in London, the Walbrook valley, before moving on to look at disposal practices in the other central London zones (Cornhill, Ludgate Hill, the waterfront and Southwark), the Thames, Greater London, and the Cemeteries.

7.3 Tools from the Walbrook Valley

The exceptional Roman finds from the Walbrook valley have long been a subject of fascination. Both organic and metal finds from the area are renowned for their fantastic preservation, and the huge quantities of material recovered. Walbrook artefacts make up a huge proportion of the material in the Museum of London, as well as a large proportion of the collection in the British Museum (Guildhall Museum, 1956; Merrifield, 1995). The sheer number of artefacts has been difficult to explain and has been a matter of debate for many years, with scholarship divided over whether they represent rubbish disposal, local activity or ritual deposition in a sacred river.

With little structural information having historically been recovered from the city, these finds have been instrumental in interpreting *Londinium* (Wilmott, 1991, p. 61). However, the concentration of so many different types of artefacts in the Walbrook has meant that 'the various activities suggested for the Walbrook valley in the past have been very diverse and make strange bedfellows' (Wilmott, 1991, p. 168). Before using the concentration of tools in the Walbrook valley as evidence for the organisation of craft activities, we need to critically consider why so many tools and other artefacts are found here.

7.3.1 Excavation in the Walbrook Valley

When noting the concentration of tools in the Walbrook valley, it is important to consider whether this is simply a reflection of the way that archaeological interventions in the city have been carried out. The Walbrook valley has been the scene for a number of major excavations, stretching back into the 19th century. These include Pitt Rivers' excavations at London Wall (Lane Fox, 1867), excavations during construction work at the National Safe Deposit Company (Puleston and Price, 1873) and Bank of England (Wilmott, 1991, pp. 51–5), and the post-war rescue excavations of the Roman and Mediaeval London Excavation Committee (RMLEC) and Guildhall Museum at the Bucklersbury House site (Guildhall Museum, 1956; Grimes, 1968, pp. 92–8; Wilmott, 1991, pp. 18–33; Shepherd, 1998). However, it would be wrong to see the concentration of metal tools in the Walbrook valley purely as a result of antiquarian interest in the area. Figure 156 shows that modern excavations in the city have continued to find more tools in the Walbrook valley than elsewhere in the city.

Whilst it is true that a number of these excavations excavated larger areas than those elsewhere in the city, this is also unlikely to be the most significant factor. Whilst it is unfortunately impossible to reliably estimate the volume of archaeological spoil recovered from a given

London site, we can point to large excavations elsewhere in the city (such as GPO75) which produced fewer tools than smaller recent excavations (such as ACW74) in the Walbrook.

At a general level we can say that a larger number of Walbrook sites have produced Roman tools than sites from other areas, and that the number of tools produced by the average excavation in the Walbrook valley is considerably higher than for any other site type (Table 5). These figures would be even starker if we included sites which have produced no tools.

London Area	No. Tools	No. Sites	Tools/site
Cornhill	42	26	1.62
Greater London	49	20	2.45
Ludgate Hill	22	15	1.47
Southwark	9	4	2.25
Walbrook	579	43	13.47
Waterfront	22	12	1.83

Table 5 The number of tools excavated in different areas of London.

7.3.2 Preservation in the Walbrook Valley

Another possible reason for the apparent concentration of tools in the Walbrook valley is the differential preservation of tools in different parts of the city. Objects in the Walbrook valley are better preserved than those from elsewhere in the city (Figure 159, Table 6), and this may have led to the increased recognition of metal finds, which might have been rendered unidentifiable if deposited elsewhere.

Site Type	No. tools	Average Condition
Cornhill	19	3.63
Greater London	31	3.68
Ludgate Hill	19	4.11
Southwark	4	4
Walbrook	523	2.92
Waterfront	19	3.42

Table 6 The condition of the tools in different parts of the city (1 = perfect, 5 = very poor).

Figure 159 Type B2 spatulas from London, showing the different levels of preservation in the city (Top, Ludgate Hill, WXS21. Middle, Cornhill, WXS12. Bottom, Walbrook Valley, WXS10).

This may be particularly important when we consider that the vast majority of the tools discussed here are made of iron, which can quickly become unrecognisable in dry conditions. It is noticeable that the distribution of iron keys is more heavily skewed towards the Walbrook valley than that of copper alloy keys (Rimmel, 2015, figs 91, 92), and future studies of artefacts from London should be aware of this potential bias.

The preservation of these artefacts is due in part to the nature of the deposits they are contained within. Constant waterlogging (of bank deposits as well as stream deposits) and slightly acidic conditions have prevented the decay of organic matter and the corrosion of metal. The depth of deposits is also likely to have been a factor. The rapid burial of objects in the banks (see p.296) will have prevented damage from exposure. The depth of the deposits has also protected the objects in the Walbrook valley from truncation by later activity, which has led to the mixing of objects on the higher ground on Ludgate Hill and Cornhill (Marshall and Wardle, forthcoming; Wardle, 2011a, pp. 348–9). It is also possible that these figures are skewed by earlier excavations in the Walbrook valley which were biased towards the collection of better preserved artefacts (Wilmott, 1991, p. 66; Wardle, 2011a, p. 348).

However, good preservation conditions are not the only reason that large numbers of metal tools have been identified in the Walbrook valley. Recent work by Marshall (in Marshall and Wardle, forthcoming) has shown that a high metal content is characteristic of a number of sites in the Walbrook area which are higher up the valley slopes, and therefore drier and shallower than those on the valley floor.

7.3.4 Context in the Walbrook Valley

With neither excavation history or preservation conditions fully explaining the concentration of tools in the Walbrook valley, we should instead look at context, and the question of when and why objects were deposited here. Early work by the RCHM (1928, p. 16) summarised the area as a ‘repository for refuse’, which was used to infill a wide river channel. Later interpretations continued to accept rubbish disposal as the main theory, even after it was recognised that the Walbrook was a narrow stream, rather than a wide river (Wilmott, 1991, p. 61; Wardle, 2011a, p. 329).

Merrifield (1965, p. 93) first suggested that ritual deposition may account for some of the objects in the stream, but maintained that accidental loss during bank-side activity was probably the most likely cause. Later, Manning (1972a, p. 249) considered the Walbrook assemblage to be ‘far too much for it to be the result of anything but the most improbable series of accidents’, and Merrifield (1983, pp. 101–2) agreed that ‘It is difficult to account for the great number and variety of these finds in the bed of the Walbrook, except on the assumption that it was a common custom in first- and early second-century *Londinium* to devote a tool of one’s trade or a sample of one’s wares to a local deity by throwing it into the stream’.

These arguments were based principally on unstratified finds until Maloney (1990) and Wilmott’s (1991) detailed analyses of site stratigraphy allowed the issues of deposition to be seriously investigated. Both works saw the Walbrook artefacts as primarily the product of waste disposal on the river banks for the purpose of land raising. Their views were not universally accepted, however, and were subject to rebuttals by Merrifield (Merrifield, 1995; Merrifield and Hall, 2008), who strongly re-asserted his earlier view that the material derives from ritual deposition in the Walbrook stream.

Subsequently, the debate about the origins of the Walbrook material has continued in excavation reports. Extensive discussions of the Walbrook valley finds from 1 Poultry (Wardle, 2011a, p. 349) and Bloomberg (BZY10, Watson and Bryan, forthcoming) favour an interpretation similar to that proposed by Wilmott. A discussion of the material from Tokenhouse Yard agrees with Merrifield, arguing that ‘the number of objects from such small trenches are persuasive and indicative of ritual activity', despite the fact that the stream itself was not encountered at this site (Leary and Butler, 2012, p. 86). A recent attempt by Crease (2015, pp. 147–9) to integrate the material published by Wilmott (1991) into a wider analysis of structured deposition in the Roman world is unsatisfactory. The work is hampered by a focus on only the stream, and minimal engagement with the complexities of formation processes in the Walbrook valley.

7.3.4.1 Bank and Stream Deposits

Any discussion of the distribution of finds in the Walbrook valley must be rooted in a detailed understanding of their context. Not all tools from the Walbrook valley come from the stream; many derive from bankside deposits. However, the exact proportion of finds from bank and stream deposits is difficult to establish.

Figure 160 shows that most of the tools from the Walbrook valley are unstratified. Of the stratified tools, more come from bank deposits than the Walbrook stream. This differs significantly from the pattern found by Wilmott's (1991, fig. 43a) study, which showed that the largest categories of stratified objects came from Walbrook stream deposits. The difference between these two sets of figures is due in part to the fact that recent commercial excavations in the Walbrook valley have excavated bank deposits, but have not encountered significant stream deposits.

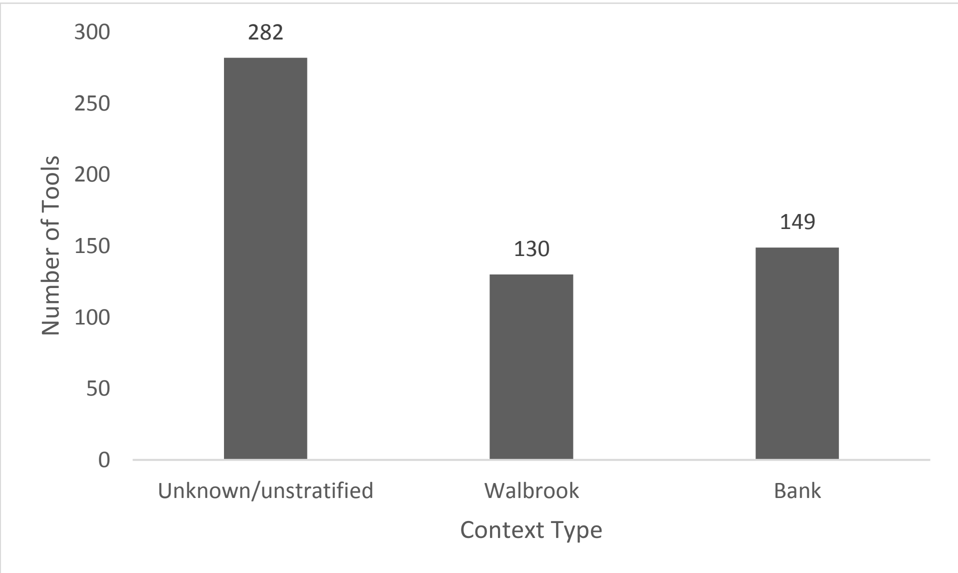


Figure 160 The contexts of the tools excavated in the Walbrook valley.

A crucial factor in interpreting these figures is that the majority of the stratified Walbrook valley tools from both recent excavations and museum collections come from just one site;

Bucklersbury House/Bloomberg London (BZY10). It is therefore worth taking some time to look at the differences between the two phases of excavation at this site, and how they produced very different artefact profiles.

7.3.4.2 Bucklersbury House/Bloomberg London Excavations

Bucklersbury House/Bloomberg London has been excavated in two main phases. Previously a city block formed of multiple smaller buildings, the site was heavily damaged by bombing during the Second World War, and subsequently redeveloped into a large office complex, Bucklersbury House, in the 1950s. Trenches dug across the site in advance of construction by W.F. Grimes and Audrey Williams of the RMLEC unexpectedly discovered a 3rd century Mithraeum, the public interest around which led to further excavations and watching briefs across parts of the rest of the site by the Guildhall Museum (Grimes, 1968, pp. 92–117; Wilmott, 1991, pp. 18–33; Shepherd, 1998).

Figure 161 Members of the public queueing to see the Temple of Mithras, uncovered in the 1950s at Bucklersbury House (http://www.mola.org.uk/sites/default/files/styles/banner/public/images/banner/3.%20Visiting%20the%20Temple%20of%20Mithras%20%28c%29%20Museum%20of%20London.jpg?itok=JCQ_pXXM).

Recently, the Bucklersbury House office complex has been demolished and replaced with a new building, Bloomberg London. Prior to construction, in 2010-14, MOLA archaeologists excavated large areas of the site, principally on the eastern bank of the stream, which had not been excavated during the original construction work (Bryan *et al.*, 2016, pp. 1–3).

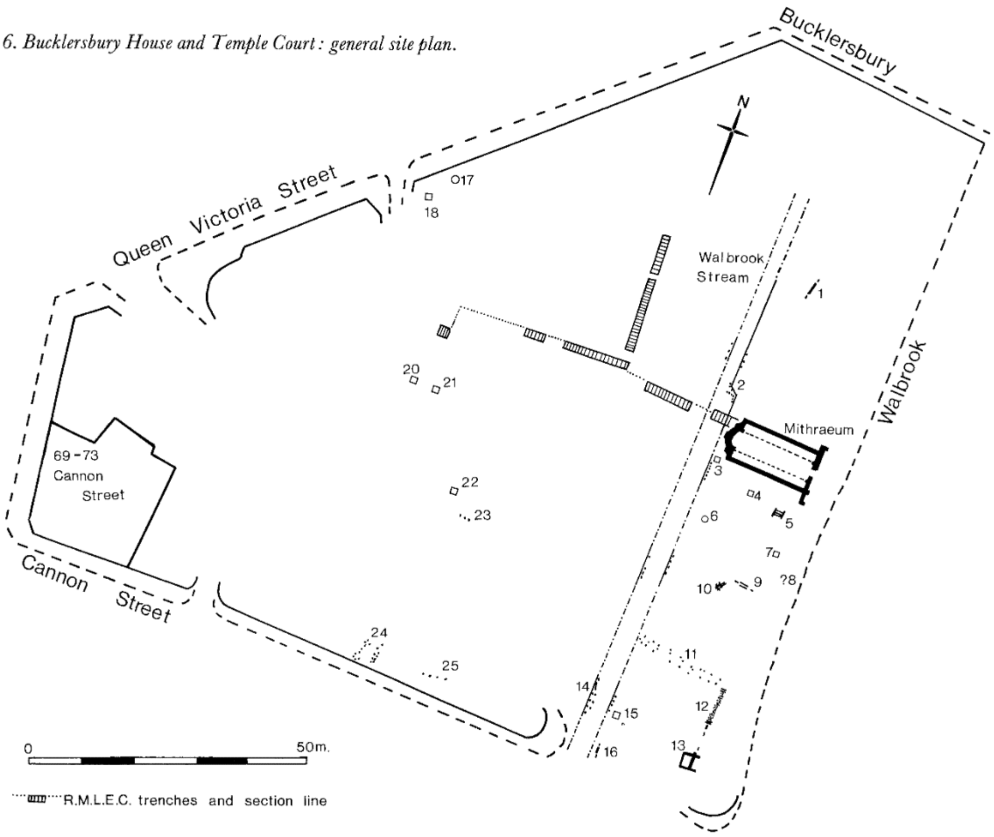


Figure 162 Features excavated at the Bucklersbury House/Bloomberg London site by the RMLEC and Guildhall Museum, 1951-1955 (Wilmott, 1991, fig. 6).

Figure 163 Areas of the Bucklersbury House/Bloomberg London site re-excavated by MOLA, 2010-2014 (Bryan *et al.*, 2016, fig. 2).

These two phases of excavation should be seen as complementary to each other. However, the stratified finds from these two phases of excavation show very different contextual patterns. Excavations by MOLA recorded a much wider range of contexts than was recorded at Bucklersbury House in the 1950s (Figure 164).

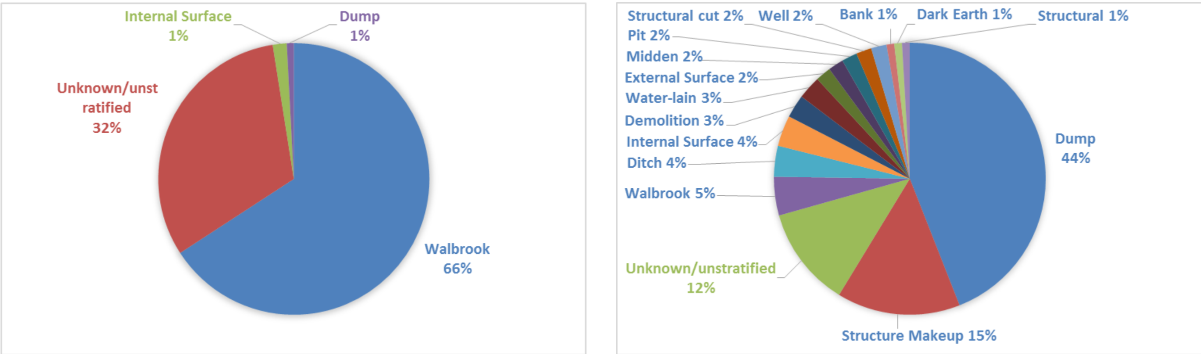


Figure 164 The contexts of the tools excavated at Bucklersbury House (left) and Bloomberg London (BZY10, right).

In part, this reflects the changing nature of context recording in London. Context records in the Museum of London are almost always street addresses or the name of a river. ER numbers, an early form of context recording, are only given to a tiny minority of objects excavated by the Guildhall Museum. The only stratified bank deposits from Bucklersbury House are from the trenches excavated by the RMLEC, the stratigraphy of which was only recently established (Shepherd, 1998). Most objects from 'dry land' deposits in the Museum of London are therefore effectively unstratified. For Bucklersbury House, this means that objects were *either* recorded as coming from the stream *or* are now considered unstratified. In contrast, the Bloomberg (BZY10) excavations were carried out by professional archaeologists working using a modern single-context recording system specifically developed for this sort of deeply stratified urban archaeology. As such, a much wider range of contexts were recorded in this phase of excavation.

It is possible that the majority of 'unstratified' finds from Bucklersbury House were found in the banks, although this can never be known for certain. Several 'unstratified' tools from this site (AWL0131, OXG32, BOR49, SAW22, WXS11, SIC29, CHI11) were collected by Francis Greenway-d'Aquila, who according to Wilmott (1991, p. 64) gathered material mainly from the 'artificial bank' rather than the stream bed. However, even if all of the 'unstratified' tools from Bucklersbury House are interpreted as bank finds, they are still overshadowed by the number of Walbrook stream bed finds (Figure 164). This is in stark contrast to the Bloomberg London excavations, where very few objects were excavated from the Walbrook stream bed.

This may be because of Guildhall Museum archaeologists and workmen focussing their collecting activities on the Walbrook stream in the 1950s, as it was known that artefacts could be found there (Wilmott, 1991, p. 63). However, it may also be a genuine reflection of the different deposits encountered in these two phases of excavation. The recent excavations at BZY10 encountered only small areas of the Walbrook stream, the majority of which had been excavated away during the digging of the foundations for Bucklersbury House in the 1950s (see Figure 162 and Figure 163).

7.3.4.3 Other Significant Walbrook Excavations

Attempting to assign a provenance to the tools from other Walbrook sites in the Museum of London and elsewhere is more difficult. Two major excavations at the Bank of England and NSDC encountered both bank and stream deposits (Figure 165), but have no surviving stratigraphic information (Wilmott, 1991, pp. 46, 51). One way in which it may be possible to differentiate between bank and stream deposits on these sites is on the basis of condition. Merrifield (1995, pp. 32–3) has argued that the condition and completeness of some of the objects from the NSDC site is so good that they must have been deposited in the Walbrook stream. However, excavations at a number of sites in the Walbrook valley have shown that well-preserved objects can be preserved in the waterlogged bank deposits of the Walbrook valley (Wilmott, 1991, p. 64; Wardle, 2011a). Conversely, the stream deposits excavated at Bloomberg London (BZY10, Marshall and Wardle, forthcoming) and observed at Bucklersbury House by Greenway (Wilmott, 1991, p. 64) have been noted for containing 'much scrap and waste iron'. The condition of tools deposited in the Walbrook stream itself seems to have been worse than that of objects recovered from the banks. From this we may assume that many of the better preserved objects from London's museums were deposited in the banks rather than the stream bed.

Distinguishing between bank and stream deposits from previous Walbrook excavations is, however, an impossible task at this stage, and we will never know what the true proportions are of these two classes of context. Nevertheless, we can say that significant amounts of tools were deposited in the Walbrook valley, both in the Walbrook stream itself and on its banks. The following sections will discuss the formation processes of these two depositional areas, and assess how they could affect our interpretation of the Walbrook tools.

7.3.5 Tools from the Walbrook Stream

Objects from the stream have dominated discussions of deposition in the valley. Merrifield has proposed several scenarios for ritualised deposition in the stream, including 'closure deposits' from bankside activities (Merrifield, 1995, fig. 41) and the deposition of 'a tool of one's trade or a sample of one's wares to a local deity' (Merrifield, 1983, figs 101-2). Merrifield (1995, p. 41) has also argued that stream deposits were made of restricted categories of artefacts, particularly pointed metal objects such as nails and styli, deposited in stereotyped assemblages as a form of sympathetic magic designed to ensure the free passage of the stream. Wilmott (1991, p. 64), however, relates the stream material to local waste disposal. A point of agreement for these works is the importance of looking at individual deposits in the stream. Instead of attempting to interpret the Walbrook stream as a whole, we should therefore examine each instance of deposition separately.

It is worth noting first of all that the number of tools known to have come from the stream itself is low. Although at first glance making up just under half of the stratified objects from the Walbrook valley (Figure 160), it is possible that the number of tools found in the stream bed has been overestimated. There must be some doubt about the true provenance of many of the objects from the British Museum and Museum of London which are described as coming from the Walbrook stream bed. The Museum of London contains 101 tools recorded on the museum's MIMSY database as coming from the Walbrook stream. The majority (79) of these objects come from the Bucklersbury House site, but there are issues with the contextual information for all but the 19 identifiable tools from stratified groups (see p.288). Of the 22 tools from other sites in the Museum of London recorded as coming from the Walbrook stream, 16 are rake tines (RAK23-34, 36-9) which may have been deposited as a single object, whilst CHI38 is only presumed to have been found in the stream. The British Museum contains 23 tools recorded as coming from the Walbrook stream bed. However, 20 of these were accessioned in 1934 from an unrecorded site. As their accessioning pre-dates the establishment by Grimes (1968, pp. 92–3; Shepherd, 1998, p. 216) of the true width of the Walbrook stream, it is possible that these were found in bank deposits rather than the stream itself. These finds will be excluded from further discussion. As a result, the number of objects deposited in the stream may be somewhat overestimated.

However, there are also reasons to see the figures used here as an underestimate. Stream deposits are known to have been encountered at the NSDC and Bank of England (Wilmott, 1991, figs 32, 35), but no stratigraphic information is available for any of the objects from these sites, and as such they have been excluded from analysis. Another major site in the upper Walbrook valley likely to have produced stream finds, Drapers' Gardens (Gerrard, 2009; Hawkins, 2009b; Pre-Construct Archaeology, 2009), is not part of this project.

A further possible complication is Merrifield's (1995, p. 31; Merrifield and Hall, 2008, fig. 126) suggestion that the need to periodically clear the stream of silt meant that artefacts initially deposited in the stream were dredged up and incorporated into the banks. Grimes' RMLEC trenches produced sections which suggested that Flavian material had been removed from the stream bed and incorporated into the banks (Shepherd, 1998, pp. 36–8, 51, 111). However, it is difficult to believe that this would have accounted for a significant proportion of the massive finds-rich bankside land-raising dumps (see p.296). Only four tools from Bloomberg (BOR02, FIL09, OSP23 and RAK15) were identified as coming from alluvial material deposited on the valley banks, and in the case of BOR02 and FIL09 this was due to flooding rather than dredging.

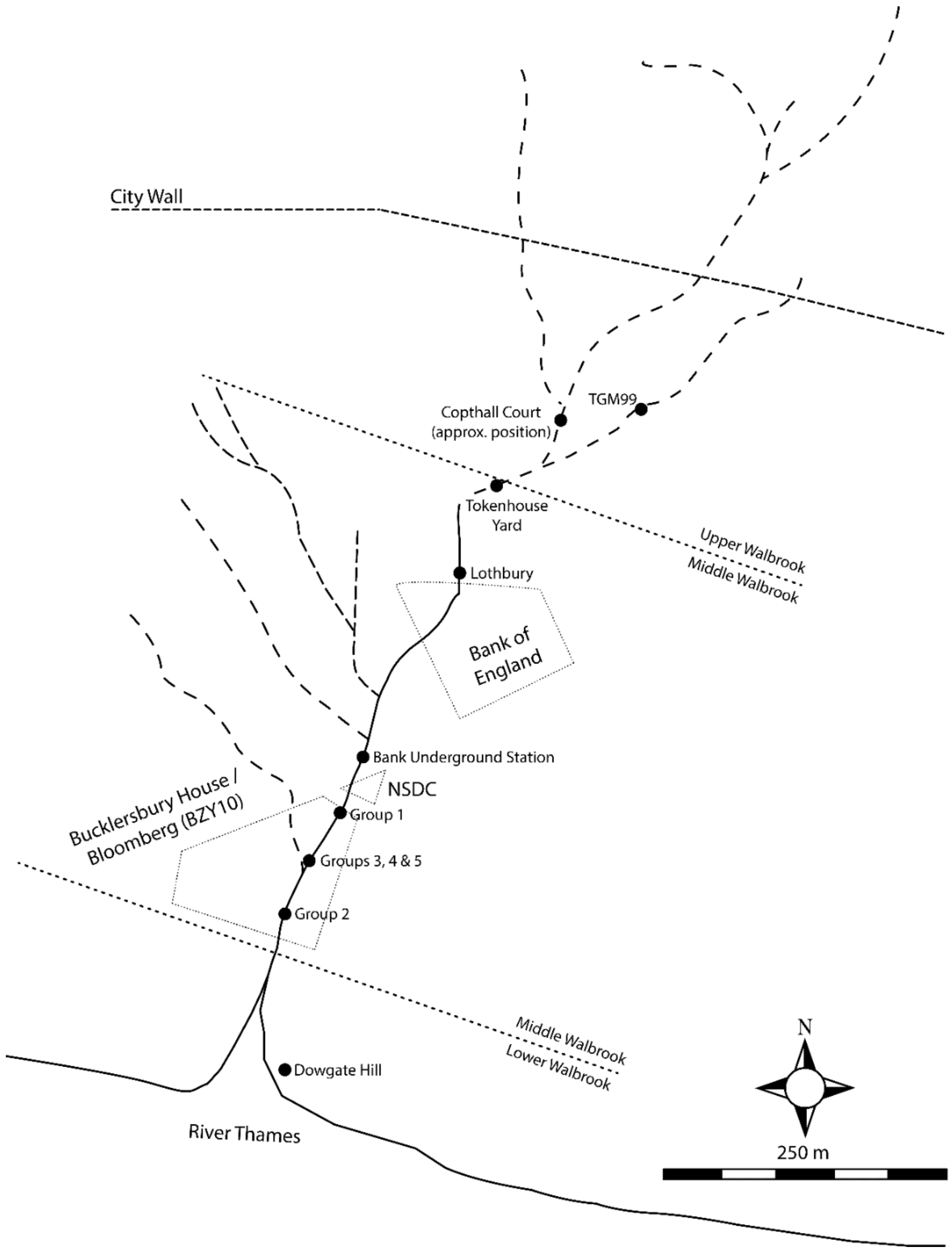


Figure 165 The locations of tools from the Walbrook stream (after Merrifield and Hall, 2008, fig. 3.2.1).

From this we can infer that dredging was not a major factor affecting the context of tools at the Bucklersbury House/Bloomberg site.

The following discussion looks at the details of the depositional contexts of tools from the Walbrook stream, site-by-site. The sites are discussed from north-south along the course of the stream (Figure 165).

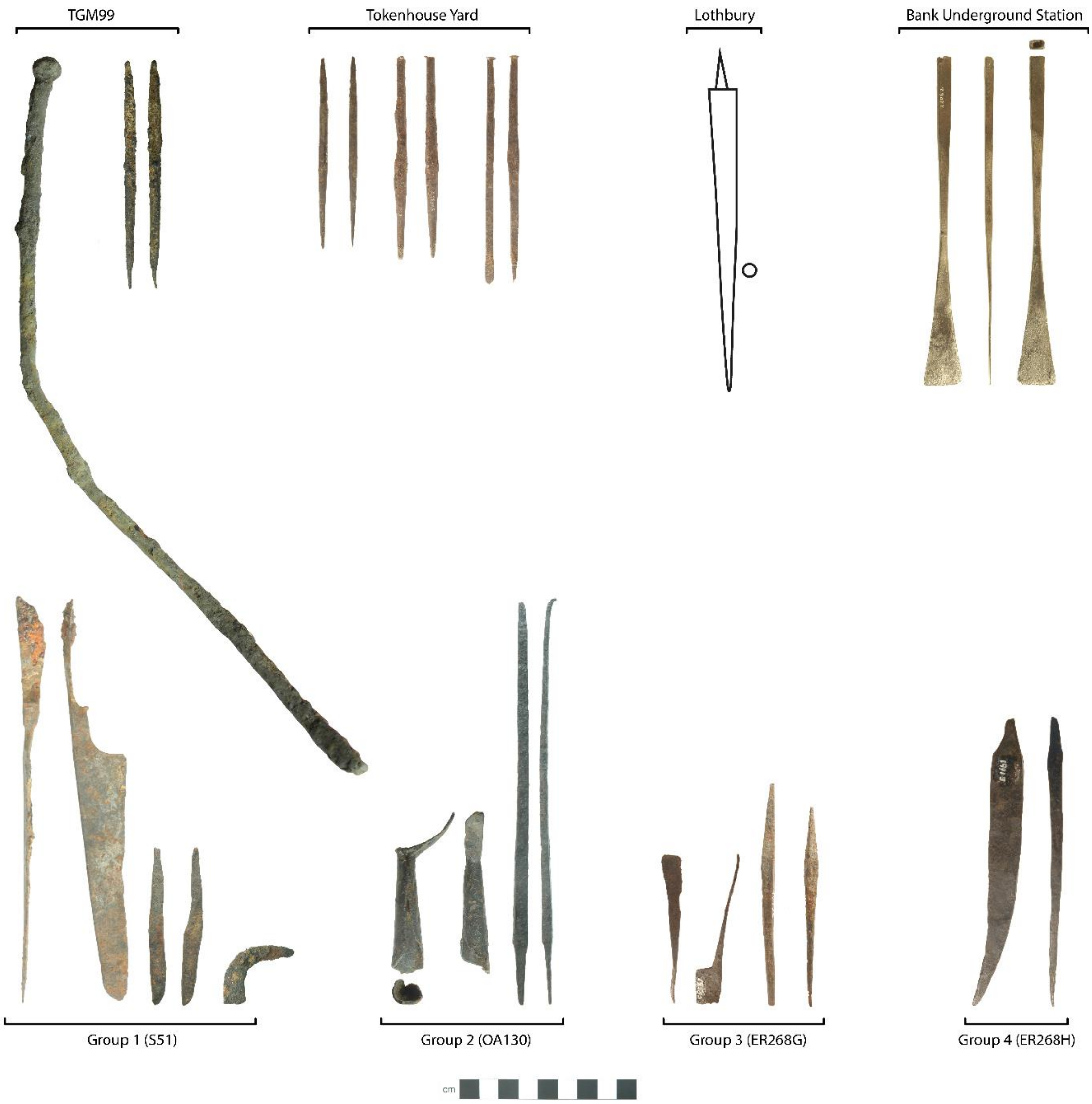


Figure 166 Tools from the Walbrook stream (Top row, left-right; TGM99, HEA07, AWL077; Throgmorton Avenue, AWL072, FIN01, FIN11; Lothbury, AWL053 (after Manning, 1985a, E5)*; Bank Underground Station, WXS40. Bottom row, left-right; Group 1, SHE17, ENG01, SIC32; Group 2, FOR19, THR06; Group 3, SHE08, AWL070, AWL079; Group 4, RAK21).*

Winchester House

A single tool, CHI38, from Winchester House, can be discarded from this dataset, as it is only presumed to have come from the Walbrook.

Copthall Court

Seventeen tools in the Museum of London are recorded as coming from the 'Walbrook bed' at Copthall Court, but no other stratigraphic information is available and it is unknown if these finds were found together. Sixteen of these finds were rake tines (RAK23-34, 36-9, Figure 78), presumably deposited as one or more complete rake heads, the only other tool being the tweezers TWE14.

Throgmorton Avenue (TGM99)

Excavations at Throgmorton Avenue (TGM99) produced two tools, deposited separately in the revetted Walbrook stream channel. A leatherworking awl, AWL077, was deposited amongst household waste in the early 2nd century. In the 2nd half of the 3rd century a bent poker, HEA07, was deposited in organic peat in the channel. These dates of deposition are to be treated with some caution as only spot dates were available.

Tokenhouse Yard

Two separate stream deposits excavated at Tokenhouse Yard produced tools. However, no stratigraphic information is available about these deposits. One deposit contained the leatherworking awl AWL072. Another contained two tracers, FIN01 and FIN11.

Lothbury

A single tool from the British Museum, AWL053, is recorded from the Walbrook at Lothbury. No other contextual information is available.

Bank Underground Station

A single tool, WXS40, a workman's find, is attributed to the Walbrook stream at Bank Underground Station (Wilmott, 1991, figs 77, 262).

Bucklersbury House/Bloomberg London (BZY10)

The largest number of tools from the Walbrook stream comes from the Bucklersbury House/Bloomberg London (BZY10) site. These tools can be divided into nine distinct stratigraphic groups.

Stream Deposits from Bloomberg (BZY10)

Two stratified groups (Groups 1 and 2) were excavated in the Walbrook stream during recent excavations at the site by MOLA.

Group 1 – S 51. A metal-rich gravel deposit on the eastern side of the Walbrook stream bed, excavated in a slot at the far north of the BZY10 site. Dated to 65-80 AD. Contained three tools (ENG01, SHE17 and SIC32).

Group 2 – OA130. Water-lain sandy gravel layer in a slot dug through the Walbrook stream towards the south of the BZY10 site. Dated to 125-170 AD. Contained two tools (FOR19 and THR06), neither of which are certainly related to craft.

Stream Deposits from Revetment 2, Bucklersbury House

Several stratified groups were excavated by the Guildhall Museum around Revetment 2 in the 1950s, three of which (Groups 3-5) contained tools. Information about these stratified groups is published by Wilmott (1991, pp. 19–21, 118–38) under their original excavation numbers, ER268K, ER268G and ER268H. However, none of the objects from these deposits were identified by their ER numbers on the Museum of London's MIMSY database, and issues arise when attempting to use Wilmott's catalogue to identify tools in the Museum's collection.

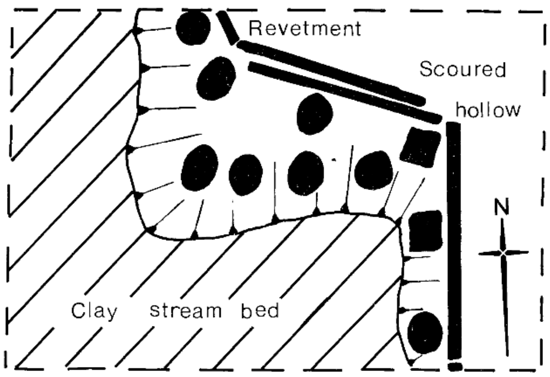


Figure 167 Revetment 2 excavated at Bucklersbury House (Wilmott, 1991, fig. 8, not to scale)*. For the position of this feature in the site, see Figure 162 and Figure 165.*

Many of the objects from ER268K and ER268G have been assigned the wrong Museum of London accession number in Wilmott's publication, whilst no accession numbers are given for the finds from ER268H. This is a real issue as most of the mis-numbered objects have not been illustrated, and as such cannot be located. Further finds from these groups are mentioned in the excavators' notes (Wilmott, 1991, p. 132; Merrifield, 1995, p. 41), which were consulted for this project, leading to the reidentification of two unillustrated ox goads from ER2268K (OXG029-30). Table 7, Table 8 and Table 9 show the correct accession and catalogue numbers, where they could be identified. Unfortunately, it is only possible to identify 21 of the tools from Bucklersbury House as having come from stratified stream bed deposits.

Group 3 – ER 268 G. c.0.6m thick layer of coarse black gravel at Northern end of the slot. Excavated by Museum staff and workmen. Contained three tools (Table 7).

Interpretation (Wilmott)	Publication No. (Wilmott)	Acc. No. (Wilmott)	Fig. No. (Wilmott)	Acc. No. (MOL)	Cat. No.	Reinterpretation
ER 268 G						
Punch	478	19631	90, 478	19631	AWL079	**Awl**
Punch	479	19632	90, 479	19632	AWL070	**Awl**
Shears	480	19595	90, 480	**19585**	SHE08	Shears

Table 7 Tools from the Bucklersbury House stream Group 3/ER 268 G. Bold text indicates corrections to Wilmott's publication.

Group 4 – ER 268 H. Group of small finds from the 'bed' of the stream, thought to represent a deliberate single deposit. Overlain by Antonine material. Amongst the objects found in this deposit was a 'hoard' of c.2,456 nails and hobnails, and pieces of slag (Rhodes, 1991a). Two tools were identified by Wilmott as having been found in this deposit, although only one, RAK21, could be tentatively identified in the collections of the Museum of London (Table 8).

Interpretation (Wilmott)	Publication No. (Wilmott)	Acc. No. (Wilmott)	Fig. No. (Wilmott)	Acc. No. (MOL)	Cat. No.	Reinterpretation
ER 268 H						
Punch	496	-	91, 496	?	-	?
Rake Tine	508	-	92, 508	**19913?**	RAK21?	Rake Tine

Table 8 Tools from the Bucklersbury House stream Group 4/ER 268 H. Bold text indicates corrections to Wilmott's publication.

Group 5 – ER 268 K. Large deposit of metalwork in black gravels and silts filling the Walbrook stream channel (Wilmott, 1991, p. 111). Pottery from these deposits suggested an Antonine date. This deposit contained the largest number of tools of any excavated Walbrook stream deposit, although the exact number is impossible to identify. Wilmott identifies 27 tools, but only 15 of these (AWL029, BEN01, BOR10, CHI37, FOR08, HOE09, OXG02, OXG29, OXG30, PUN23, SAW04, TWE01, TWE02, WXS52, and WXS62, Figure 168) could be identified in the collections of the Museum of London (Table 9).

Interpretation (Wilmott)	Publication No. (Wilmott)	Acc. No. (Wilmott)	Fig. No. (Wilmott)	Acc. No. (MOL)	Cat. No.	Reinterpretation
ER 268 K						
Punch	370	19213	85, 370	**19165**	AWL042	Awl
Punch	371	19214	-	?	-	?
Punch	372	19215	-	?	-	?
Punch	373	19889	-	?	-	?
Punch	374	19217	-	19217	PUN23	Punch
Ox Goad	405	19242	-	**19496**	OXG29	Ox Goad
Ox Goad	406	19645	85, 406	**19495**	OXG02	Ox Goad
Ox Goad	-	19646	-	**19497**	OXG30	Ox Goad
Chisel	427	19159	86, 427	19159	CHI31	Chisel
Gouge	428	-	86, 428	**19172**	BOR10	**Drill Bit**
Knife/Shears	432	19636	86, 432	**19584**	SHE18	**Shears**
Knife/Shears	433	19586	-	19586	-	**Knife**
Knife/Shears	434	19587	-	?	-	?
Knife/Shears	435	19588	-	?	-	?
Knife/Shears	436	19589	-	?	-	?
Knife/Shears	437	19591	-	?	-	?
Knife/Shears	438	19593	-	?	-	?
Knife/Shears	439	19594	-	?	-	?
Saw	443	19280	87, 443	19280	SAW04	Saw
Chisel	444	19245	87, 444	19245	WXS62	**Spatula**
Bailing Fork	445	19260	87, 445	19260	FOR08	Bailing Fork
Two-tined Hoe	446	19259	88, 446	19259	HOE09	Two-tined Hoe
Pruning Hook	447	19170	87, 447	19170	BEN01	**Bench Knife**
Scriber	449	19171	87, 449	19171	AWL029	Scriber
Spatula	450	19250	88, 450	19250	WXS52	Spatula
Tongs	453	19168	-	19168	TWE01	Tweezers/tongs
Tongs	454	19169	88, 454	19169	TWE02	Tweezers/tongs

Table 9 Tools from the Bucklersbury House stream Group 5/ER 268 K. Bold text indicates corrections to Wilmott's publication.

Figure 168 Tools from Bucklersbury House/Bloomberg London Group 5 (ER268K) (Top row, left-right; bailing fork, FOR08; drill bit, BOR10; two-tined hoe, HOE09; chisel, CHI31. Bottom row, left-right; tweezers/tongs, TWE01-02; shears, SHE18; saw, SAW04; bench knife, BEN01; scribers/awls, AWL029, AWL042; drift, PUN23; spatulas, WXS52, WXS61).

Other 'Walbrook Stream' Deposits from Bucklersbury House

The exact provenance of the remaining 58 'Walbrook stream' tools from the Bucklersbury House excavations in the Museum of London is unknown. However, these objects can be divided into four further groups (Groups 6-9) based on how their provenance is described by the Museum of London on the MIMSY database.

Group 6 – 'eastern edge'

Nine tools in the Museum of London (AWL042, CBR02, DRW02, HEA01, MAS01, PUN04, PUN15, PUN16, and SIC28) were identified on the Museum of London's MIMSY database as coming 'From Walbrook stream bed, close to eastern edge.' The same descriptor was used for the objects from Group 5 (ER268K), and it is possible that some of these objects are the 'missing' tools from Wilmott's list which cannot be identified. However, in a letter from 1982 (now kept with the GM157 site records) Hume himself expresses doubt as to the accuracy of this description. It is also possible that these tools derive from unrecorded deposits on the eastern edge of the Walbrook stream bed.

Group 7 – 'upper levels'

Two tools, AWL080 and PUN17, were recorded on the MIMSY database as coming 'From upper levels of Walbrook stream'. This presumably indicates that these objects derive from the fills of the Walbrook channel, rather than stream bed deposits, although the location of their discovery is unknown.

Group 8 – 'stream bed'

The largest group of tools from the stream at Bucklersbury House site are the 38 tools (AWL002, AWL009, AWL015, AWL059, AXE15, BRU01, CHI22, CHI31, CHI41, COL02, CUR03, FIN03, HAM06, HAM11, HOE06, HOE07, LEA04, LEA08, OXG04, OXG29, OXG30, PIC03, PIC09, PUN18, RAK44, SHE12, SHE18, SHE19, SIC21, SPA15, SPE04, SPE12, THR12, TRO02, TWE10, WXS53, WXS54, and WXS56) described only as coming 'From Walbrook stream bed'. It must be presumed that these objects were not found together, and they may represent objects found during collection on any part of the site. Two of the ox goads given this descriptor by the Museum of London (OXG029 and OXG30) can be assigned to Group 5 (ER268K) based on sketches in the excavator's original notes, which may suggest that this group includes other objects which belong in the stratified stream groups.

Group 9 – 'stream'

The final group from Bucklersbury House are the 13 tools (AWL022, AWL039, AWL063, BOR36, CHI34, CHI40, FIL13, FOR09, FOR10, GOU08, GOU12, THR13, and WXS10) described as coming 'From Walbrook stream'. It is not clear whether this is meant to imply that these objects, unlike those in Group 8, come from stream fills rather than the stream bed. It is perhaps most likely that these different descriptors were not meant to imply a difference in context between these finds and those in Group 8.

Dowgate Hill

Two tools in the British Museum, HAM12 and FIL03, were found together in 'watery peat, in an extension of the Walbrook's silt bed' with a fragment of early 2nd century stamped samian (Painter, 1961, p. 116). This ambiguous context description opens up the possibility that these objects were found near, rather than in, the Walbrook stream.

7.3.5.1 Discussion

From the above discussion, it should be clear that only a very small number of the tools from London can be said with confidence to have been found in the Walbrook stream. The lack of stratigraphic information for most museum finds means that little can be said about their depositional contexts. Modern excavations in the Walbrook stream (especially Bucklersbury House/Bloomberg London Group 1) have confirmed the findings of earlier interventions and demonstrated that large, metal-rich deposits are to be found there (Marshall and Wardle, forthcoming). However, tools do not form a major part of these deposits. The majority of the stream deposits are characterised by only one or two tools deposited together, with Bucklersbury House/Bloomberg London Group 5 (ER268K) being the only notable exception. This contradicts Crease's (2015, pp. 164–6) suggestion that tools made up 89% of the finds in the Walbrook; a conclusion which was skewed by their decision to group the hoard of nails from Bucklersbury House/Bloomberg London Group 4 (ER268H) as tools.

The objects from the stream deposits are mostly very small, and a number are fragmentary (e.g. Bucklersbury House/Bloomberg London Groups 1-3). This goes against Merrifield's (1995, p. 33) argument that the stream was a focal point for the deposition of 'serviceable' objects representative of a particular craft, and supports Wilmott's (1991, pp. 64, 170) interpretation of the stream containing 'much scrap and waste iron'. Again, Bucklersbury House/Bloomberg London Group 5 (ER268K) is different, containing a number of larger and more complete objects (e.g. BOR10, CHI37, FOR08, HOE09, and TWE01-02). A number of complete objects also come from the less securely identified 'stream' assemblages, such as Bucklersbury House/Bloomberg London Groups 6, 8 and 9, and from the unprovenanced 'stream bed' finds from the British Museum. This could indicate the variable character of stream deposits along the course of the stream, but it is also possible that these objects, which lack good contextual information, were not found in the stream.

Conversely, it has also been suggested that some of the material from the Walbrook may have been ritually 'killed' – subject to deliberate and excessive breakage to remove it from functionality and transfer it to a spiritual realm (Merrifield, 1995, p. 36; Leary and Butler, 2012, p. 84). This has been advanced as evidence of ritual activity at Tokenhouse Yard, where bent styli were found in bank deposits (Major, 2012, p. 35), but no quantitative survey exists to show how common this practice may have been. An attempt at work of this sort by Crease (2015) was based solely on the material published by Wilmott (1991), which is not sufficiently detailed or comprehensive to make the study worthwhile. Amongst the material from the Walbrook stream itself, only one object (HEA07, Figure 166) shows obvious bending which could be the result of ritualised destruction. This is particularly interesting, as deliberately bent pokers were found near London in the Late Iron Age/Early Roman Waltham Abbey hoard (Manning, 1977), and other pokers from London may also have been ritually deposited (see p.321). Two more bent tools (AWL063 and PUN18) come from Bucklersbury House/Bloomberg Groups 8 and 9, and may not have been deposited in the stream. Other objects from the stream groups are fragmentary, and it is unclear whether these were deliberately broken or damaged in use.

The mechanisms by which objects entered the stream at Bloomberg (BZY10) have recently been considered by Marshall (in Marshall and Wardle, forthcoming). An important issue Marshall raises is that objects were not only deposited at points of public access to the stream (i.e. bridges and roads). Deposits made away from these must have been made by people with access to properties abutting the stream. The objects in the stream may therefore reflect the activities of those living on the banks rather than the ritual practices of the city as a whole (Wilmott, 1991, p. 64). Several deposits at Bucklersbury House/Bloomberg London were noted as coming from the eastern edge of the stream, and so may indicate the activities taking place on the eastern bank (although this may not be an accurate description of the provenance of some finds from the Museum of London, see p.292). Group 3 contained awls and shears, and may indicate leatherworking. Group 4 contained a fragmentary rake tine and possibly an un-located punch, alongside a hoard of nails and slag. It is possible that this represents metalworking debris (Rhodes, 1991a), although Merrifield (1995, p. 41) has argued that whilst these objects may have been *collected* as metalworkers' waste, they were *deposited* as a ritual act of closure. Other ironwork deposits containing scrap have been interpreted as ritually deposited hoards (Manning, 1972a; Hingley, 2006; Humphreys, 2017a), including a deposit from Inchtuthil containing mostly nails (Manning, 1985c; Dungworth, 1997). Metalworking debris was also found in Bucklersbury House/Bloomberg London Group 1, and it is possible that the fragmentary tools from this deposit were destined for recycling. Local fine metalworking may be indicated by the deposition of two chasing punches together at Tokenhouse Yard. At least one of the deposits at Throgmorton Avenue was simply household rubbish disposal.

Bucklersbury House/Bloomberg London Group 5 (ER268K) may also represent ritual deposition in the stream. The large, complete objects from this group are generally rare as site finds, but are typical of the sorts of tools found in ironwork hoards (Humphreys, 2017a, p. 388). Hoards of this type are sometimes associated with closure (Merrifield, 1987, pp. 49–50; Hingley, 2006, pp. 228–30) and often (although by no means exclusively) with water sources of various kinds (Humphreys, 2017a, pp. 366–8). This deposit also contained a number of smaller non-ferrous objects (Wilmott, 1991, pp. 118–28), which are not typically found in ironwork hoards alongside tools (Humphreys, 2017a, p. 388), although votive river deposits often show more diversity (Künzl, 1993; Walton, 2008; Kappesser, 2012). It is therefore possible that this deposit represents ritual activity, perhaps a closure deposit for bankside activities, or marking the partial infilling of the stream channel (Millett, 1994, p. 430). A note of caution about this interpretation is that in London similarly complete objects have been found in land-raising dumps (e.g. HOE03, PIC04, PLA03, TON03, see p.304, 318) and occupation deposits (e.g. HAM03, see p.319), and it is therefore not impossible that Bucklersbury House/Bloomberg London Group 5 (ER268K) also represents the disposal of waste in the stream. It is also unclear from the available information whether this group built up over time or was deposited in a single episode.

7.3.5.2 Conclusions

The evidence for the Walbrook stream as a significant depositional feature for London's tools is ambiguous. The majority of the objects supposedly from the stream have so little contextual information that nothing can be said about the circumstances of their disposal. This is frustrating, as these finds are so different in character to those recovered from well-recorded contexts. Basing our interpretation solely on well-provenanced finds gives the impression that the tools from the Walbrook stream are mostly small, broken objects deposited as part of local waste-disposal activities. These objects may be representative of local craft activities, particularly metalworking and leatherworking.

However, Bucklersbury House/Bloomberg London Group 5 (ER268K) shows that large, well preserved objects of the type associated with ironwork hoards could also be deposited in the stream. Whilst the interpretation of hoards remains uncertain, current opinion favours a ritual interpretation (Manning, 1972a; Hingley, 2006; Humphreys, 2017a), and it is possible that some deposits in the Walbrook stream were deposited under similar circumstances. It is also possible that some objects were deliberately destroyed before deposition, although the majority seem to have been simply waste fragments.

7.3.6 Tools from Walbrook Bank Deposits

Whilst interpretations of the Walbrook valley have focussed on the stream, stratified tools from the Walbrook valley are more likely to have derived from bank deposits (Figure 160). Understanding the concentration of tools in this area of the city will therefore rely more on an understanding of the formation processes of the banks than those of the stream.

Recent excavations in the middle Walbrook at Bloomberg London (BZY10) have shown that the 'banks' are composed of a wide range of context types (Figure 169). However, by far the largest number of tools from the Walbrook bank deposits derive from dump layers. These dumps were laid down as surface dumps, or dumps behind revetments, for the purpose of raising the level of the banks, creating surfaces at elevated levels which were used for building and occupation (Wilmott, 1991, pp. 175–8; Hill and Rowsome, 2011, pp. 444–5; Bryan *et al.*, 2016, p. 32). Other deposits have a similar 'dumped' origin. Structure makeup deposits (dumps which were laid specifically to create sills and bedding for structures, or to fill cribwork) and demolition deposits (which were mostly redeposited dumped material rather than in-situ demolition) can also be considered part of the 'Walbrook dumps'. Together, these deposits make up the majority of the contexts in which tools were deposited in the Walbrook valley (Figure 169).

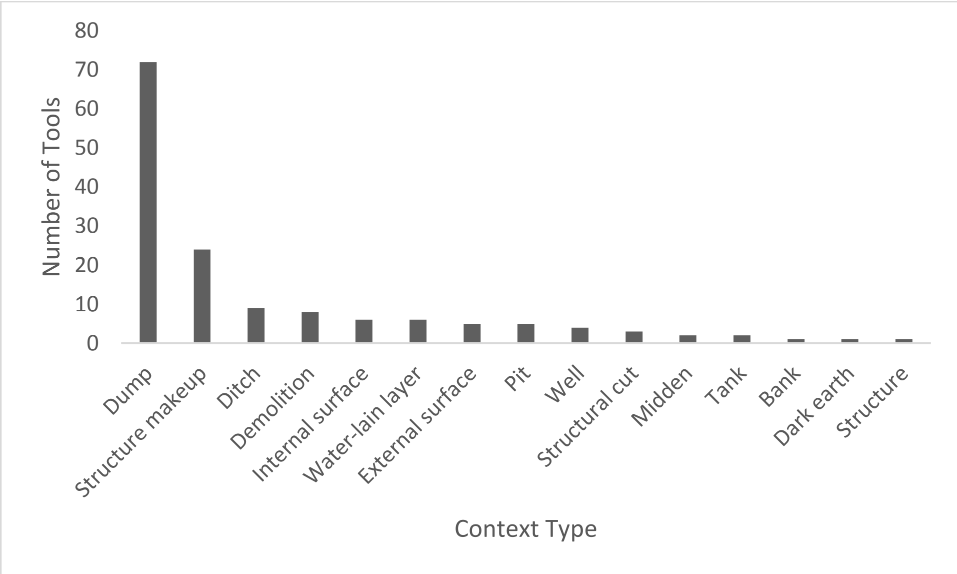


Figure 169 The contexts of the stratified tools from the Walbrook valley banks.

One significant implication of this is that the material deposited in the dumps may not have derived from local sources. Wilmott (1991, p. 64) has argued that the bankside land-raising dumps were formed of waste material brought in from a wide range of sources across the city. However, Merrifield (1995, p. 28) argued against the assertion that waste was moved across London, drawing attention to the lack of storage middens elsewhere in the city. Whilst middens have since been identified in London (Watson and Bryan, forthcoming; Wardle, 2011a, p. 330), Wardle (2011a, p. 330) nevertheless points to other aspects of the Walbrook assemblage, such as the concentration of individual types and the lack of fragmentation of objects and pottery, which would appear to support Merrifield's suggestion that artefacts had not moved far. At 1 Poultry, these factors were used to argue that the Flavian deposits were derived from local sources, albeit from a broader area than just the excavated site (Hill and Rowsome, 2011, p. 349).

However, some pre-Boudican deposits from 1 Poultry (Hill and Rowsome, 2011, p. 272) and mid-late 1st century deposits from Bloomberg (Marshall and Wardle, forthcoming) contained pottery which indicates that the material had been moved to the Walbrook from the eastern hill of the city, perhaps the area around the Forum. Moreover, the size of the Bloomberg dumps and the apparent speed with which they developed has been taken as indicating that they must have incorporated material brought in from elsewhere (Watson and Bryan, forthcoming; Bryan *et al.*, 2016, p. 32). Other evidence for the movement of waste material in the city includes the lack of smithing waste from the metalworking centre in Southwark, indicating that the majority must have been moved off site to an unknown location (Starley, 2003, p. 138). These examples show that (*contra* Merrifield, 1995, p. 28) waste was moved around the Roman city, and indicate that the rapid accumulation of waste for land-raising purposes (Hill and Rowsome, 2011, p. 272; Bryan *et al.*, 2016, p. 32) was the result of an organised system of waste management in London (Millett, 1994, p. 429).

It therefore seems unlikely that the majority of the material deposited on the banks of the Walbrook relates to local activity. On this basis, the concentration of tools and industrial waste in the Walbrook valley should not be taken as reliable evidence for the area as an 'industrial zone'. Nevertheless, a range of other context types also contained tools, and these deserve exploration in order to characterise deposition on the Walbrook banks. Given the complexities of deposition in the Walbrook valley, this is best achieved through a detailed case study of the material from recent MOLA excavations at Bloomberg London (BZY10). This is the only Walbrook site where significant numbers of tools come from well understood bank contexts which, allowing them to be plotted accurately, by period, on GIS maps. In the near future, it may also be possible to conduct similar work on the bank deposits from excavations at Moorgate (MOQ10) and Drapers' Gardens (DGT06).

7.3.6.1 The Banks at Bloomberg London

The earliest occupation at the Bloomberg site (Periods 2.1-2.2, 43-60/61 AD) consisted of ground clearance and the construction of a number of bank and ditch enclosures. Although there is evidence of metalworking from these features (Tomlin, 2016, pp. 34–7), no tools were found.

Period 2.31 (60-62 AD)

The earliest tools were deposited in site Period 2.31 (60-62 AD, Figure 170), when the enclosures were reorganised following the Boudican fire (Tomlin, 2016, p. 37). As this period pre-dates the large-scale dumping of material at the site, very few tools were recovered, although PUN22 was deposited in an early dump. A pit in the north eastern corner of the site contained the possible leatherworking knife LEA07 and pieces of leather waste. This may indicate the presence of a leatherworking workshop nearby, perhaps on the nearby road leading across the Walbrook from Cornhill. No associated building was found within the excavation area, however.

No objects were recovered from the stream in this period, although three objects come from related contexts. The ox goad, OXG12, was incorporated into a bank erected to attempt to control the flow of the Walbrook. This find has no obvious significance, and may have been accidentally incorporated. FIL09 and CIM01 were recovered from water-lain deposits some distance from the Walbrook itself. These are unlikely to have been dredged from the Walbrook, however, and are thought to represent dumped deposits remodelled by flooding (Tomlin, 2016, p. 37).

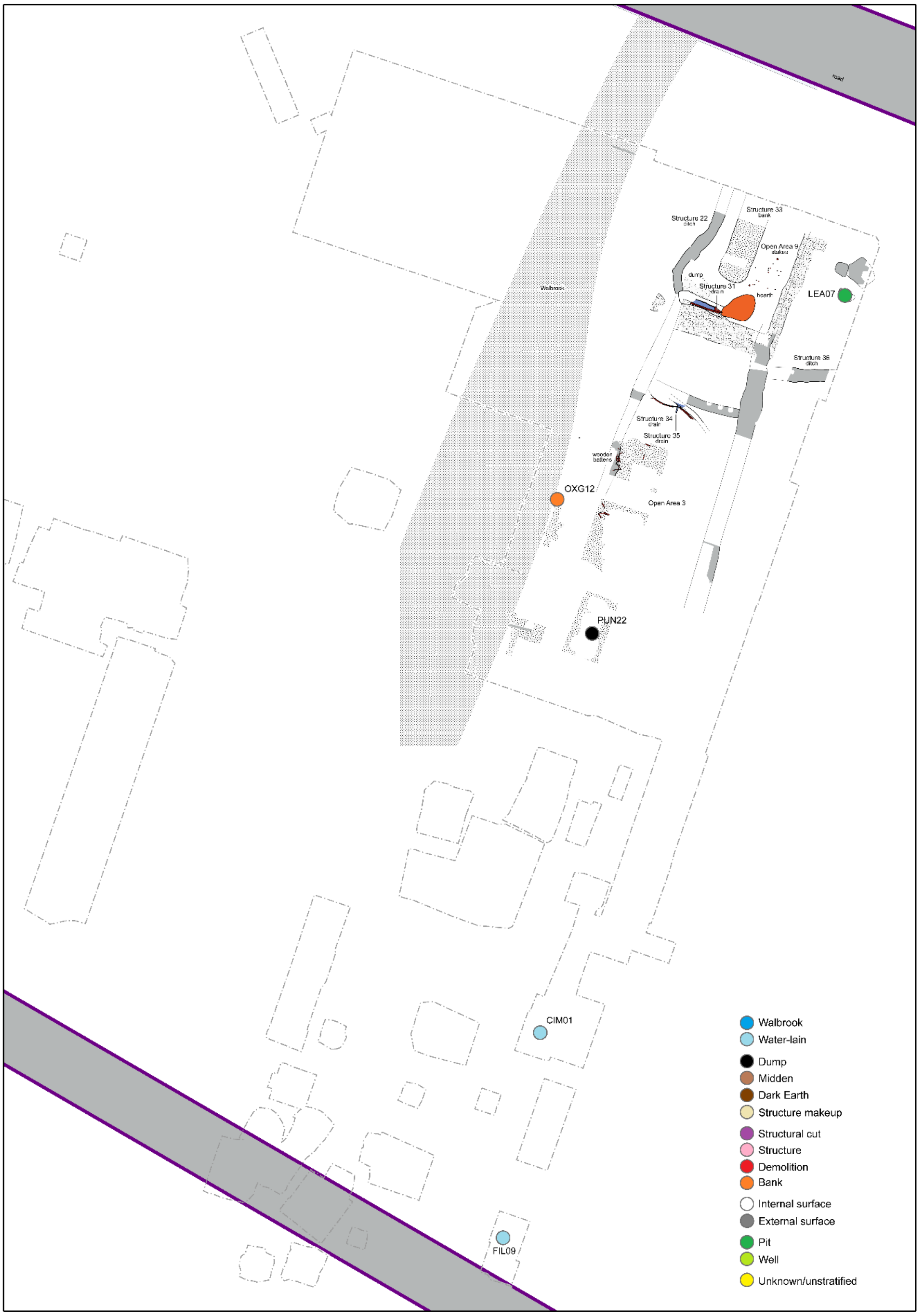


Figure 170 The distribution of tools at Bloomberg London, 60-62 AD (BZY10 base map courtesy of MOLA).

Periods 2.32, 3.1 and 3.11 (62-80 AD)

Figure 171 shows three periods of occupation at Bloomberg London. Period 2.32 (62-65/70 AD) was a short phase of dumping followed by the construction of the first short-lived buildings on the eastern bank of the Walbrook (Tomlin, 2016, pp. 37–42). This was soon replaced with more substantial dumping and the construction of cribwork buildings in Period 3.11 (65/70-80 AD) (Tomlin, 2016, pp. 42–5). Period 3.1 (65/70-90/95 AD) represents contemporary terracing and building construction on the western bank of the Walbrook, which extended into the period represented in Figure 172 (Tomlin, 2016, pp. 49–51).

This represents the most intense period of tool deposition, with most of the tools clustering around the buildings in the north of the site. It is notable that this period of timber construction is associated with a large number of woodworking tools (Marshall and Wardle, forthcoming). However, this should not be seen as a simple association. Some of these tools may be related to local woodworking. GOU13 was found in a dump which may have formed the construction level of a cribwork building foundation. It may have been used in the construction of these buildings, although its form suggests a use in carving rather than structural carpentry. GOU04 was found in a midden-like rubbish dump, and may also indicate carving in the area, although the function of this object type is disputed (see p.492). Although found close together, these two gouges are not from the same period, and may have been deposited as much as 33 years apart. SAW09 was found in makeup from the resurfacing of a floor in Building 4, and may have been used in this structure, if only in its refurbishment. It is contemporary with GOU04, which was dumped in the alleyway next to this property, potentially indicating that Building 4 functioned as a workshop.

Other tools indicate woodworking in the city more generally. BOR51, a broken drill bit tip, was found in a dump containing woodworking debris. As this was recorded rapidly with a number of other contexts, it is not clear if this relates to local activity. GOU02 was found in a dump of redeposited demolition material, and may have derived from a fire-damaged workshop outside of the excavation area. Woodworking tools are very common on the site in this period, but it must be remembered that woodworking tools are the most common tools in London (Figure 21), and the majority from this phase were deposited in dumps and makeup layers. These would mostly have been in place before timber construction began, and may have derived from anywhere in the city.

The scraper SCR04 was the only tool from the site to be deposited within a structural element, in this case a wattle wall. The significance of this is obscure given the uncertainty around

SCR04’s function. It could have been used for applying plaster or daub, and so may be related to the construction of this wall. However, it could also have been used to cut and move dough; a plausible use given that the building it was deposited in contained a large bread oven.

Not shown on this map is another group of finds from a truncated ditch excavated on the western bank of the Walbrook, to the south-west of the area shown on these plots. The ditch contained the rasp fragment FIL11, miniature hammer HAM07, and spatula OSP20, all in the same initial abandonment fill. These objects do not form an obvious functional group. The rasp suggests woodworking, whilst the hammer may be evidence of fine metalworking. Little is known about this area of the site due to the keyhole nature of excavation.

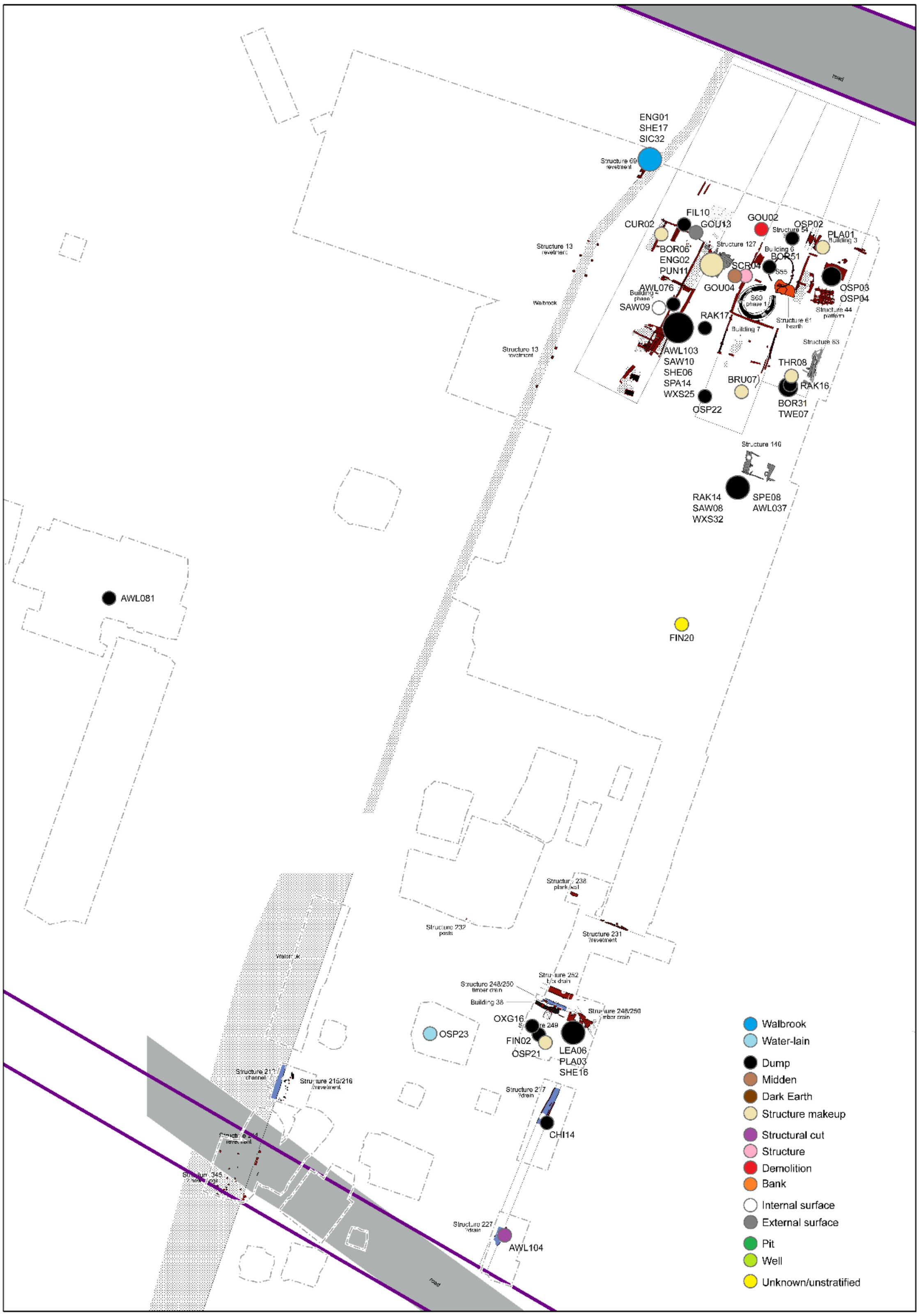


Figure 171 The distribution of tools at Bloomberg London, 62-80 AD (BZY10 base map courtesy of MOLA).

Period 3.12 (80-90/95 AD)

A significant number of tools was also deposited during Period 3.12 (80-90/95 AD, Figure 172); another period of significant dumping and building construction on the eastern bank of the Walbrook valley (Tomlin, 2016, pp. 45–9). As in the previous period, there is a concentration of woodworking tools around the buildings in the north of the site. Again, the majority derive from dumps, but two tools may indicate the presence of a carpentry workshop. BOR21, a possible drill bit tang, was trampled into the floor of a room in a timber strip building. CHI42, a large and well-preserved mortice chisel, was found within an external surface in what appears to be the back yard of the same property. A note of caution on this interpretation is that the external surface was noted for containing a large amount of metalwork, and the chisel may have been part of this rather than an object lost on the surface. The drill bit tang cannot be identified with certainty.

Other possibly significant finds from this period include SPA16, a fragmentary spade shoe possibly from a back yard midden, but equally likely to be from a dump, and the crucible tongs TON03. These tongs are the sort of large, well-preserved object that is usually associated with special deposits, such as ironwork hoards (Humphreys, 2017a), and it is therefore interesting that it was discarded in the Walbrook dumps alongside so many more unassuming objects.

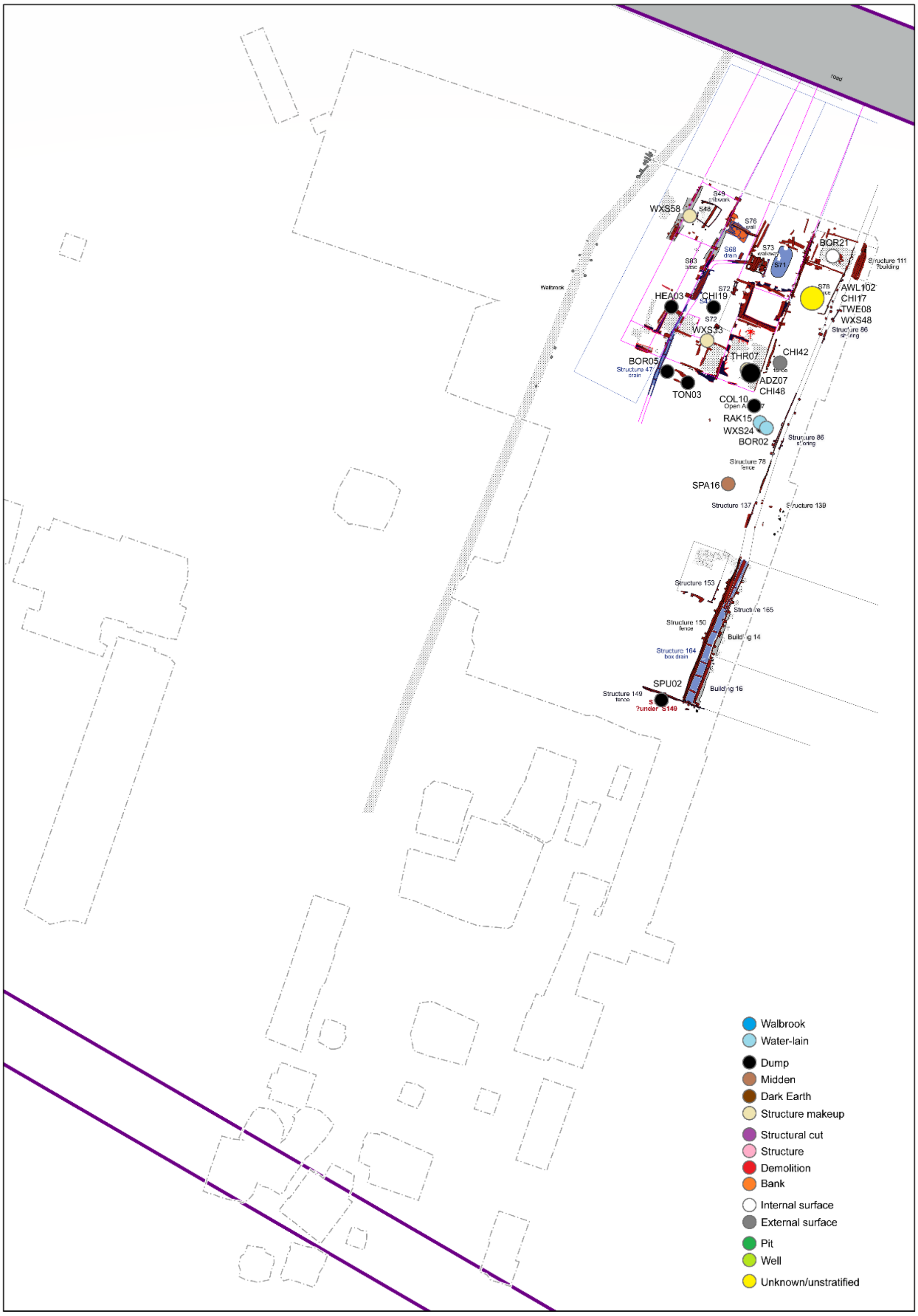


Figure 172 The distribution of tools at Bloomberg London, 80-90/95 AD (BZY10 base map courtesy of MOLA).

Periods 3.2 and 4 (90/95-125 AD)

Significantly fewer tools were deposited in Period 3.2 (90/95-100 AD), a very short period of dumping on the east bank of the Walbrook, and Period 4.1 (95-125 AD, Figure 173), a new phase of building construction (Tomlin, 2016, p. 51). This is probably a reflection of the relatively short period of dumping which occurred, given that almost all of the tools that were found were again deposited in land raising dumps. One curious exception is the miniature spade shoe, SPA01, found in occupation material over an internal floor, the significance of which is not clear. The spear-shaped spatula SPE09 was possibly found in a pit, although this interpretation is not clear.

There is a higher ratio of metalworking tools in this phase, although the numbers are low and most derive from dumps. PUN05, from a rubbish midden, may indicate that metalworking was being carried out locally, however. More striking is the concentration of ox goads in the south of the site. This concentration is difficult to explain as the function of these objects is uncertain (see p.519). If metalworking was being carried out nearby, it is possible that these objects were being manufactured here, although as they derive from dump layers they may not have had a local origin. This evidence of metalworking is broadly contemporary with the material recovered from within the revetted channel at Bucklersbury House, which may also represent metalworking waste (Wilmott, 1991, p. 21).

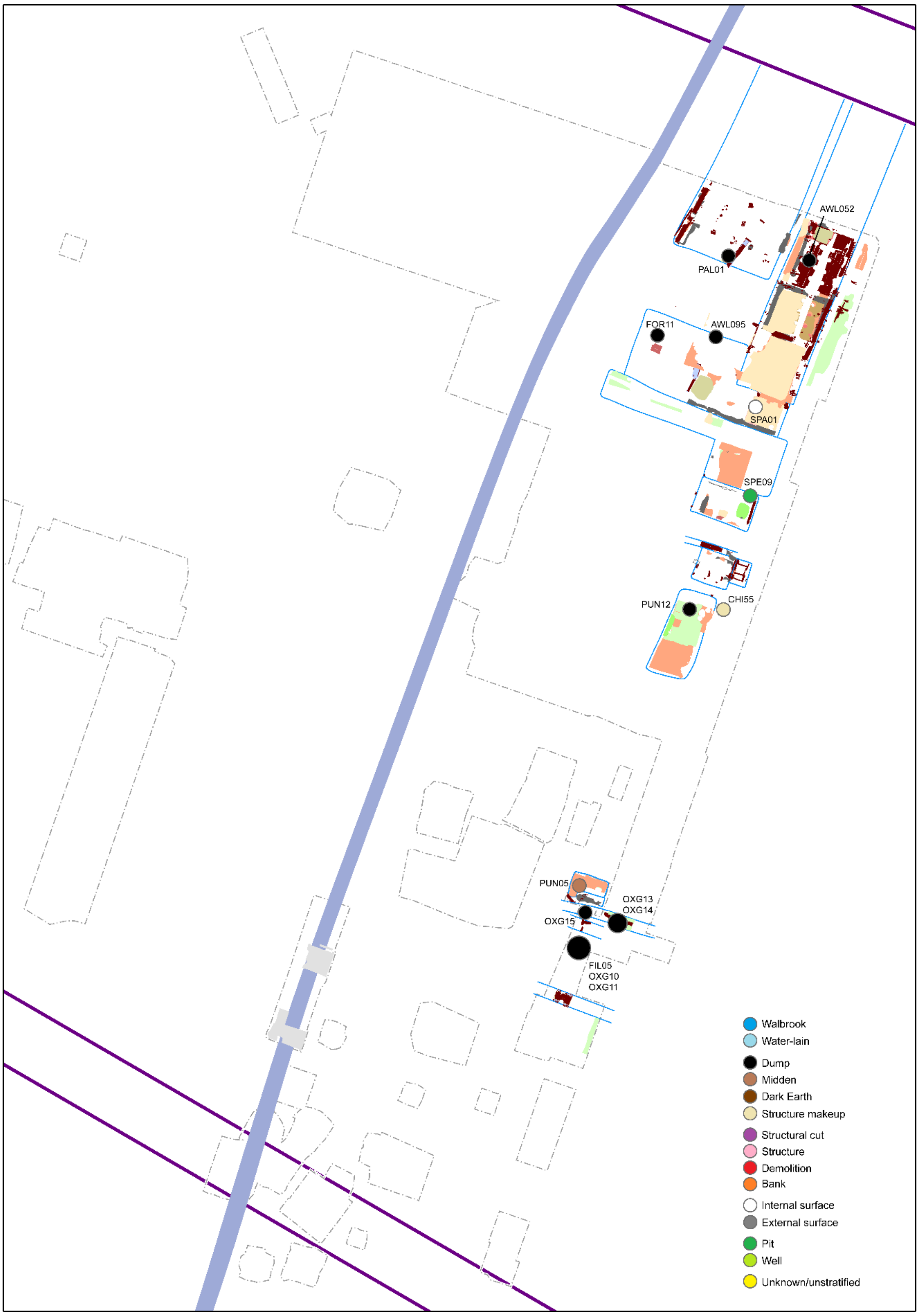


Figure 173 The distribution of tools at Bloomberg London, 90/95-125 AD (BZY10 base map courtesy of MOLA).

Periods 5-6 (125-340+)

The final map (Figure 174) represents an extremely long period of occupation after the Hadrianic fire (Periods 5-6). These phases are shown together on one map as the number of tools found was extremely low. Partially this is the result of the truncation of the upper levels of archaeology at Bloomberg by the construction of Bucklersbury House. The latest periods are represented only by finds from deep cut features, such as wells, which penetrated into the lower layers. Another factor is the lack of landraising dumps deposited at this time (Watson and Bryan, forthcoming). Consequently, the objects from this period are few, and mostly very poorly preserved. This reinforces the importance of the Walbrook dumps as a depositional context for tools in London, and hampers interpretations of practice in these periods.

The tools in this phase were nevertheless deposited in a variety of feature types. Four derive from structures, although their contexts (two from demolition material and two from a structural cut) are not necessarily related to the occupation of these buildings. Two of the latest tools from this period come from wells. AWL007 may represent the re-use of the abandoned well as a cess-pit, and may therefore derive from local leatherworking activity. The tongs, TON01, however, were deposited in the backfill of the construction cut of the well. As they are fragmentary they may simply be discarded waste, but it is notable that this was the largest tool deposited at the Bloomberg site (Humphreys in Marshall and Wardle, forthcoming). It is possible that this object was deposited in the well as part of a foundation ritual. The link between this object and local ironworking is therefore not clear, although slag of a contemporary date was dumped at the site (Watson and Bryan, forthcoming).

Three awls/bradawls from this period may indicate that wood- or leatherworking was taking place in the area, although all are fragmentary and their functions cannot be established with certainty. The two awls in the northeast corner of this map are from different phases, and should not be taken to represent a concentration of craft activity in this area of the site. CHI47, a fragmentary paring chisel, is contemporary with two of the awls/bradawls. It was found in a soil-like deposit, but it is not clear whether this represents dumped earth or garden soil developing in situ.

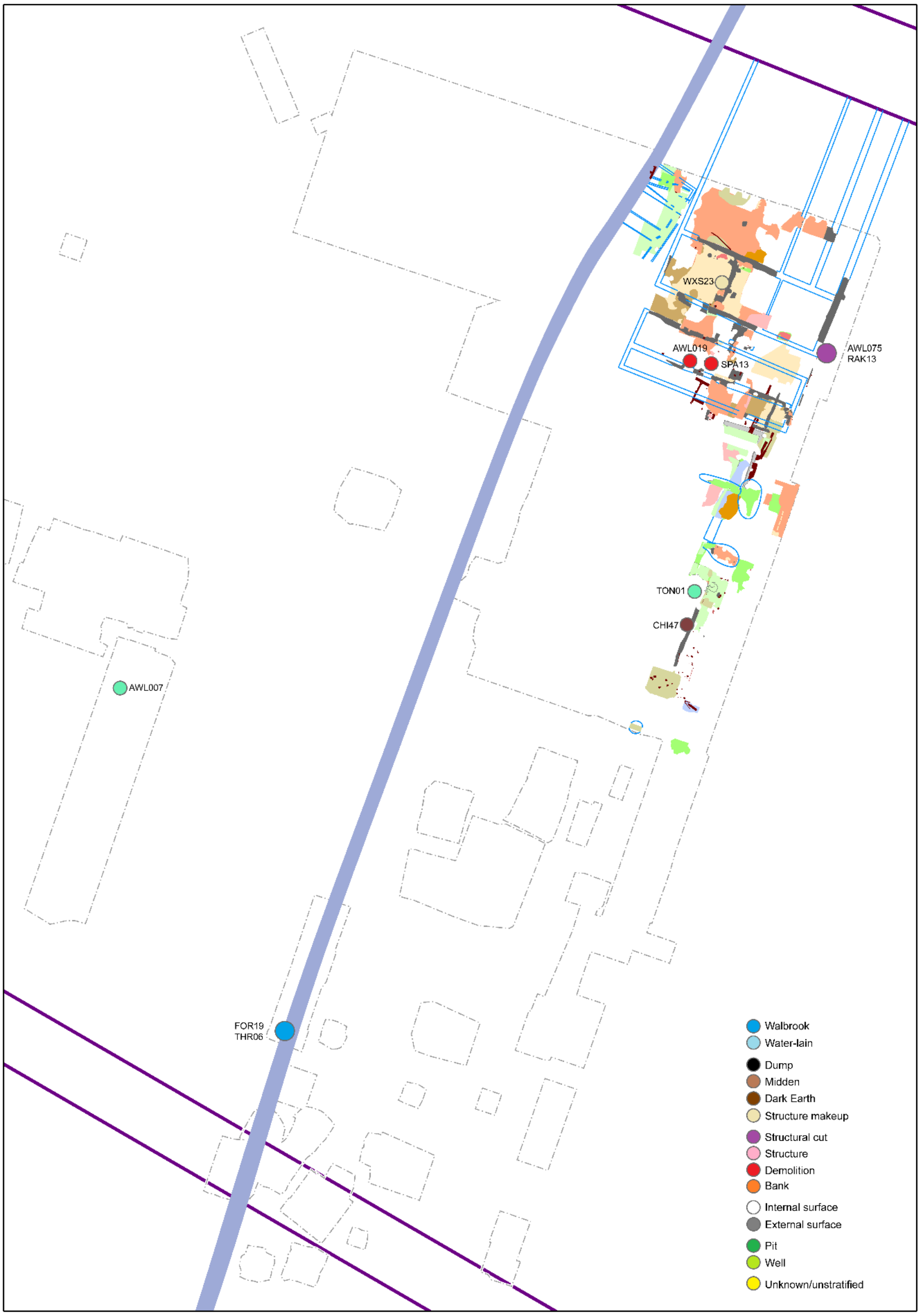


Figure 174 The distribution of tools at Bloomberg London, 125-340+ AD (BZY10 base map courtesy of MOLA).

Conclusions

Analysis of the bank deposits from Bloomberg London shows the complexities of interpreting 'Walbrook metalwork'. Simply describing this material as 'bank deposits' masks a great deal of variation in formation processes.

Some of the finds deposited in the valley are certainly related to local activity, and indicate a degree of industry in the middle Walbrook valley. Through looking at context closely, we can see evidence of leatherworking in the Boudican period, and possibly also in the post-Hadrianic period. Woodworking, perhaps including wood carving, was taking place in the Flavian period, and woodworkers may have occupied two of the strip buildings fronting onto the main road in this period. Metalworking may have been practiced in the south of the site in the later Flavian period, and perhaps again in the late 3rd century. However, we can also see that tools are not always a reliable indicator of industrial activity. Pre-Boudican metalworking in the earliest enclosures on site is not reflected in the tools from the site.

However, the majority of the tools derive from dumps, and as such may not relate directly to local activity. Concentrations of dumped finds around buildings can be especially misleading when viewed on distribution maps. These concentrations are related to pre-construction dumping activity, and do not relate to the functions of these buildings. Broader changes in the makeup of the dumps may be related to shifts in the economy of the area, however. The main periods of deposition of woodworking tools correspond with evidence of on-site woodworking, for example.

These dumps can contain large and well preserved artefacts, such as TON03 and PLA03, which have previously been seen as an indication of religiously motivated deposition in the Walbrook stream (Merrifield, 1995, p. 33). Analysis of their context, however, suggests that they were simply part of the material deposited as rubbish in land-raising dumps. Other finds show that ritual activity involving tools could also take place on the banks of the Walbrook, rather than only in the stream. The tongs TON01 may have been deposited as part of a foundation deposit for a well.

7.3.7 Conclusions: The Walbrook Tools

This analysis has shown that there is no single simple explanation for the concentration of the tools in the Walbrook. Preservation and recovery are likely to have influenced this profile, especially given the poor condition of the ironwork from elsewhere in the city. However, the disposal of waste for the purpose of land raising seems to have been the major motivating factor behind the deposition of tools in the Walbrook area.

Few tools were found to have been deposited in the stream itself, although analysis here was heavily hampered by the lack of well described stratigraphic contexts. The majority of the tools from the stream appear to relate to activities taking place in bankside properties. A number of tools from other contexts, such as internal and external surfaces, pits and wells, also seem to have been related to local activity. The objects from these contexts are generally small and fragmentary, and were not great in number. Although indicative of industrial activity in the area, the evidence from tools does not support the notion of the middle Walbrook valley as an 'industrial zone'.

The majority of the tools from the banks derive from large land-raising dumps and construction makeup layers. The material in these deposits appears to have been sourced from across the city, and the objects contained within are reflective of the economy of the city as a whole, and not of the Walbrook valley specifically. These dumps incorporate large, well preserved objects which could be considered 'serviceable'. The 'serviceable' condition of the Walbrook metalwork has been used by Merrifield (1995, p. 33) to argue for ritual deposition. However, the fact that these tools were found alongside more fragmentary objects within rubbish dumps suggests that they too were discarded as rubbish. The disposal of large amounts of useable, repairable, or recyclable objects is surprising in an ancient city, where it is often presumed that most metal objects will have been recycled. Nevertheless, it seems likely from this evidence that, as is the case today, material items were sufficiently easily available in early Roman London, and waste collection and disposal so efficient, that a culture of conscientious recycling did not exist (Wilmott, 1991, p. 172).

Although often singled out as an example of exceptional depositional practices, the Walbrook valley is not totally unparalleled. Marshall (in Marshall and Wardle, forthcoming) has drawn comparisons between the Walbrook valley dumps and those deposited at Vindonissa. Another potentially similar site is the rural settlement and cemetery at Tiel-Passewaij, which was traversed by a waterlogged (although, by the Roman period, largely blocked) river channel and a number of waterlogged ditches (Roymans, Derks and Heeren, 2007; Heeren, 2009b). These features produced large quantities of imported metalwork, such as rings and brooches, which have been used to suggest that people in the Roman period had access to a much larger amount of metalwork than was previously thought (Heeren, 2009b; Hoss, 2017). However, these also indicate that even rural communities could deposit large amounts of metalwork as waste. These sites show that the 'profligate' use of material culture, including metalwork, seen in London was not totally out of the ordinary for the Roman period. The suggestion that ancient cultures always had established and efficient mechanisms for collecting and recycling waste therefore needs to be challenged (a subject recently tackled by Peña, 2017). What remains to be established is whether these sites were the norm for the Roman period. These sites occupy very different positions in the 'social hierarchy' (urban, military, rural), although it may be significant that Tiel-Passewaij had a significant veteran population (Heeren, 2009b, p. 166). This attitude towards material culture may be interpreted as a facet of 'romanized' society; a very different interpretation to seeing it as a continuation of 'native' religious practices.

Despite this, ritually-deposited objects are to be found in the Walbrook valley. These objects include a possible foundation deposit in a well (TON01), and individual objects (HEA07) or possible hoards of objects in the Walbrook stream (Bucklersbury House/Bloomberg London Group 5, see p.290). These ritual deposits may have been made regardless of whether the Walbrook valley was considered a sacred area, although this is a debate which requires a broader evidence base than the tools alone.

7.4 Tools from other City of London and Southwark Sites

When comparing the tools from London's other 'zones' to those from the Walbrook, it is worth remembering that there are significant qualitative and quantitative differences between them. Only 89 tools were recorded from Cornhill, Ludgate Hill, their respective waterfronts, and Southwark, compared to 566 from the Walbrook. Southwark produced the fewest tools, with only nine recorded. This is surprising given the evidence for extensive industrial activity in this area (Hammer, 2003), and may reflect the very poor preservation of iron in this area of the city (Table 6). The tools from all of these areas are considerably less well preserved than the tools from the Walbrook valley, as the drier ground on the hills does not preserve iron well. Due to waterlogging, some finds from the Thames waterfront are in comparable condition to those seen in the Walbrook (Figure 175), although others, such as the finds from KWS94, are considerably more degraded.

Figure 175 Two 1st century Type 1 iron adze-hammers from London (Left, ADZ03 from Bull's Wharf, Ludgate Hill Waterfront (with replica handle). Right, ADZ05, from Plantation Place, Cornhill).

London's non-Walbrook tools come from a very different range of contexts to those in the Walbrook valley (Figure 176). However, it should not be assumed that the tools from these contexts are automatically more representative of local practice than those from the Walbrook dumps.

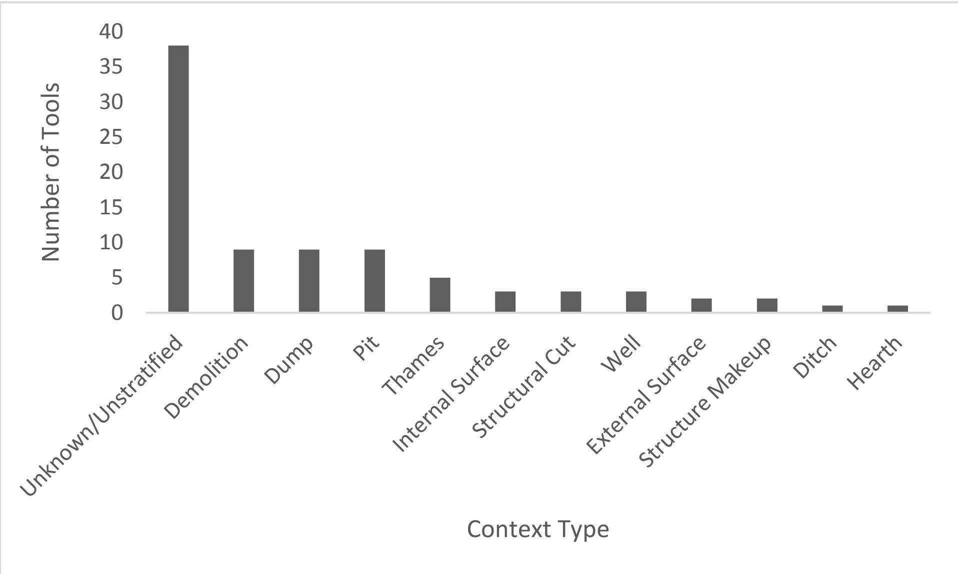


Figure 176 The contexts of the non-Walbrook tools from the City of London and Southwark.

7.4.1 Tools from Cut Features

The most important depositional contexts for tools outside the Walbrook are cut features; particularly pits and wells. Some of the material in these features may be related to local activity. The majority of the tools from these features (ADZ05, AXE06, AXE29, BOR46, CHI26, CHI27 and PLA04) relate to woodworking, and may support the idea that woodworking was widespread across the largely timber-built city. A curious find is the hoe HOE02, part of the backfill of a possibly early Roman quarry pit on Cornhill (GWS89). This find probably pre-dates the construction of the city wall, and may represent cultivation on the unenclosed periphery of the early Roman city. Only one object, the sculptor's pick PIC05, was deposited in a ditch. It is possible that this stonemason's tool was associated with the nearby Cripplegate Fort or Amphitheatre, although this cannot be confirmed as the feature is poorly dated. It is also possible that some of these tools were used in the digging of the features they were found in. The spade shoe fragment SPA04 was deposited in the construction cut of a well, and may have broken in use. SPA05 was found in the robber cut of an *opus signinum* cistern.

However, some of the objects from deep cut features may relate to ritual activity in London, rather than to craft or industry. The importance of pits and shafts as contexts for ritual deposits has long been recognised in Roman archaeology (Ross, 1968; Ross and Feachem, 1976; Fulford, 2001; Woodward and Woodward, 2004), and these features are known to have been particularly important for the ritualised deposition of ironwork (Hingley, 2006; Humphreys, 2017a). Hoards of ironwork deposited in pits and wells often contain stereotyped assemblages of objects, amongst which tools are a particularly important category of object (Humphreys, 2017a, pp. 394–7). Whilst no ironwork hoards have previously been identified in the city of London, a number of large iron tools have been found in pits and wells here.

HEA08, a possible poker or cooking spit, was deposited in the base of the large timber-lined Well 2 at Gresham Street (GHT00). Other items in the base of the well were a copper alloy cauldron and the remains of an iron lifting mechanism (Blair *et al.*, 2006, p. 24). These items were found in a layer thought to relate to the destruction of the well superstructure by fire, but the cauldron and HEA08 have no obvious place in such a structure. It is possible that these objects formed a closure deposit commemorating the end of the life of this well. A number of hoards are known from Britain (Humphreys, 2017a, Table 3, No. 2, 4, 5) and Continental Europe (Künzl, 1993; Berton and Petit, 1997; Mazimann, 2012; Hanemann, 2014; Historischen Museum der Pfalz Speyer, 2015) containing a mixture of copper alloy vessels and iron tools (Humphreys, 2017a, pp. 399–400). These deposits are sometimes associated with the closure of features or areas of sites (Merrifield, 1987, pp. 49–50; Hingley, 2006, p. 230; Humphreys, 2017a, p. 401). Other possible evidence for closure rituals involving mechanical pumps includes the deposition of an iron axe with a water pump at Kilverstone (Garrow, Lucy and Gibson, 2006, p. 123).

Figure 177 Cauldron under excavation in Well 2, Gresham Street (GHT00) (Blair *et al.*, 2006, fig. 24).

AXE06 was found in a possible cess pit alongside a copper alloy steelyard. Unfortunately this feature was excavated by machine without archaeological supervision, and these were the only finds recovered. No dating evidence is available for this feature. Nevertheless, bronze scales and steelyards have been found in hoards containing iron tools (Humphreys, 2017a, Illus. 3, Table 3), and it is possible that these two objects were deposited together as part of a ritual pit deposit.

Other potentially significant deposits may be indicated by the presence of single objects of the type deposited in ironwork hoards. The woodworking tools ADZ05, CHI26, CHI27 and PLA04 were all deposited in pits, as was the agricultural tool HOE02. AXE29 (NCZ07) was deposited in a well, although its exact position in the feature is unknown. Cut features containing large tools were also found in the Walbrook area. The mattock MAT02 was deposited in a pre-Boudican quarry pit on Cheapside (CID90). TRO06 was deposited at the base of a well on Queen Victoria

Street (GM144). A possible ritual foundation deposit may also be represented in the Walbrook valley by the presence of TON01 in the construction cut of a timber-lined well at Bloomberg London (BZY10, seep p.308). All of these objects can be paralleled in ironwork hoards (Humphreys, 2017a, Table 3), although ADZ05, CHI26 and MAT02 were deposited amongst material apparently consisting of household rubbish and cess.

7.4.2 Tools from Demolition Layers

Demolition material was one of the most productive context categories of non-Walbrook sites in London. These deposits are particularly interesting for their potential to act as snapshots of the tools kept in buildings in the city.

A number of hammers (HAM02, HAM05 and HAM08) derive from probable in-situ demolition material from clay and timber buildings. HAM08 is of a rare type which may represent leatherworking on Cornhill (FER97). HAM05 and HAM08 both appear to be Type 2 cross-pene hammers. Whilst these may have been used in metalworking, this was also the most common basic hammer type in London, and these may be general household tools. OXG22 was also found inside a building destroyed by fire on Ludgate Hill (PNS01), although the function of this artefact type is uncertain.

Other finds from demolition layers represent dumped material, which may have originated some distance from the site of deposition. Two axes, AXE21 and AXE24, were found together on Ludgate Hill (KGT06) and may represent material from a carpenter’s workshop, although axes also have domestic uses, such as chopping firewood, and may have been common in Roman buildings. Another axe, AXE14, was found in demolition material from a fire-damaged building deposited in the Walbrook valley (LOW88). Two hearth tools, HEA05 and HEA10, were probably common domestic artefacts, and do not necessarily indicate metalworking. A saw from the Cornhill waterfront (KWS94), SAW11, may indicate craft activity, but was recovered from dumped material.

A recurring pattern in these deposits is fire damage. This may explain why so many large objects (especially hammers and axes) were deposited. These can mostly be interpreted as household tools which may have had a place in any home. It is likely that they would have become irretrievable after a building fire, but it is also possible that they were not considered to be worth recovering. Pliny (*The Natural History*, 34.43) wrote that ‘Iron which has been acted upon by fire is spoiled, unless it is forged with the hammer.’

7.4.3 Tools from Dumps

The main difference between the Walbrook valley and other areas of the city is that far fewer of the tools derive from dumps. Only two tools, PIC04 and HOE03, were deposited in dumps on Cornhill and Ludgate Hill, and none in Southwark. It is therefore interesting that these are the type of large, complete objects that we might expect to find in the Walbrook dumps. This indicates that the attitudes towards objects which led so many tools to enter the Walbrook dumps also allowed objects to be discarded elsewhere in the city, although on a much smaller scale.

An interesting exception is the Thames waterfront, where dumps were the most prolific depositional context for stratified tools. Here, these dumps are mainly deposits backfilling the areas behind revetted waterfronts (Figure 178). A further object, MAS04, was found in the backfill of a drain behind a revetment, but the material used to backfill this structure may have been the same as that used in the dumping above the drain (Brigham and Woodger, 2001, p. 30). The depositional processes of tools on the Thames waterfront may therefore have been similar to those observed in the Walbrook valley (see p.296). It is therefore curious that, given the scale of dumping behind these revetments, more tools were not found here. Similarly, few tools were found in Southwark, despite the presence of waterlogged ground raising dumps here (Wardle, 2009).

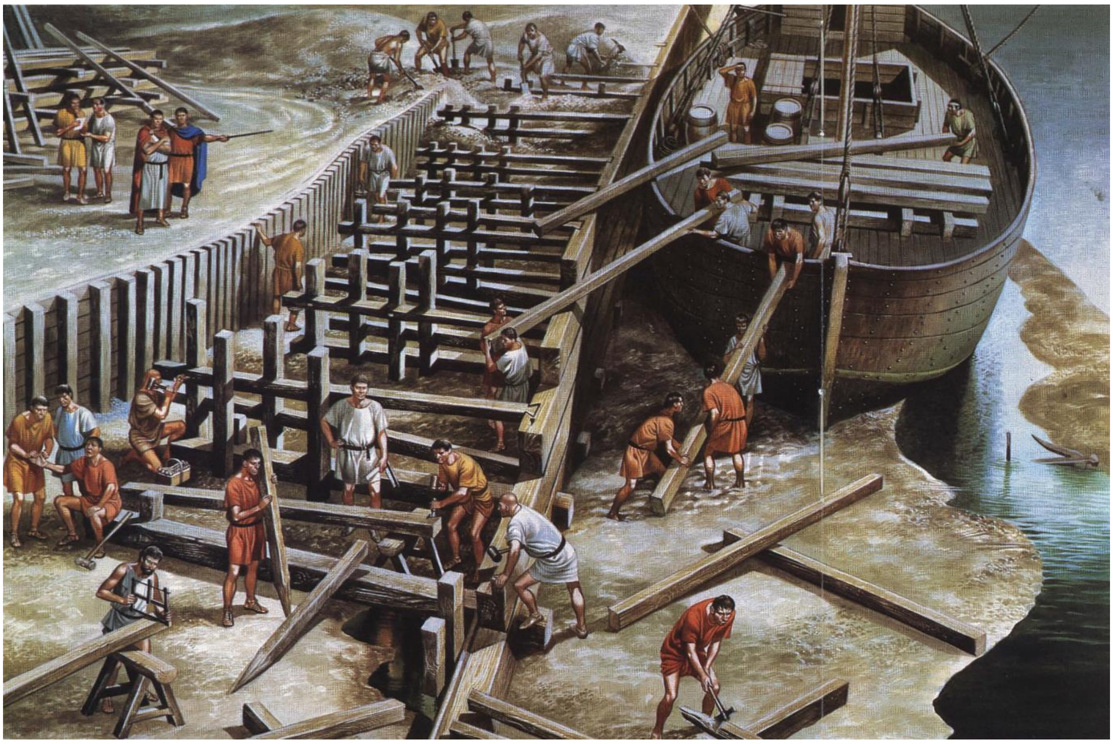


Figure 178 The construction of timber quays at St Magnus' House. Figures in the background can be seen packing the quays with dumped material. Reconstruction by Ronald Embleton (Miller, Schofield and Rhodes, 1986, p. 1).

7.4.4 Tools from Occupation Layers

Several tools from outside the Walbrook valley come from possible occupation layers. Three tools came from external surfaces, and can be related to practices in the city. RAK40 was found in the gravel surface of a public precinct at Tabard Square, Southwark (LLS02). Duvauchelle (1990, p. 45) has suggested that iron-tined rakes were used to maintain gravel surfaces, and RAK40 may have been lost while in use. PUN20 was found in the alleyway between two buildings on Fenchurch Street, Cornhill (FNE01), one of which was used for metalworking (Birbeck and Schuster, 2009, p. 22). It may have been lost or causally discarded from this workshop. The presence of the hammer HAM04 in a gravel road surface on Cornhill (XSM10) is less easily explained.

Four tools were found on internal surfaces. Surprisingly, these do not provide strong evidence for craft activity in any of the buildings that they were found within. WXS05, although found in the floor of an industrial building at Plantation Place (FER97), is related to writing rather than craft. AWL023, from the makeup layer of a floor in a possible shop on Ludgate Hill (GPO75), is too poorly preserved for its function to be identified with certainty. SPE11, a fragmentary spear-shaped spatula from the floor of a waterfront building at Pudding Lane (PDN81), has been tentatively associated with pottery production (see p.596). This seems unlikely in a waterfront property, although evidence of other industrial activities, including glass work and bonework, have been found in these dockside warehouse structures (Keily, 2006, p. 146). As SPE11 has a unique form, its true function is unknown. These objects are all quite small, and could have been lost.

Two other tools, HAM03 and TON10 were associated with buildings. The tongs or shears TON10 were found associated with an open-fronted waterfront building at Regis House (KWS94), although little can be said about them as their function is so unclear. HAM03 was found in occupation debris within a probable domestic or storage building on Ludgate Hill (NGT00). Whilst this tool may indicate industry within the structure, other evidence suggests that hammers of this kind were general household tools as well as blacksmiths' tools. The building also contained three possible pieces of militaria; a cavalry harness strap terminal, button-and-loop fastener and blade fragment (Watson, 2006, p. 31). This is interesting, as military sites have been seen as more prone to depositing large iron objects than civilian ones (see for example the pits from Newstead (Curle, 1911; Clarke, 1997; Manning, 2006)), and this may explain the presence of HAM03 in an occupation deposit.

Three other tools may have been deposited at or near the place in which they were used. WXS21, a wax tablet spatula, was found associated with an industrial hearth on Ludgate Hill (GPO75), and may have been used in some capacity in metalworking, perhaps to shape wax for castings (see p.319). BOR47, also from GPO75, was found in a posthole, and could have been used in the construction of the building it was associated with. CHI50, a robust fragment of a chisel blade, was found dumped behind a masonry wall at the amphitheatre (GYE92), and may have been used in its construction.

7.4.5 Conclusions: Tools from the City of London and Southwark

The comparative lack of attention paid to the deposition of metal objects on Cornhill, Ludgate Hill and Southwark has disguised a wealth of depositional practices which are just as diverse as those seen in the Walbrook valley. The major difference between the Walbrook and other areas of the city is the lack of deep, waterlogged dump deposits. As a consequence, objects from London's hills are extremely poorly preserved, and this hampers the degree to which they can be interpreted. Very few tools were deposited in dumps outside of the Walbrook valley, although the waterfront is a key exception. Instead, cut features were the key depositional context. Whilst some of these may contain objects related to local industrial activity, there is reason to suspect that some of these tools may have been deposited as part of ritual actions, comparable to small ironwork hoards. Other tools, particularly axes and hammers, appear to have been household items lost in house fires.

7.5 Tools from the Thames

Twenty-seven tools come from the River Thames, with a further three coming from other major rivers in the London area (the Lea and the Wandle). Thames river finds are the largest group of tools from Greater London (Figure 182, Figure 183). However, only seven tools were found in the Thames in central London.

Artefacts from the Thames from the prehistoric (Ehrenberg, 1980; Thomas, 1984; Field, 1989; Cotton and Wood, 1996; York, 2002; Cotton and Green, 2004; Schulting and Bradley, 2013) and Early Medieval periods (Raffield, 2014; Naylor, 2015) have been the subject of dedicated surveys in the past. To a lesser extent, this literature has also highlighted the potential significance of the Lea (Raffield, 2014, p. 640; Naylor, 2015, p. 125). However, with the exception of Rhodes' (1991b) study of the coins from London Bridge, there has never been a comprehensive survey of the Roman artefacts recovered from the Thames. This has led to a significant gap in our understanding of the continuity of depositional practices between prehistory and the Middle Ages. We are therefore limited in the degree to which we can contextualise the tools from the Thames, and the observations made here should be considered preliminary pending further study in the future.

The objects from the Thames in London's museums were mostly recovered through dredging of the river in the 19th and early 20th centuries (Ehrenberg, 1980, pp. 1–5; Rhodes, 1991b, pp. 179–82; York, 2002, pp. 77–9; Naylor, 2015, p. 126). The recovery of artefacts therefore depended on a sequence of fortuitous events. Artefacts had to first be dredged by machines that required the dredged material to be viewed, and to be recognised as valuable by the dredgers. In the 19th century these dredgers needed to know of collectors in the local area who were prepared to pay for such finds. The artefacts themselves needed to be of sufficient interest to the collectors for them to be retained until eventually passing into a public collection. In the early 20th century this was replaced by a new system, in which all finds were to be given to the Thames Conservancy Board in return for a small payment (Ehrenberg, 1980, p. 4; York, 2002, p. 79). This will have had a significant effect on the formation of the archaeological record.

7.5.1 Tools from the Thames in Central London

The majority of the tools from the Thames in central London (AWL049, BRU02, RAK48, SHE10) are small or fragmentary objects from foreshore deposits and silting around waterfronts, of the sort that could easily be lost or discarded as rubbish.

Figure 179 Tools from the Thames in Central London (Top row, left-right; awl, AWL049; brush/blade, BRU02; rake tine, RAK48; shears, SHE10. Second row; poker, HEA02. Bottom row, left-right; sickle, SIC24; twitch, TWI01 (Francis, 1926, fig. 9)).

An exception is HEA02, a complete poker. It may be significant that the only other stratified pokers from London also derive from 'watery' contexts; the Walbrook stream at Throgmorton Avenue (HEA07) and a well at Gresham Street (HEA08). This may be a reflection of preservation patterns, with slender pokers only surviving in a complete state in waterlogged environments. Fragmentary hearth tools, which may be pokers, were also recovered from dumps (HEA03-04) and demolition material (HEA05) elsewhere in the city. However, it is also possible that this indicates the selective deposition of pokers in watery contexts for votive purposes. Pokers were also part of the Waltham Abbey hoard; a group of smith's tools buried together in a chest in or near the River Lea in the Late Iron Age or Early Roman period (Manning, 1977).

Two tools, the sickle SIC24 and twitch TWI01, were found in the Thames near London Bridge. London Bridge has been recognised as a focal point for the deposition of bronze objects, with large numbers of coins, statues and other artefacts having been recovered from dredging, and during the construction of New London Bridge, in the 19th century (Ehrenberg, 1980, p. 9; Rhodes, 1991b; Durham, 2010, pp. 331–2). Rhodes (1991b) interprets these objects as votive deposits made by casting objects from the bridge, possibly from shrines set up on the bridge itself.

Rhodes (1991b, p. 184) has suggested that the twitch TWI01 may have been ritually destroyed and deposited in the river in this way. Previously, this tool has been seen as a pagan item destroyed and disposed of by early Christians (Roach Smith, 1844, p. 550; Francis, 1926, pp. 104–5). It is possible that this elaborately decorated tool, with its busts of deities, was deposited alongside other representations of gods and emperors found at London Bridge (Figure 180), which includes the decapitated head of Hadrian (Rhodes, 1991b, p. 183) and several statuettes (Ehrenberg, 1980, p. 9; Durham, 2010, pp. 331–2). Other statuary from London, such as those from the Temple of Mithras (Grimes, 1986) and bronze statue fragments from across the city (Bayley *et al.*, 2009), are also thought to have been deliberately broken up and ritually deposited.

Figure 180 Bronze statuary from the Thames at London Bridge. Left, head of a larger-than-lifesize statue of Hadrian (http://www.britishmuseum.org/collectionimages/AN00033/AN00033340_001_l.jpg). Right, statuette of Mercury (http://www.britishmuseum.org/collectionimages/AN00845/AN00845025_001_l.jpg?width=304).

It is less likely that SIC24 was deposited in this manner. Rather than being a votive deposit specifically related to activity at London Bridge, this appears to be part of a wider pattern of the deposition of agricultural equipment in the Thames to the west of London.

7.5.2 Tools from the Thames in Greater London

The Roman tools from the river west of London (and in London's other major rivers) are restricted to a very narrow suite of objects; mostly sickles and reaping hooks (SIC04, 07, 08, 11, 12, 17, 24, 31, 34), billhooks (BIL03, 08) and axes (AXE04, 07, 08, 11, 12, 17, 18, 23), in addition to which are one adze (ADZ02) and one ploughshare (PLO01). Whilst axes and adzes could be considered woodworking tools, none of these objects would be out of place in a rural setting, and may indicate the importance of agriculture outside the city.

It is noticeable that these objects are considerably larger than most of the objects recovered from elsewhere in London (Figure 181). The same is also true of the finds from the river Lea. It is possible that this represents the selective deposition of certain artefact types, many of which are also found in ironwork hoards (Humphreys, 2017a). However, this may also be in large part due to recovery bias, as dredging favours the recovery of large, recognisable objects (Naylor, 2015, p. 125).

Tools are recorded from a number of points on the Thames west of London (Figure 182), although there are reasons to be cautious about interpreting these as focal points for deposition or occupation. Objects could be moved significant distances by water action (Ehrenberg, 1980, p. 5). Recovery practices will also have had an influence. The findspots recorded for Thames objects are vague, and 'reflect the recording of the dredging process rather than exact places the metalwork entered the water' (York, 2002, p. 79). The presence of known collectors may also have influenced this pattern. The concentration of finds around Brentford may in part be related to the collector Thomas Layton's personal and business interests in that area (Whipp and Blackmore, 1977).

There is nevertheless some evidence of patterning. Reaping hooks are found throughout the study area, from central London (SIC24) to Shepperton (SIC08). Axes, however, are only found in a comparatively narrow stretch of the river from Putney to Isleworth, with the majority coming from Brentford. Ideally, future study will look at the Greater London objects alongside other finds from the Thames, which in other periods continue to be found west of Oxford (Naylor, 2015).

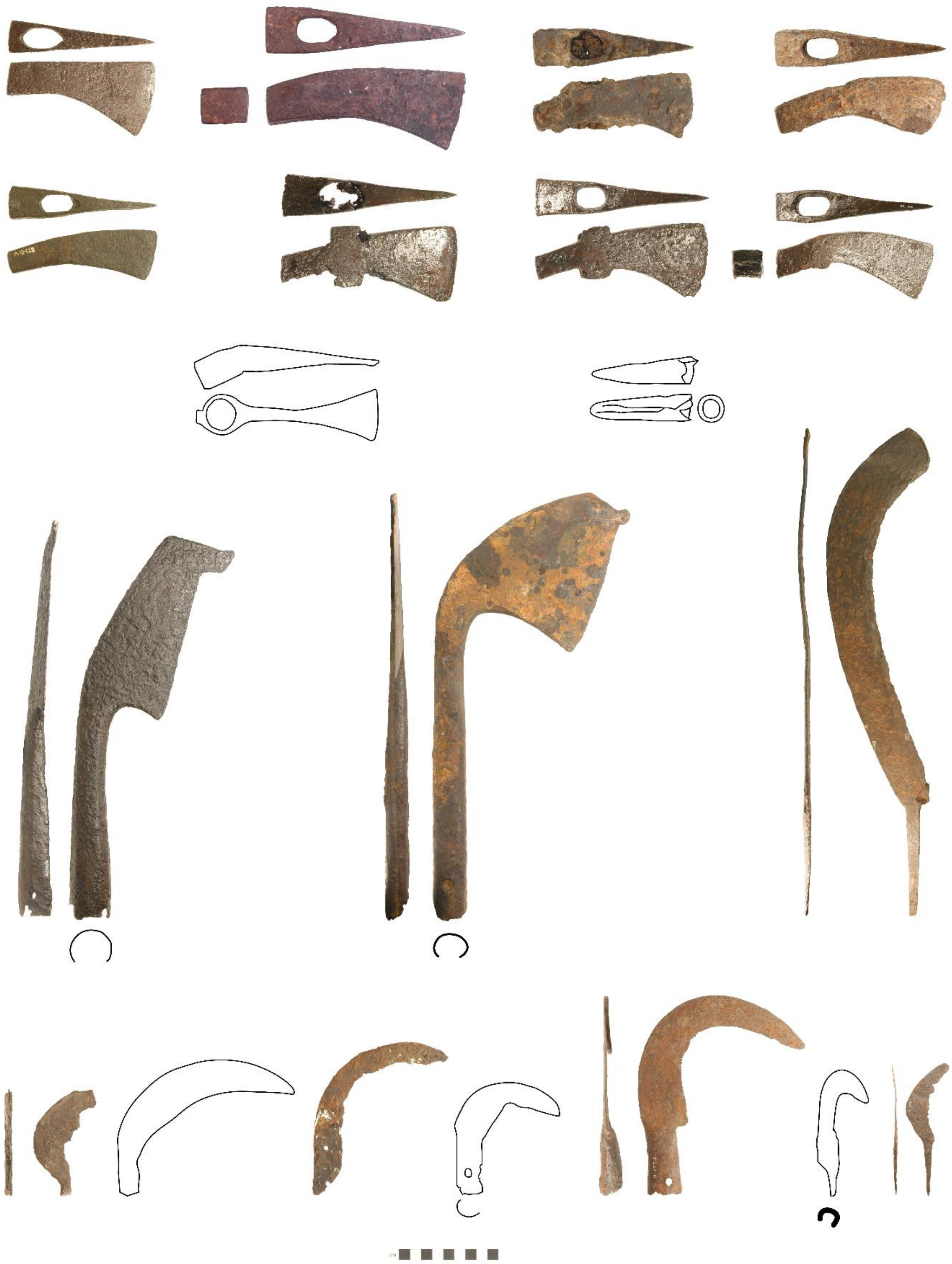


Figure 181 Tools from the Thames in Greater London (Left-right. Top row; axes, AXE04, 07, 08, 11. Second row; axes, AXE12, 17, 18, 23. Third row; adze, ADZ02 (after Hayes, 1991, fig. 151); ploughshare, PLO01 (after Manning, 1985a, F1)*. Fourth row; billhooks, BIL03, 08; sickle, SIC04. Bottom row; reaping hooks, SIC07, 08* (after Manning, 1985a, F25)*, 11, 12* (after Manning, 1985a, F27)*, 17, 31* (after Manning, 1985a, F49)*, 34).*

A few of the objects from the Thames west of London can be dated typologically, suggesting a wide range in depositional dates. ADZ02 conforms to Darbyshire's (1995) Form 2a, dating from c.300 BC to the mid-1st century AD. AXE17 and AXE18 have long but wide rectangular lugs, which

Pietsch (1983, Abb. 26) dates from the 2nd to mid-3rd centuries AD. AXE23 may date to the 3rd-5th centuries, although the dating and distribution of the curved version of this form has not been firmly established (see p.404). As such, these objects need not be seen as contemporary with each other.

It is not clear how these objects entered the river. Several different mechanisms have been suggested for Thames objects in the past, which largely condense into four groups; rubbish disposal, accidental loss (in riverside battles, during crossings or from ships and shipwrecks), erosion from riverside deposits (such as settlements, burials or hoards), and deliberate ritually-motivated deposition in the river itself (Ehrenberg, 1980; Thomas, 1984, p. 17; York, 2002, p. 90; Raffield, 2014, p. 639).

Accidental loss seems the least likely given how few tools of these types were found in the Thames in central London, where river crossings and boat movement would be most frequent. Although recovery may have been a factor, it is worth remembering that other object types have been recovered in some quantity from London Bridge (Ehrenberg, 1980, p. 9; Rhodes, 1991b; Durham, 2010, pp. 331–2). Erosion from burials can also be discounted, as the types of objects found in the Thames were not often deposited in graves in the Roman period (although AXE22 (see p.333) is an exception). It is nevertheless notable that a large concentration of tools was found at Brentford, where a roadside settlement existed (Canham, 1978; Cowie, Thorp and Wardle, 2013). It seems likely that there would have been a river crossing here, although the London-Silchester road may have been more important to the settlement's creation (Cowie, Thorp and Wardle, 2013, p. 9).

It is not impossible that some of these objects were eroded from riverside ironwork hoards, although this too seems unlikely. The Late Iron Age/Early Roman Waltham Abbey hoard (Manning, 1977) is the only known Roman ironwork hoard from a river bank in the London area, although a number of possible smaller special deposits have been identified tentatively in the city of London (see p.314). Moreover, tools appear to have been deposited in the Thames throughout the Roman period, whilst hoards are only found in southern England during distinct periods in the 1st and 4th centuries (Manning, 1972a, p. 237; Humphreys, 2017a, p. 364).

The types of large objects found in the Thames are rare as settlement finds on Roman sites. Whilst a number of similarly large objects were deposited as rubbish within the city of London itself (see p.310), similar finds are not common in the surrounding settlements (see p.329). It therefore seems unlikely that finds represent rubbish disposal in or near the river.

Deliberate ritual deposition has been suggested for the Bronze Age (York, 2002, pp. 90–1) and early medieval (Raffield, 2014; Naylor, 2015) objects from this part of the Thames, possibly motivated by the importance of the Thames as a liminal space or boundary (York, 2002, p. 91; Naylor, 2015, p. 133), or the special properties of the objects themselves (York, 2002, pp. 90–1). Ritual deposition has also been suggested as a motive for the deposition of metalwork in other rivers of the Roman period, although in Britain iron objects are rarely part of deposits in open water (Humphreys, 2017a, pp. 366–7). The only significant deposit containing iron tools is the 3rd century deposit from Piercebridge, thought to represent items thrown from a bridge into the river Tees, possibly as a marker of boundary crossing (Walton, 2008). Large amounts of material have been found in Continental rivers, however, and ritual motives have been suggested for deposition in the Rhine (Kappesser, 2012) and Ljubljanica (Gaspari, 2006, pp. 12–3).

It is possible that some of these tools were deposited in the Thames for ritual purposes. Objects of the same type are known to have been deposited in hoards, also probably for ritualised reasons (Manning, 1972a; Hingley, 2006; Humphreys, 2017a). Whether these deposits represent 'imported' Roman practices, referencing river deposits made elsewhere in the Empire, or continuations of pre-Roman depositional practices is unclear.

7.5.3 Conclusions: Tools from the Thames

From this analysis, it seems likely that a large number of the objects recovered from the Thames were deliberately deposited in the river for ritual reasons. It is possible that three separate ritual activities were taking place in this river. The twitch TWI01, from London Bridge, may be related to a bridge shrine, and is possibly connected to the deposition of other religious images in this part of the Thames. The deposition of the poker HEA02 may be related to a broader understanding of a connection existing between metalworking tools (particularly pokers) and water. The agricultural equipment deposited in the Thames to the west of London, however, may be related to pre-Roman deposition in this area.

However, with so little study having been dedicated to Roman period deposition in this river, it is difficult to contextualise these finds. Future study is needed to confirm or dispute these suggestions. Ideally, such work would encompass the entire course of the Thames, not just the area around London, and encompass all artefact types, rather than focussing exclusively on tools as has been done here. Links with other possible ritual deposits need to be explored. For example, pewter dishes have been found at Shepperton (Naylor, 2015, p. 125), and are also sometimes deposited alongside tools in ironwork hoards (Humphreys, 2017a). More fundamentally, future work should critically consider the history of dredging and collecting in the river, as Kappesser (2012) has done for the Rhine. Attention should also be paid to the details of the riverine landscape, taking note of the potential importance of bridges, bogs, confluences and tributaries etc. (Yates and Bradley, 2010; Raffield, 2014, p. 643).

7.6 Tools from Greater London

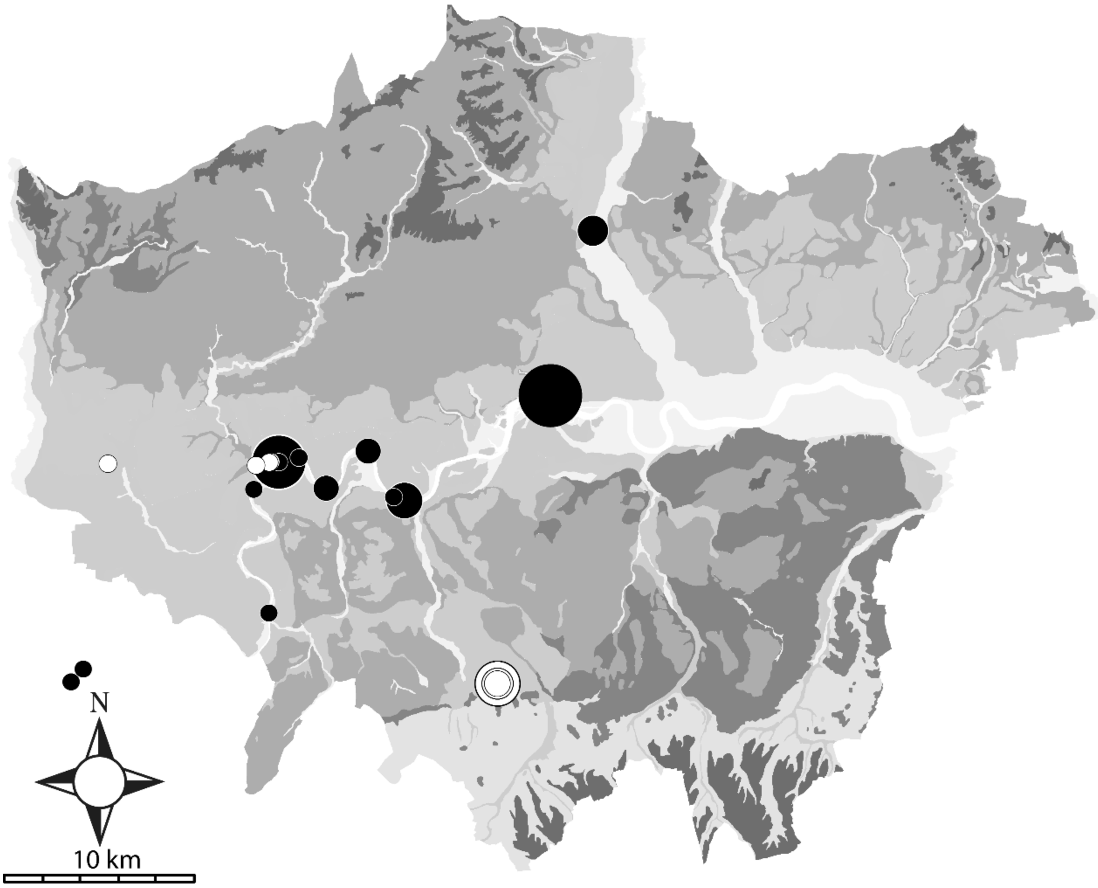


Figure 182 The distribution of tools in Greater London.

The pattern in Greater London is very different to that seen in the city. This is the only part of the London tools assemblage in which the largest category of finds is not 'unstratified' (Figure 183). This is due to the fact that the largest number of tools from Greater London are Museum of London and British Museum finds from the major rivers of the Thames valley; the Thames, Lea and Wandle (see p.324). It is also likely that many of the unstratified finds from Greater London were originally deposited in rivers, owing to their large size, although this cannot be proved. Nevertheless, a small number of tools have been excavated in rural settlements in the London area, and these also show differences in context when compared to the City. Finds from Greater London are much more likely to have derived from dark earths, ditches and surfaces, with fewer coming from dumps or pits.

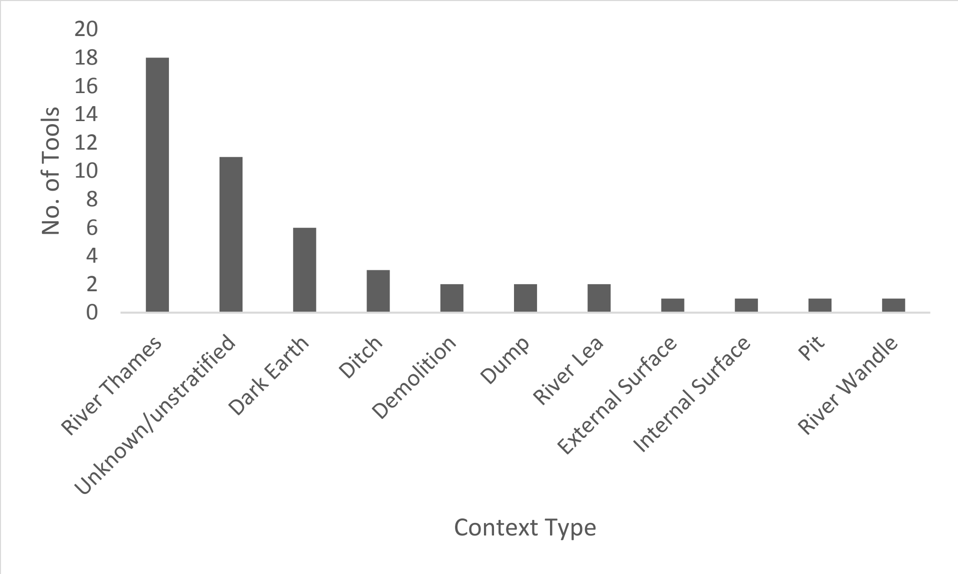


Figure 183 The contexts of the tools from Greater London.

The most significant assemblages in the area are from Beddington Villa in Croydon (BSF81-87) and a small hoard from Cranford Lane, Hillingdon (CFL94). Smaller assemblages include the two tools from a bath-house just outside London at Shadwell (HGA02), and a concentration of tools from the roadside settlement at Brentford. The majority of the finds from Brentford come from the Thames, and largely relate to the dredging and collecting activities of Thomas Layton. Only one tool, FOR01, comes from a stratified context associated with the settlement, adding little to our understanding of the site. The survey of Greater London was not as complete as that of the city itself, however, and it is likely that a number of other tools are housed in local museums in the counties around London.

7.6.1 Tools from Beddington Villa

Thirteen tools were found at the Beddington Villa, Croydon (BSF81-87, Howell, 2005); the largest concentration of tools outside of the city itself. Unfortunately dating evidence was scarce, and it is not possible to confirm whether all of these tools were in fact Roman.

A number of tools from the site may indicate metalworking. These include two possible metalworking chisels (COL08-09) a hot punch (PUN10), and a chasing punch (FIN06). A Type 8 hammer (HAM10) may be a metalworking tool for raising vessels, or a woodworking tool for setting saws, but does not come from a secure context. These is also ambiguous evidence for leatherworking at the site. A possible leatherworking knife or turf cutter (LEA03) could not be located and physically examined. A possible scraper (SCR05) may have been used to process hides, but does not come from a secure context, whilst no structures obviously associated with tanning were found. Five ox goads (OXG25-28, 36), the function of which is not certain, and a rake tine (RAK12) were also found.

The majority of the tools were found in soil layers, the dates of which are uncertain. This probably represents the ease with which objects could be disposed of on surfaces or in fields in a country setting. COL08 and PUN10 were both found in the same ditch, possibly indicating metalworking nearby, whilst FIN06 was found on an external surface, possibly indicating fine metalworking in the yard area. One ox goad, OXG26, was found in plaster from a collapsed ceiling. Like OXG22, from a demolition layer in the city, this indicates that ox goads could be stored in the house in both town and country, although their function remains obscure.

7.6.2 The Cranford Lane Hoard

One of the most intriguing finds from Greater London is a small ironwork hoard from Cranford Lane, Hillingdon (CFL94). The hoard is currently undergoing post-excavation processing, so the full details of its context and contents are unknown. The deposit is nevertheless known to have comprised chain fragments, double-spiked loops, an iron plate, a large lead ring filled with short iron rods, and the billhook BIL02. The mixture of iron tools, in this case agricultural, with smaller fragments of 'scrap' iron is common in ironwork hoards (Humphreys, 2017a).

The deposit was found in a pit, [408], within a network of ditches defining a group of rectangular enclosures, thought to have been stock enclosures (Figure 184). No occupation areas were found, so the exact nature of the occupation at this site is unknown (Maloney and Greenwood, 1995, p. 341). Pottery dated the feature to the second half of the 4th century.

This deposit is typical of a small Roman ironwork hoard, forty-seven other examples of which have been identified (Manning, 1972a; Hingley, 2006; Humphreys, 2017a, p. 364). This is only the second ironwork hoard to have been found in Greater London, after the Late Iron Age/Early Roman Waltham Abbey Hoard (Manning, 1977; although see above for a discussion of small hoard-like deposits in the city of London).

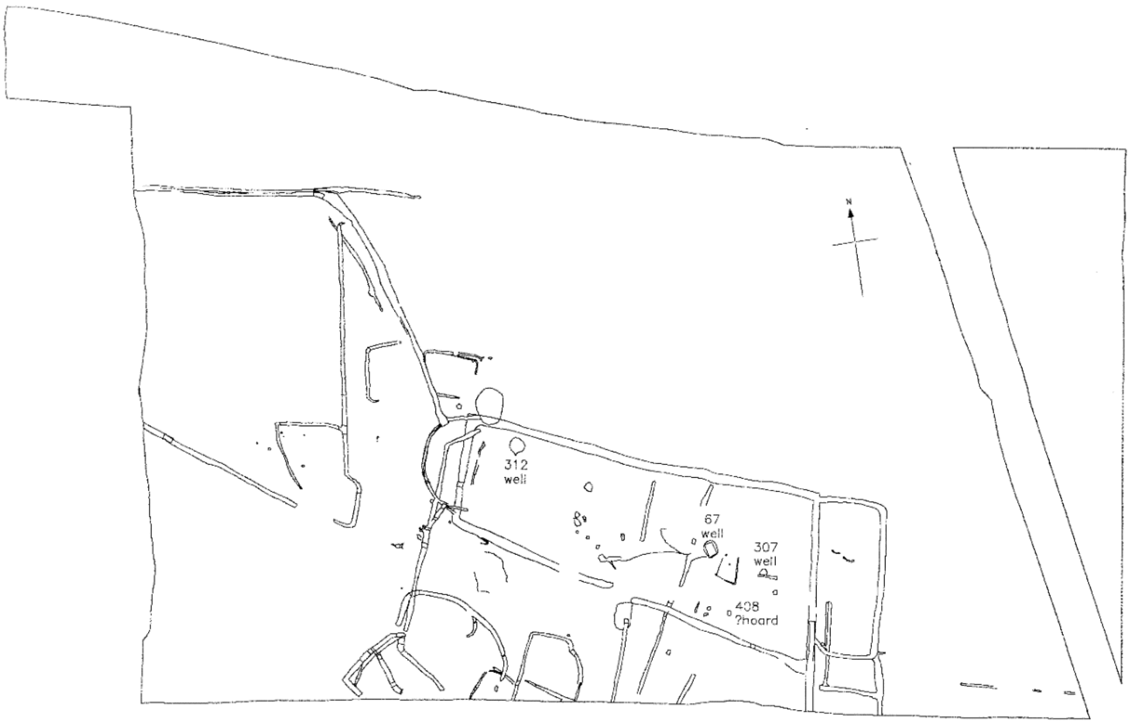


Figure 184 The location of pit [408] within the Cranford Lane site (CFL94, Elsden, 1996).

Roman ironwork hoards are only found within well-defined chronological and spatial boundaries in Britain (Manning, 1972a, pp. 226–8; Humphreys, 2017a, p. 364, Illus. 1). A small number of Late Iron Age/Early Roman hoards (including the Waltham Abbey hoard) are known from southern Britain, after which a second group is found in northern England and Scotland in the 1st and 2nd centuries. There then appears to be a hiatus in hoard deposition, before a large number were deposited in southern Britain and Yorkshire in the Late Roman period. It is to this group that the Cranford Lane hoard belongs.

Although previously interpreted as stores of scrap or evidence of conflict, ironwork hoards are now widely interpreted as ritual deposits (Piggott, 1952; Manning, 1972a; Hingley, 2006; Humphreys, 2017a). The exact meaning of these deposits is obscure, however. Some appear to be related to site abandonment, and as such they may have functioned as termination deposits (Merrifield, 1987, pp. 49–50; Hingley, 2006, pp. 228–30; Humphreys, 2017a, p. 401). The significance of the objects deposited in these hoards may have come from the cultic associations of the objects contained within them, particularly tools (Humphreys, 2017a), or from the special status of iron as a metal (Hingley, 2006). As the bulk of the objects from this hoard have not yet been identified, it is not possible to advance a reason for the creation of this deposit at this stage.

7.7 Tools from the Cemeteries

Only one tool was found in a grave context in London. AXE22 was found at the north end (near the head?) of an inhumation burial (B256) in London's Eastern Cemetery. Near the axe was a shale armlet. At the other end of the grave was a pair of hobnailed shoes. The body was highly disturbed, so nothing is known about the physical anthropology of the person interred here. The shale armlet would usually be interpreted as a female artefact, although as it was not being worn in the burial it may not have belonged to the interred, who was thought to be a craftsperson based on the inclusion of AXE22 (Barber and Bowsher, 2000, p. 134). Nails in the grave may suggest the presence of a wooden coffin. The burial itself was poorly dated, but the finds suggest a 3rd or 4th century date (Barber and Bowsher, 2000, p. 162).

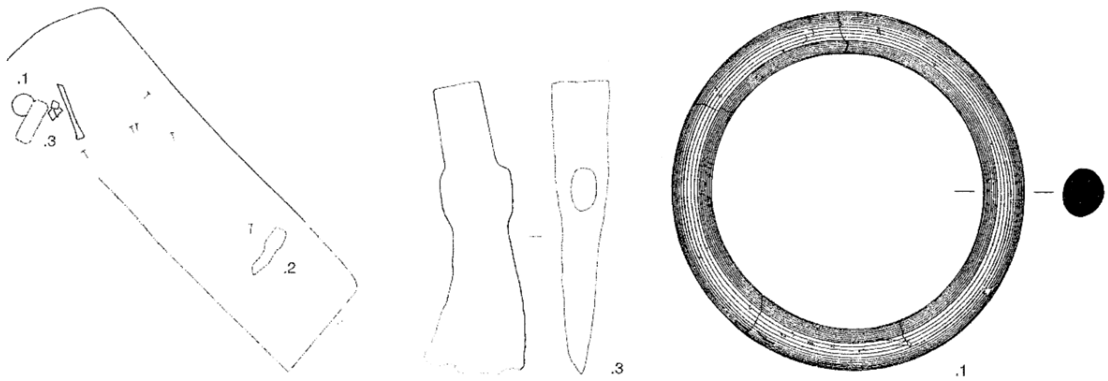


Figure 185 Burial B256 and grave goods (Barber and Bowsher, 2000, p. 162). *Not to scale.*

In order to put AXE22 into its proper context, it needs to be seen alongside other Roman period burials containing woodworking tools. Although grave goods are common in many types of Roman burial, metal tools (excluding knives and shears) are extremely rare. Philpott (1991, pp. 186–7) lists only a small number of graves containing metal tools, at least two of which (those from Burbage (Goddard, 1894; MacGregor, 1985, p. 160) and Tattershall Thorpe (Hinton and White, 1993)) are no longer thought to be Roman. Because of this, tools have been seen as highly personal items, reflective of individual craft identity, and not a class of artefact from which patterning can be discerned (Barber and Bowsher, 2000, p. 134). However, this is not the case. Despite the small numbers of graves with woodworking tools, it is possible to see patterning in the burial record, and to suggest that this burial followed a particular burial type which does not necessarily reflect craft specialisation.

7.7.1 Burials with Woodworking Tools

Including the London burial, six burials with woodworking tools are known from Britain. The details of these burials are given below, and in Table 10.

Location	Sex	Type	Date	Tools
Driffied, Glos.	Unknown	Inhumation	Unknown	Axe
Dyke's Hill, Oxon.	Male	Inhumation	5th century	Axe
London	Unknown	Inhumation	3rd-4th century?	Axe
Tiddington, Warks.	Unknown	Inhumation?	Unknown	Chisel?
Turner's Hall Farm, Herts.	Female?	Cremation	AD 150+	Planes and saw
Wellwick Farm, Bucks.	Unknown	Cremation	AD 135-55	Adze-hammer

Table 10 Burials with woodworking tools in Britain

Driffield (Glos.)

A stone coffin, uncovered during drainage works in 1861 (Church, 1922, p. 47; RCHM, 1976, p. 45), possibly close to a road leading from *Corinium* (Franks, 1865, pp. 202–4), contained an iron axe and a number of pottery vessels (Church, 1922, p. 47; Historic England, 1999). Although recorded as an inhumation, no information is available about the person in the burial, or its date.

Dyke's Hill (Oxon.)

Damage to an Iron Age earthwork at Dyke's Hill (Oxon.), caused by the use of a machine excavator to retrieve a lost dog, uncovered human remains in December 2009. Further excavation at the site by a team of archaeologists in 2010 uncovered a scatter of human remains and pieces of Roman metalwork. Although separated by several meters, these are thought to relate to a single grave in the area of the disturbance (Booth, 2014). The human remains comprised the majority of the skeleton of an adult male (aged 30-40 years), as well as four fragments of the skull of a child (aged 8-12 years), thought to be unrelated. The metal finds (Figure 186) included Continental style copper alloy military belt fittings, and an iron axe head (Hanemann, 2014

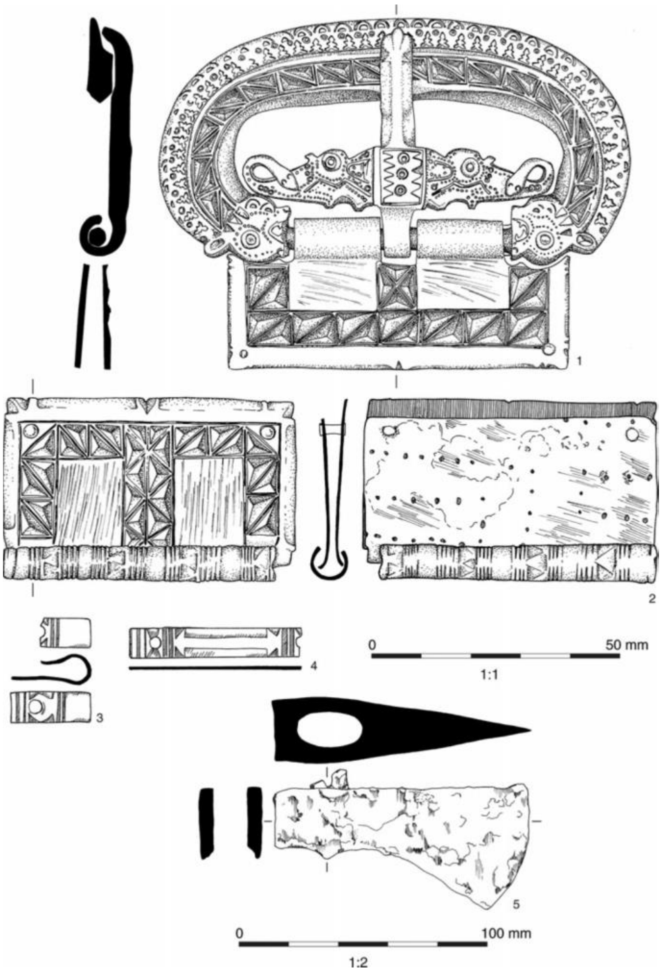


Figure 186 Copper alloy belt fittings and iron axe head from Dyke's Hill, Dorchester on Thames (Booth, 2014, fig. 3).

Type 4). Green staining to the adult skull suggested that the copper alloy finds belonged to this skeleton. The morphology of the skull and isotope analysis on the teeth of the skeleton suggest that the interred was an immigrant, possibly from Denmark. The axe and belt fittings are also both Continental types. It is thought that the person may have been an immigrant military official (Booth, 2014).

Tiddington (Warks.)

Commercial excavation at Tiddington, Warwickshire, in 1980-81, uncovered 35 burials, one of which contained a 'cold-chisel like iron object' (Palmer, 1981, p. 22). The site is unpublished, and nothing else is reported about this burial. Most of those excavated were inhumations rather than cremations.

Turner's Hall Farm (Herts.)

In 2002, metal detectorists uncovered a number of metal objects, including bronze vessels and silver brooches, in a grave at Turner's Hall Farm, Hertfordshire. Subsequent re-excavation produced more finds, and led to a larger excavation and survey project at the site, a villa in the vicinity of Verulamium, which remains unpublished (West, 2004, 2005).

Figure 187 Left, plan of the burial from Turner's Hall Farm. The iron tools (No. 19) are in the lower left hand corner. Right, selection of grave goods from the Turner's Hall Farm burial. Above, vessels, lamps and brooches. Below, woodworking planes (West, 2005, pp. 271–3).

The burial consisted of a cremation, probably of a woman aged 20-45 years old, in a bone and ivory-inlaid casket within a larger wooden chamber or chest, dated to after c.150 AD. The grave was richly furnished, with bronze, ceramic and glass vessels, two silver brooches, and a range of arrowheads. A copper-alloy mounted wooden box in the grave contained an unquantified mass of iron tools, including four or five small woodworking planes and a saw blade. Two of the planes had grooved bases, and are thought to represent smoothing planes used to produce arrows.

Wellwick Farm, Wendover (Bucks.)

In 2000, metal detectorists at a rally uncovered a cremation burial at Wellwick Farm, Buckinghamshire. No Roman settlements are known nearby. The find was reported to the local archaeological service and subsequently excavated, although the cremation urn itself was stolen before excavation took place (Zeepvat, 2003). The cremation urn and grave goods were placed together in a wooden box in a pit, dated AD 135-55. The chest contained pottery vessels, some holding offerings of food, fragments of glass vessels, a lead lamp, and an iron adze-hammer. Based on the inclusion of the adze-hammer, the grave was interpreted as that of a carpenter, cooper or wheelwright (Zeepvat, 2003, p. 58), although the tool does not appear to have the hollowed blade of a cooper’s adze.

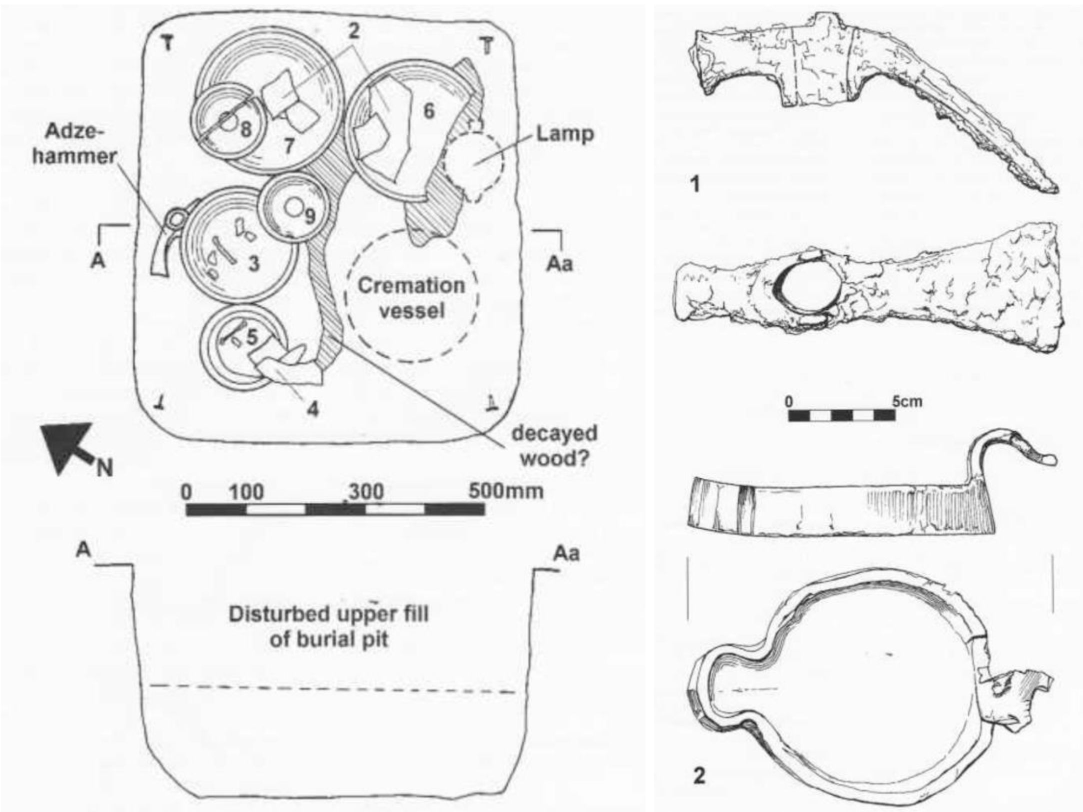


Figure 188 The burial from Wellwick Farm, Buckinghamshire. Left, the grave cut and position of the grave goods (Zeepvat, 2003, fig. 2). *Right, the iron adze-hammer and lead lamp* (Zeepvat, 2003, fig. 3).

7.7.2 Discussion

Even amongst the very small group of burials with woodworking tools from Britain, two groups begin to emerge. Comparing these burials to examples known from Continental Europe reinforces the impression that these constitute distinct burial traditions.

7.7.2.1 Cremation Burials

The first group are cremation burials. The burials from Turner's Hall Farm (West, 2004, 2005) and Wellwick Farm (Zeepvat, 2003) are part of this group. Continental examples can also be cited. A child's cremation (aged 4-5 years old) from Xanten was buried in a stone box, containing clothes and shoes, glass vessels, a lamp, dice, and metal objects, including a coin and strigil, as well as a miniature iron axe and hammer (Bridger, 2013). The cremation of an adult male from Avenches (Tombe 3) contained 25 ceramic vessels, a glass bead, coin, and three iron tools (a saw, adze, and pair of shears) in a wooden box (Castella, 1987, pp. 51–5). At Sagnes à Pontarion, Creuse, nine cremation burials in stone vessels contained both full-sized and miniature carpentry tools, some alongside pottery and other domestic equipment (Lintz, 2001, Sep. 50, 55, 68, 87, 91, 144, 150, 169, 238).

Figure 189 Cremation grave of a child from Xanten (Bridger, 2013, fig. 4).

Although scattered across northern Europe, these burials share a number of remarkable similarities. Most were interred in the 2nd century, most sometime around the middle of the century, although the dating evidence from Sagnes à Pontarion is not clear. They are all composed of the cremated remains of an individual, usually collected in a container, which was itself deposited in a wooden chest. The grave goods from all burials are un-burnt, and were therefore not part of the funeral pyre. The range of objects deposited is remarkably similar; most contain a number of pottery, glass or metal vessels, alongside carpentry tools and sometimes a lamp.

Despite this uniformity in burial treatment, the people involved in these burial practices were a very diverse group. Whilst we would expect tools to appear in the graves of adult men, this group includes the burials of women and children. This indicates that we should not see these as straightforward 'woodworker' burials. Whilst we should not discount the possibility of female woodworkers off-hand, the rich furnishings of the Turner's Hall Farm grave do not suggest a 'female carpenter'. The tools, which may have been used to make arrows, could plausibly be seen as part of the hunting equipment of an aristocratic woman. The miniature tools buried with the Xanten child may be representative of their expected future career; a special treatment given to the prematurely dead (Martin-Kilcher, 2000). These burials call into question the straightforward association between tools and craft professions in male burials, as it is noticeable that none of these graves contained a full suite of carpenter's tools. The London burial is not of this type, however.

7.7.2.1 Inhumation Burials

The second group are Late Roman inhumation burials with axes. The Dyke's Hill burial belongs to this group, as does the London burial, and possibly the Driffield burial. Burials of the Dyke's Hill type, combining military belt sets and axes, become common on the Continent in the Late Roman period (Booth, 2014, p. 261), and axes continue to be deposited in 'weapon burials' into the early middle ages (Böhme, 1986; Theuws and Alkemade, 2000; Dobat, 2006; Theuws, 2009; Halsall, 2010). Although mostly interred with adult males, axes are also found in child graves on the Continent (Theuws and Alkemade, 2000, p. 458). However, although 73% of Late Roman/Early Medieval 'weapon' burials included axes, with the largest number containing only axes (Theuws and Alkemade, 2000, p. 456; Theuws, 2009, p. 301), no other examples are known from Britain (Booth, 2014, p. 261). Burials containing only imported belt sets are known, however, including from London (Simpson, 1976; Barber and Bowsher, 2000, pp. 206–8; Eckardt, Müldner and Speed, 2015, pp. 203–6).

These burials have traditionally been interpreted as an imported tradition brought to the Empire by Germanic soldiers (*foederati*) serving in the Roman army (Böhme, 1986; Theuws and Alkemade, 2000, p. 456; Theuws, 2009, p. 287; Halsall, 2010, pp. 109–10). However, Halsall (2010, pp. 107–68) and others (Theuws, 2009, pp. 288–90) have argued strongly against this, suggesting that these rites originated in Northern Gaul, and actually decreased in frequency after the collapse of the Roman Empire in the early 5th century (Theuws, 2009, p. 297). Whatever the situation in Gaul, it seems likely that the Dyke's Hill grave was that of an immigrant to Britain; the skull morphology, tooth isotopes and belt set all suggest a non-British origin (Booth, 2014). Although Halsall (2010, pp. 119–21, 134–5) suggests that the case for a 'Germanic' origin for the axes in these burials has been overstated, the axe in the Dyke's Hill grave has the triangular lugs of Hanemann's (2014, p. 345) Type 4, the distribution of which is mainly in free Germany (Figure 217).

The same cannot be said of the London burial containing AXE22. The other grave goods (a pair of hobnailed shoes and a shale armlet) are not obviously foreign, whilst the bracelet may indicate that AXE22 was deposited in a woman's grave. AXE22 itself is of a common type (Hanemann, 2014 Type 3B), five other examples of which come from London (AXE17-21). It is possible, however, that AXE22 was manufactured as a piece of military equipment. Rectangular lugs around the shaft hole are a feature which developed on early Roman military sites (Hanemann, 2014, p. 345), and are predominantly (although by no means exclusively) found on military sites (Manning, 1966, p. 13).

The axes in these burials are typically seen as weapons (Theuws, 2009, p. 298), particularly as throwing weapons, but deposition may also have referenced their use as tools (Theuws and Alkemade, 2000, pp. 458–9). Although possibly of military manufacture, AXE22 itself is far too large to have been used as a throwing weapon, and has the typical form of a Roman axe; a multi-purpose tool used for everything from tree felling to structural carpentry and object manufacture. Some axes are found in Late Roman graves alongside other woodworking tools, and these surely reference the trade of woodworking, and may indicate that those interred were military carpenters (Gluščevič, 2014).

Others have highlighted the potential symbolic associations of the axe as a tool. Theuws and Alkemande (2000, p. 459), discussing the axe burials from Northern Gaul, suggest that axes may have been symbolically important tools because of their role in clearing and claiming farmland. Theuws (2009, pp. 307–9) has also suggested that axes should be interpreted alongside other objects deposited in contemporary graves (bows and lances) as a suite of objects related to claiming power over land, rather than as weapons claiming martial power or making statements of ethnicity. However, axes have other symbolic associations in the Roman period. Axes appear to have been associated with political authority; they formed part of the *fasces*, and the discovery of buried prehistoric axes could serve to legitimate political authority (Kiernan, 2009, pp. 147–8). Axes were also used in to dispatch animals in religious

Figure 190 Sacrifice scene on the 1st century Boscoreale Cup (Aldrete, 2014, fig. 1).

sacrifices, and miniature axes may have been used as substitute sacrifices (Kiernan, 2009, pp. 148–51; Aldrete, 2014). The role of sacrifice in establishing authority has been suggested as a reason for the inclusion of an axe in the later Sutton Hoo ship burial (Dobat, 2006). This object is especially interesting; its peculiar form has been a source of debate for decades, but from a typological perspective it seems to be either a Roman antique, or copy of a Roman period axe (Hanemann, 2014 Type 3B), similar to AXE22.

Figure 191 Left, head of the axe-hammer from Sutton Hoo (Dobat, 2006, fig. 1)*. Right, Hanemann (2014) Type 3B axe from London (AXE18). Not to scale.*

Interpreting the significance of AXE22 is therefore difficult. The burial referenced a tradition emerging in northern Gaul at the time, although the interred may have been a local person. This tradition is associated with the military, and it is possible that AXE22 was manufactured in a military workshop. Nevertheless, AXE22 is a tool rather than a weapon. Axes in graves may have referenced a wide range of symbolic associations, many linked to religious or social authority, and it may even have been the potential for multiple meanings that made axes suitable for deposition in graves (Theuws and Alkemade, 2000, p. 457; Theuws, 2009, pp. 301–3). It cannot be taken for granted that the person buried with AXE22 was a carpenter.

7.8 Conclusions

This section has examined the disposal of London's tools, using distribution, dating and context as evidence. Understanding these practices is fundamental to interpreting the distribution of tools in London. Studying disposal practice in detail also reveals important information about social attitudes towards material culture. At the outset, this analysis sought to answer two questions:

- Where were tools deposited and why?
- What evidence is there for 'zones' of craft practice in London?

This analysis has shown an extraordinary diversity in the disposal practices of tools in Roman London. Tools were not deposited evenly across the city. Whilst preservation and recovery have undoubtedly been important factors in shaping London's archaeological record, it appears that the concentration of tools recovered from the Walbrook valley is a real representation of the greater amount of material deposited there. Little evidence was found to support the supposition that these tools demonstrate that the Walbrook valley functioned as an 'industrial zone', however. The majority of the tools deposited here were found in landraising dumps on the valley banks. These deposits comprised waste brought from across the city, and therefore reflect the disposal practices and industrial activities of communities living outside the valley as well as within it.

The question of whether London's different 'zones' had different craft economies, or whether the city had dedicated 'craft zones', is therefore very difficult to answer using London's tools. The fact that waste was deposited in the Walbrook valley from all over the city means that the sample of tools excavated in any area of the city has already been heavily selected, and may not be representative of the economy of the area. Even broad patterns in the distribution of tools can be misleading unless context is considered. For example, agricultural tools are common in Greater London, but this appears to be related to the ritual deposition of tools in the Thames rather than agricultural practice. Woodworking tools are common during phases of timber construction in the Walbrook, but most relate to pre-construction dumping, rather than construction activity.

The number of tools from anywhere in the city that can be specifically related to local industrial activity is very low. Tools from occupation deposits tend to be small, fragmentary, and poorly preserved. As such few can be identified with certainty, and few workshops can be positively identified through the presence of tools. Notable exceptions are the possible carpenter's workshop at Bloomberg London (BZY10), and the metalworking shop at Fenchurch Street (FNE01).

It is curious that so many well-preserved tools were thrown away in the Walbrook dumps. The most plausible explanation is that these objects simply were deposited as rubbish, and this has implications for the importance of objects in the society of early Roman London, suggesting that they were easily available and affordable to working craftsmen. Large objects from small dumps elsewhere in the city confirm that this reflects city-wide attitudes. Accidental losses in occupation layers were mostly small and fragmentary, although a few larger objects (such as axes and hammers) were lost in house fires.

We have also seen how tools were involved in a wide variety of ritual practices. Whilst attention in the past has focussed on votive deposition in the Walbrook stream, this was found to be difficult to substantiate owing to the poor recording of context in 20th century rescue excavations. It nevertheless seems likely that some artefacts were ritually deposited in the stream as votives. However, votive deposits were also made in the Thames, at London Bridge and possibly at multiple points further west, and in pits and wells across the city. Tools could also, on rare occasion, be deposited in burials.

Chapter 8- Conclusions, Reflections and Future Directions

> *'Hitherto tools have been much neglected… Even when the best samples of Greek tools have been presented to a national museum, they have been thrown away by the head of the Department, who remarked that they were ugly, and he did not care for them.'* (Flinders Petrie, 1917, p. 1)

The sentiments reported by Flinders Petrie a century ago find regrettable resonance with the opinions of some archaeologists today. Whilst few now would suggest that tools should be discarded, the author can scarcely leave a conference without being commended for attempting to 'make tools interesting'. And this from people who study coins and brooches! Iron tools especially have been seen as unchanging and undiagnostic, and for that reason not worthy of study (Sands, 1997, p. 78). It is hoped that the present study has demonstrated that this is not the case.

8.1 Tools and Typologies

Roman tools have not been systematically investigated in Anglophone literature for decades, since the major works of Manning (1976b, 1985a) and Rees (1979). There is now a large body of high quality non-English scholarship available on Roman tools (Gaitzsch, 1980; Pietsch, 1983, 1988; Pohanka, 1986; Duvauchelle, 1990; Penack, 1993; Tisserand, 2010, 2001, Marbach, 2004, 2012; Hanemann, 2014), which deserves to be used more often in Britain. It is hoped that future researchers on tools will be able to use this thesis as an entry point to this wide body of previous scholarship.

Much of this work has been primarily typological, and typological discussion has made up a substantial part of this thesis. Whilst existing typologies were used wherever possible, Manning (1985a) and Rees' (1979) Anglophone typologies were only used for a minority of artefact types (e.g. billhooks, ox goads, picks, and ploughshares). Many more artefacts (e.g. adzes, axes, brush holders, hammers, hoes, plane irons, hole punches, spuds, tongs, and trowels) were more easily accommodated in Continental typologies, in particular those from the excellent recent work of Hanemann (2014). It also quickly transpired that the numerous well preserved tools from the city would require many existing typologies to be revised (e.g. for rake tines and spades), whilst the presence of unique or unusual objects meant that several new typologies were created (e.g.

for awls, cold chisels, clawbars, dies, gouges, fine metalworking punches, hot punches, and spear-shaped spatulas).

As hand-made artefacts, many tool types do not fit easily into neat and specific typological classifications. This issue is further complicated if a typological scheme attempts to account for both functional and stylistic variation. In places, bi-partite typologies were used to make sense of artefacts with a high degree of variation (e.g. chisels and drill bits). However, even these sometimes convoluted new schemes do not do proper justice to the variation seen in Roman tool forms. Future work at an intra-site level may resolve some of these issues. However, this research has also highlighted how typological complexity and 'messiness' can be exploited to explore the practices involved in manufacture (Chapter 5).

Identification of unusual objects was greatly helped by reference to the Continental literature, and every effort has been made to highlight comparanda from a wide range of sources. Whilst contextual, chronological and site-type information was collected for the comparanda cited in this study, it was often found that even the most basic information was not available without significant amounts of extra research, which was beyond the scope of this project. Future work could address this, and it is particularly important that the study of tools be expanded to areas with a less well developed tradition of finds research.

It was at the stage of typological discussion that functions were assigned to the London tools. Accurately establishing the function of tools is key to being able to use them in further discussion, but is far from straightforward. Numerous theoretical paradigms (e.g. SCOT, Bijker, 1995; or design theory, Swift, 2017) stress the potential differences between what an object was designed for and how it was actually used. However, with so few tools being directly contextually associated with waste or finished products, a normative functional interpretation is often all we have. However theoretically unsatisfactory it may be, the best evidence available for the function of iron tools is analogy to modern examples. In this regard, the important works of Salaman (1975, 1986) on recent woodworking and leatherworking tools were invaluable, whilst the identification of tools used in other industries, such as metalworking or plaster work, was hampered by a lack of convenient resources available for the hand tools used in recent centuries.

8.2 New Approaches

This project therefore represents a major step in updating our understanding of this object class. However, this project should not be seen as a straightforward 'replacement' for these typological works. The time is right to move studies of tools away from the purely descriptive and typological, and to see how they can enhance our interpretations of the past. No previous studies of tools have attempted to use them as information about ancient society on the scale pursued here. Key to making a study such as this work was selecting a suitable case study and examining the objects in detail within the specific setting of Roman London.

At the outset, it was intended that this study be similar to other Roman artefact studies; focussing on using distribution to understand the internal geography of London, and comparisons with other assemblages to understand its place within wider regional and international networks. However, London's tools were not well suited to this type of analysis. Artefact disposal practices have obscured the spatial arrangement of craft activities within the city, whilst few tools have good contextual information. Social distribution could be considered for some types of agricultural tools thanks to the work of Rees (1979), but the lack of a comparable study of Roman craft tools in Britain means that this approach could not be applied to all industries.

Instead, it was realised that tools open up opportunities for the study of the past that other artefact types do not. By exploring theories of social agency through technology, these uniquely 'practical' artefacts have a special contribution to make to our understanding of life and lived experience in the Roman world. To this end, the discussion pursued here was structured into three parts, examining the practices involved in the manufacture, use and disposal of tools. Each of these sections required a different approach to material culture.

Whilst most work on ancient technology utilises scientific techniques, such as metallography, this project has been entirely form-based. Typology can be used in two ways to advance discussions of manufacturing practice. By using traditional archaeological information about the distribution and chronology of stylistic types, it was possible to identify different social groups involved in manufacturing. Moreover, by highlighting deviations from typical types, and evidence of shared traits between types, it was possible to approach the manufacture of tools in terms of mental process and social interaction (Chapter 5).

The bulk of the discussion in this thesis has revolved around the issue of what the tools from London were used for (Chapter 6). As tools alone cannot provide a holistic view of craft practice, this section involved collecting a large amount of data on craft practices in the city from non-tool sources, including waste products, finished artefacts, tool marks, structures, epigraphy, classical sources and iconography. In doing so, I have sought to create a synthesis of craft work in Roman London, focussing on the practices which involved recognisable tools. Whilst this process was key to establishing with greater certainty what London's tools were used for, and by whom, it was found that the ability of tools to alter this picture was highly variable between different industries. Tools provide good evidence for wood- and leatherworking practices, with the large numbers of tools recovered compensating for the poor survival of organic remains. In metalwork, tools provide evidence of wrought techniques and finishing processes; stages of production which are not visible in most forms of metalworking waste. Other industries, such as glassworking, pottery making and skeletal-materials working, are poorly represented by tools, which are difficult to identify with certainty or to reconcile with the detailed picture of craft practice already built up from craft waste and finished artefacts.

Finally, this project has looked at the practices involved in the disposal of tools. Doing so was crucial less for what it told us about craft activity in the city, but instead for how it highlighted the complexities of archaeological data, and distribution patterns in particular. There is no simple single explanation for why a tool was deposited in a particular location, and this question can only be approached by looking at an object's specific archaeological context. By examining context at this detailed level I have shown how simple distribution patterns, even when mapped around specific, phased buildings, can be extremely misleading. Almost no workshops or craft activity zones can be identified in London based on the distribution of tools; instead, distribution is the result of specific disposal practices related to waste management, loss, and ritual activity.

8.3 Working Life in Roman London: Economy, Technology and Society

8.3.1 Economy

The London tools have provided evidence for a wide range of craft and agricultural practices which can make an important contribution to our understanding of the economy of the Roman city. In particular, London's craft industries can now be viewed within debates about the place of cities in regional economies in the Roman world (Parkins, 1997; Erdkamp, 2001; Wilson, 2002).

It is clear from London's tools that production of a range of goods was taking place within the city (Chapter 6). Taphonomic factors, and the inherent biases of using only metal tools as evidence, mean that proportions of different tools cannot be used to uncritically rank the importance of different industries. Industries such as woodworking and leatherworking nevertheless feature prominently amongst the tools, indicating an important position in the city's economy, and supplementing the evidence from preserved organic remains.

Metalworking and agriculture also appear to have been key. However, other industries known to have been important in London, such as pottery and glassworking, are virtually invisible in the tool record.

It is difficult to use tools to address questions about the place of production in the overall economy of the city, and of urban production in the wider economy of the region. Some tools undoubtedly relate to activities taking place for the benefit of the city, such as the construction of masonry and timber buildings. Others are evidence of the integrated nature of the economy, with evidence that objects such as planks and tool handles may have been produced for resale to other craftsmen (see p. 70, 105).

A large number of tools nevertheless appear to relate to the production of goods for sale. In particular there is evidence of the production of decorated objects in wood (see p.108, 115), leather (see p.225-227) and metal (see p.183-197). Seen alongside other evidence for industry in London, such as the large metalworking area in Southwark (Hammer, 2003), it is hard not to see these specialised production tasks as evidence for London acting as a major manufacturing centre for the surrounding area at least. There is also evidence of fine metalworking taking place outside the city itself, at Beddington Villa (see p.330).

Other tools can be linked to trade rather than production. Coopers' tools (see p.110) and claw bars (CBR02), for example, can be linked to the packaging and movement of goods. Other tools appear to have been imported from the Continent (see p.55), providing evidence for long-distance trade as a component of London's economy. Some may have been imported to London and intended for redistribution, rather than use within London (e.g. ploughshares, p.147). These imported objects are often extremely rare in Britain outside of London, providing evidence for the unique position of London as an import centre.

That goods were exported from London can be seen in DIE01, a possible official stamp for marking ingots, which may provide evidence for the intervention of the state in exporting metals from Britain, presumably to Continental Europe. Rather than relating to urban production, this object is evidence of London's place in the administration of Britain as a province within an exploitative colonial system (see p.199). The state was also involved in other aspects of craft work in the city, controlling elements of the supply of metals (see p.161) and timber (see p.81). State control was far from absolute, however, as other dies and stamps show that trades such as cooperage (see p.110), tanning (see p.215) and tool production (see p.623) were largely controlled by citizens and private individuals. This clear evidence for citizen involvement in manual trades is somewhat at odds with primitivist models of the Roman economy, in which elites held disdain for such activities (Erdkamp, 2001, p. 335).

Further information about the economy of the city comes from the analysis of the depositional contexts of tools (Chapter 7). This analysis has shown that the majority of tools recovered from the Walbrook valley, the most productive area of the city for tool finds, were deposited as waste in land-raising dumps. Many large and complete objects were deposited as waste, indicating that early Roman London indulged in lower levels of recycling and reuse, and higher levels of metalwork consumption, than would be expected in an ancient settlement.

8.3.2 Technology and Society

Since 'we know little about the social position of artisans in Roman Britain' (Hammer, 2003, p. 15), a key aim of this project has been to use tools to explore the lives of these neglected groups of people. This has been achieved through contextualising the tools within a wide body of data drawn from other sources, and also by moving the end point of our analysis away from simply using tools to reconstruct working practices, and instead to explore what those practices meant for the creation of 'society' in Roman London.

Identifying 'technological change' in London is difficult owing to the poor chronology of most tool types. London's tools nevertheless indicate the introduction of a number of technologies which were not known in pre-Roman Britain. These range from entirely new industries, such as masonry construction (see p.230) or garden horticulture (see p.138), to new methods of working materials, such as vegetable tanning (see p.204), various leatherworking techniques (see p.219), and new timber construction methods (see p.96). Although the largest number of dateable tools from London derive from the 1st century, there is also some evidence in the form of Late Roman axes to show that technologies continued to change throughout the Roman period (see p.107).

It is very difficult to say how far this represents a cultural replacement, with 'Roman' tools and techniques replacing those of the Iron Age. Whilst few 'Iron Age' type tools were found (see p.53), there is plentiful evidence from other sources in London to show that metalworking (see p.169) and woodworking (see p.97) based on Iron Age traditions continued in London. Other Iron Age technologies, such as tanning technologies, may also have persisted, although they are all but invisible archaeologically (see p.204). Clearly tool form alone is not an appropriate measure of cultural change, as many 'Iron Age' craft traditions could have been carried out with 'Roman' tool types.

Whilst it is difficult to make inferences based on the *absence* of tools, it should also be noted that, despite the large numbers of apparently imported tools in London, some technologies were not introduced here. A good example are heavy three- and four-tined hoes, which are considered to be ideally suited to British soils, having developed in the northern provinces (Rees, 1979, p. 482). Absences of tools such as this may indicate the selective ways in which new technologies were taken up in Britain, even in a city as 'Romanised' as London.

Moreover, London's population was more diverse than simply consisting of 'natives' and 'Romans'. Different tool types from London hint at the presence of soldiers (see p.55), administrators (DIE01), and immigrants (see p.55) who may have brought tools from modern day Hungary and Austria (AXE24-5), or from outside the Empire (AXE23). Beyond the form of tools, it has proved less easy to identify craft technologies which are indicative of different social groups. This can be attempted for horticulture, with the range of cultivation tools from London suggesting a more diverse population than exhibited on other settlement types (see p.144). However, further survey work is required within Britain before it will be possible to characterise settlements by the overall makeup of tool assemblages, as Pietsch (1983, p. 79) has attempted to do in Germany. Some indication that different social groups used different elements of London's tool assemblage can be seen in the sizes of axe marks on different structures (see p.99). The London tools also provide evidence of social groups differentiated through depositional practice (Chapter 7, especially p.313, 319, 333).

The most obvious development in London's tools, and one that has been observed elsewhere (Goodman, 1964; Tisserand, 2011) is the huge increase in the number of tool types when compared to the preceding Iron Age. The introduction of this suite of tools has been linked to increases in the amount of material culture available in society, and the need for craftsmen to produce a wider range of products in order to support 'Romanised' lifestyles (Tisserand, 2011). In London this can be seen through the introduction of new industries, and also in new foodways (see p.130). Recent years have seen concerted attempts to understand this multiplication of material forms in terms of their effects on society (Van Oyen and Pitts, 2017).

Across multiple industries in London, we can see the development of technologies which are not only specialised, but begin to approach mass production. This can be seen in the use of moulding planes, plough planes, crozes and rip saws in woodwork (see p.105, 110, 115), dies in metalwork (see p.190), and hole punches in leatherwork (see p.225). These tools allow the simplification of otherwise time consuming tasks and the creation of greater volumes of more 'standardised' material culture, particularly decorative objects. However, in an exploration of this phenomenon through mould-made ceramics, Murphy (2017) has stressed the amount of craft skill and negotiation that was required to produce objects even when using these standardising technologies. This technological development in London therefore needs to be seen against the large numbers of freehand tool technologies which continued to be employed. These technological changes may nevertheless have had an effect on consumer expectations, limiting the ability of craftsmen who did not have access to these tools to enter into the craft market. This suggestion would require a separate study of completed objects to substantiate, however. The complexity of many of these new tool technologies also appears to have created the need for maintenance technologies, such as saw-setting (see p.127) and millstone-dressing tools (see p.240), which may have been accompanied by dedicated professions, although this cannot be known for certain.

The increase in the number of specialised tool forms in the Roman period can also be used as evidence for the lived experience of craft work. Whilst we should be careful not to equate types of objects with types of people, these tools complement other evidence from elsewhere in the Roman Empire, particularly epigraphy, to suggest that crafts were highly professionalised, with specialists producing only a small range of objects. Specialist professions evidenced in London include sawyers, joiners, coopers, fine metalworkers, vessel manufacturers, tanners, shoemakers, etc. These specialisations are not based solely on material type; some are discrete specialisations within a material type, whilst others used multiple materials to produce a narrow range of composite objects.

It is also clear from using tools to reconstruct working practice that not all 'specialists' had the same lived experience of 'specialisation'. This can be seen most clearly when looking at the evidence for different types of woodworking specialisation, with some professions (such as joiners (see p.115)) using large numbers of specialised tools to make (presumably) expensive products, and others (such as sawyers (see p.105)) working in teams with a smaller number of tools and skills to produce large numbers of (presumably) lower value products.

We could see the increasing need for craftsmen to maintain a large number of specialised tools as necessarily excluding people from certain industries and locking them in to others, reinforcing the specialisation of professions. However, whilst I have argued against limiting our discussion to professional categories based on material type, it is certainly true that many skills would be transferable. A cart maker would have many skills useful in other aspects of carpentry, for example. Some industries in London operated under the control of citizens or the state, and as such many of London's tools may have been owned by workshops rather than individual craftsmen. This may have allowed workers more flexibility in moving between specialisations, although it may ultimately have limited their ability to shape their own career paths. Other tools can be inferred to have been personal possessions on the basis of decoration or ownership marks (see p.124), and indicate investment in good tools.

This evidence of specialisation should not be taken to show the ghettoization of different social groups amongst London's workers. Rather, they demonstrate the level of social connectedness between these groups. These groups would often be dependent on each other to provide raw- and partially-worked materials. These interactions can even be seen in the forms of tools, many of which would have been composite objects (see p.70). These connections spread out into London's hinterland, throughout Britain and into the wider Empire, with some tools in London being imported from Continental workshops (see p.55).

Tools nevertheless have major limitations for the study of professional lived experience. The lack of contextual data about many tools means that it is not possible to link them directly to discussions of gender or the lifecourse, and we should be careful not to artificially insert them into a normative interpretative scheme in which tools were used only by adult men. Some evidence of changes in professional skill throughout the lifecourse may come from tools executed with different levels of skill (see p.64), although these cannot be tied to individuals. The few stamped tools from London appear to represent male names (see p.623), although the one tool from a grave in London, AXE22, is as likely to have been buried with a woman as a man (see p.333).

8.3.3 Tools in Roman Ritual Life

This research has also highlighted the importance of tools within Roman society in a more abstract sense. Tools were frequently used as symbols of divine or political power, and used as such in social displays and rituals. Some tools have documented genealogies, with Classical authors attributing their invention to specific people, some mythical. In London this can be seen primarily in miniature tools (collected for this thesis but not discussed here), depictions of tools on ritual vessels (Figure 83), and images of gods with tools (Figure 99). How far these associations affected the use of tools in industry is unclear, although it is notable that smith's tools, which figure particularly prominently in Vulcan iconography, appear to have been more conservative in London than the tools of other industries. The heavily decorated twitch TWI01 provides an extremely strong link between functional tools and religious symbolism, although the exact circumstances in which it was used are unclear (see p.261).

In general, the archaeological record is such that we can only approach these symbolic associations through rituals of deposition. Tools were used in closure rituals, forming part of structured deposits and hoards within pits and wells, and may also have been used as foundation deposits (see p.314, 331). In the Thames, the deposition of tools appears to have been maintained in continuation with pre-Roman practices (see p.324). Some tools may have had perceived properties and associations making them suitable for deposition in particular circumstances, as seen in the deposition of pokers in watery places (see p.321), agricultural tools in the Thames (see p.324), and AXE22 in a grave (see p.333).

This project has looked in particularly close detail at the deposition of tools in the Walbrook. Whilst the deposition of tools (and other artefacts) in this area of the city has often been interpreted as ritual activity (Merrifield, 1995; Merrifield and Hall, 2008), it is the contention of this thesis that the majority of deposits here relate to the deposition of dumps of waste on the Walbrook banks for the purpose of land raising. Nevertheless, there is some ambiguous evidence that a minority of tools were deposited in the Walbrook stream as ritual actions, although poor contextual information makes the circumstances of deposition very unclear (see p.284).

8.4 Recommendations for Future Study

This study has highlighted the potential for tools and working practices to provide insights into society in the ancient world. Whilst London's collection is in many ways exceptional, there are numerous other collections of tools in Britain which would benefit from analysis and publication following this model, including those on Hadrian's Wall (e.g. Corbridge, Vindolanda), other military sites (e.g. Caerleon, Newstead), and towns (e.g. Silchester, Verulamium). Perhaps even more desirable would be a systematic regional survey of craft tools to complement Rees' (1979) study of agricultural tools in Britain. As well as establishing what variations in the use of different tool types can be seen across the country, this would allow us to understand depositional practices more fully. At an even wider level, it can be observed that scholarship on metal tools has a considerable bias towards the northern provinces; the areas of the Empire within modern Britain, France, Germany, Austria, Hungary and Switzerland, although scholarship is also available from the Balkans. Less is known about the tools of Italy (besides those from Pompeii), Iberia, Greece, the Near East or North Africa, and these would be fruitful areas for future study.

The approach taken in this project, in which specific practices were investigated in a holistic manner, using multiple data sources and a combination of stylistic and functional analyses of material culture, can be expanded in ways beyond simply cataloguing more tools. Iron objects generally are often ignored, but have a valuable contribution to make to our understanding of daily practice and the economy. Future studies could look at trade and transport, cooking, or domestic practices such as lighting, heating or cleaning the home through iron fittings and implements.

The discussion of woodworking practice in this thesis was greatly aided by Damian Goodburn's work collecting tool marks from timbers in London, and a wider project to collect tool marks, as has been carried out for prehistory (e.g. Sands, 1997), would be invaluable. These approaches would also be greatly aided by a closer study of the evidence of manufacturing techniques seen on finished artefacts, allowing production practices to be linked more closely to consumption. A clear candidate for such work in London is leather, large amounts of which have been recovered from the city, and which a systematic study could contextualise against the London tools and the well documented evidence for modern leatherworking practice (e.g. Salaman, 1986).

Owing to a dearth of such evidence from Britain, apprentice systems and the legal status of craftsmen have not figured largely in this discussion, but future work, especially if undertaken in Italy, could integrate these sources with archaeological evidence for the organisation of trades.

8.4.1 The Museum of London

This project was conducted in collaboration with, and partially funded by, the Museum of London. It is therefore worth briefly reflecting on how this study can benefit the Museum specifically. This project has re-examined the function of many tools, identifying industries in London which are not reflected in the Museum's current displays. Particularly notable is the evidence in the tools for fine metalworking, and the production of jewellery (see p.183) and vessels (see p.190). A temporary exhibition (Figure 192) staged as part of this research has already shown how agricultural tools can be used to enhance the image of Roman London presented to the public (Humphreys, 2017b).

This project has shown how complex the society of craft and agricultural workers in the city was. Future displays could use the object stories discovered in this project to highlight the level of professional specialisation seen, or the different statuses of different types of workers. London's Roman tools can provide a perspective on current political debates by highlighting the level of Continental connectedness displayed, and the evidence for economic migration to London throughout the Roman period.

Figure 192 Cases from an exhibition based on this research curated and designed by the author, displayed in the Museum of London's 'Looking for Londoners' space, 12th January - April 2017. © Museum of London.

Tools are familiar-looking artefacts that allow people to make an immediate connection to the ancient past. However, tools can also be used to highlight how much more alien the past was than we may expect. For example, the Museum's current 'workshop' displays show tools in a recognisable setting on work benches. Would displaying workers and their tools at ground level (Figure 91) make people feel differently about the past? This could also be achieved by highlighting the importance of religion and superstition in ancient industry.

Part of keeping these displays up-to-date will be ensuring that there are mechanisms for identifying significant newly excavated objects for display. An example from the London tools would be the two Type 2 hoes (HOE02-03), both from recent excavations, which are perhaps unique in Britain. At present there does not appear to be a mechanism for identifying such objects; a process hampered by the fact that not all excavated small finds are published.

A further obstacle is the poor condition of many of the objects in the LAARC compared to those in the Museum of London's Core Collection. A certain amount of iron degradation is unavoidable, and metalwork storage conditions in the LAARC represent a good example of current best practice, being far better than in many other collections. Nevertheless, corrosion is being exacerbated by the fact that many iron finds enter the LAARC in an uncleaned state. Some objects (e.g. SPA02) have been cleaned only in small places, allowing specific features to be examined. Whilst the conservation of iron is expensive, and not a priority for commercial units, there are several issues with this approach. The lack of conservation on many objects has proved extremely detrimental to their long-term storage, with many objects found to have disintegrated since entering the LAARC. This appeared to be far worse for objects archived with earth and stones still adhering to them. The poor state of some objects also prevents them being used by researchers. Few researchers will have the budget or inclination to have iron objects conserved themselves. Whilst conservation was recommended in this project, it was not possible to have this completed before the project finished. The poor condition of much ironwork also puts it at risk of disposal before researchers are able to examine it, and there appears to be a continuing attitude that ironwork is not diagnostic or interesting, putting it at further risk of disposal.

It is hoped that this project has shown that iron objects are worth investing in and preserving for the valuable contribution they make towards out understanding of the past. This project has been over 60 years in the making (Guildhall Museum, 1956, p. 2), demonstrating the vital importance of the long-term preservation of iron objects and their associated documentation; neither of which are particularly glamorous. At a time of financial cuts and a drive towards tangible 'impact', it is worth underlining how integral these neglected resources can be to the future study of our past.

Appendix 1.1- Methodology

A1.1.1 Introduction

This chapter details the methods used in defining the scope of the study, collecting and recording the data used in this study.

A1.1.2 Definitions

London

The aim of this study is to use the Roman tools recovered from the modern city of London as a dataset to address specific research questions about ancient *Londinium*. The study area will consist of the whole of modern Greater London, roughly corresponding to the area within the modern M25 motorway.

Tools

'Tools' is a broad category of objects that has rarely been explicitly defined in archaeological studies, and the low numbers of tools recovered on a typical archaeological excavation mean that this would not usually be worthwhile. Often, a 'Tools' section will include any everyday objects found on a site with a possible role in production or the manipulation of substances, usually including general purpose objects such as knives or handles (e.g. Crummy, 1983, pp. 107–13). White (1967, pp. 12–3) distinguishes between 'tools' and 'machines' on the basis of the number of parts and the nature of force application, with the most obvious example of an ancient machine being the plough. Nevertheless, many authors have considered ploughs and plough parts alongside other agricultural tools. This thesis will use the definition employed by Blake (1999) of 'an instrument used or worked by a handi-craftsman or labourer in [their] work'.

However, the size of the London collection means that certain extra caveats need to be added. With the exception of ploughs and anvils, only hand-held tools will be examined, which will exclude objects such as crucibles. This project will focus on the tools employed in craft, industry and agriculture. Textiles-working tools will not be considered. There are over 700 objects attributable to this category in the Museum of London's Core Collection alone, making it large enough to form the basis of a dedicated thesis of its own. Similarly, knives, of which the Museum of London holds nearly 300, will also be excluded, except where they have an obvious purpose in craft work. Objects employed in cooking, cosmetics and medicine, weighing and measuring, and writing will also be excluded, although they could be considered tools. Only metal tools will be examined. This will primarily be a study of iron tools, although objects of all metals will be considered.

A1.1.3 The Dataset

The core of this project was the recording of the tools held by the Museum of London, but material from other museum collections and commercial units has also been studied. 837 objects were catalogued, although not all of these are used in every stage of analysis. The Museum's collections are split between the Museum of London Core Collection and the London Archaeological Archive and Research Centre (LAARC).

The Museum of London Core Collection

The Museum's Core Collection was formed by the merger of the collections of the Guildhall Museum and London Museum in 1964. It consists of antiquarian finds and collections, mostly from the City of London but also from further afield, and finds from excavations in the city up to the mid-20th century. For our purposes, the most notable were those at the NSDC in the 19th century, the Bank of England in the 1920s-30s, and at Bucklersbury House in the 1950s.

All objects in the core collection are catalogued on the Museum's MIMSY database, which records artefact descriptions and acquisition information. Most of this information has been taken from the original acquisition catalogues. Location data is in the form of postcodes or street addresses, with further contextual information only occasionally given in the artefact description.

A preliminary search of the database located 609 potentially-relevant tools. 157 of these objects are on display in the Museum's Roman Gallery; the rest are held in two store rooms (Metal and General) on the Museum's London Wall premises. A physical search was made of the Roman, Iron Age and Medieval sections of the Museum's metal store. Due to the similarity of tools across time, only objects of distinctive Roman form were catalogued from these sections. Other objects were discounted from the project after examination, leading to 494 tools from the Museum of London's Core Collection being incorporated into this project.

The London Archaeological Archive and Research Centre (LAARC)

The LAARC was established as a repository for the material from commercial excavations in Greater London, receiving material from all commercial units operating within the M25. In 2012 it was recognised as the largest archaeological archive in the world (Guinness World Records

News, 2012). The LAARC is currently housed in Mortimer Wheeler House. 61 tools were identified in the LAARC's collections.

Despite its size, the LAARC has no single database. Details of the registered finds from the LAARC's c.9,000 site codes are stored on individual Excel spreadsheets. Whilst these are in the process of being formatted for future uploading to the Museum of London's MIMSY database, this will not be completed in time for this project. The spreadsheets record accession and context numbers and object names, but only a few have catalogue-entry-style descriptions. Many iron objects remain unidentified. The LAARC also maintains a card catalogue for registered finds, with illustrations of every object on the back of the card. These illustrations range in quality from simple sketches and traced outlines to professional publication illustrations. A searchable online database also exists, but as this does not include images or give the age of the objects recovered, it is of no use to this project. Published gazetteers (Schofield and Maloney, 1998; Thompson, Westman and Dyson, 1998) give details of the sites deposited at the LAARC before 1992, and this information can also be accessed through the LAARC website (Museum of London, 2017).

The collections of the LAARC were searched by first identifying site codes with Roman occupation from the published gazetteers. Sites where only possibly Roman levels were listed, where only sections were recorded, where no location was provided, or where Roman finds were described as being limited to pottery or CBM, or were described fully but did not include tools, were not searched further. From this, a list of 363 site codes was generated (209 from the City of London, 84 from Southwark, and 70 from Greater London).

The largest of these sites (by number of Roman registered finds) was GPO75, and this was used as a test site for identifying tools. A search of all of the catalogue cards for copper alloy and iron registered finds revealed no identified tools that were phased as Roman. However, a drill bit appeared to be Roman in form. A search of the Excel spreadsheet revealed another drill bit that was phased as Roman, but which had not been phased on the card. Other objects of potential interest were identified or phased either on the cards or the Excel spreadsheet, but not always on both. When physically examined, several of the tools from the GPO75 site were found to be too corroded to be recognisable, showing that the objects had been examined on x-ray when originally identified. A visual examination was made of a sample of unidentified iron objects, and all were found to be in too poor a condition to assign function to. This exercise demonstrated that initial identification of the objects had been more thorough than anticipated, but also that not all identifications or dates given to objects would be found by using only one search method.

The remaining relevant site codes were searched by first consulting the Excel spreadsheets, and then the card catalogue. For small sites, all of the ironwork accession cards were searched. For larger sites with multi-phase occupation, only the cards for objects identified in the Excel search were examined. From this a list was drawn up of Roman tools, unphased tools, Roman unidentified ironwork, and Roman knives (as several tools in the MoL had been misidentified as knives). Following this, x-rays were consulted in order to discount heavily corroded and obviously misidentified objects, after which the remaining objects were physically examined and catalogued.

As it was clear that the records kept by the LAARC were not complete, a search was also made of published tools from London. All editions of the *Transactions of the London and Middlesex Archaeological Society* were searched, from which a small number of tools were identified. A search was also made of the index of the *London Archaeologist* magazine, but as expected, the short articles contained no detailed finds information.

In total, after searching c.9,000 sitecodes, 61 tools were identified from 25 sites. This may not represent all of the Roman tools stored at the LAARC, as many sites appeared to have had no object identification or phasing carried out. However, the LAARC contains far too much material for a review of all of the unidentified ironwork to have been carried out.

Contextual information was gathered by consulting the unpublished archive records. The amount of documentation available for each site was highly variable, some having full written reports, other having only context sheets or site notebooks, and unedited specialist reports. The vast majority of these documents were not signed or dated, and so references are not given for this information. Details of the relevant documentation can be found through searching the LAARC's online site database (Museum of London, 2017). Where publications were available, these have also been used, and references are given in the 'publication details' section of a catalogue entry.

Other Museums

In addition to the Museum of London's holdings, a number of other museum collections have been identified as potentially significant. The amount of information available for these objects is broadly comparable to that found in the Museum of London.

The British Museum holds a number of tools from London, 63 of which have been published by Manning (1985a). The majority were sold to the Museum by the antiquarian Charles Roach Smith in the 1856 (Manning, 1985a, pp. 179–81), having previously been part of his London Museum of Antiquities. Others come from excavations in the 20th century (Painter, 1961). These tools were physically re-examined.

The Pitt Rivers Museum, Oxford, holds material from Pitt Rivers' excavations at London Wall in 1866, from which 8 tools were incorporated into this project. Another part of Pitt Rivers' collection entered the Salisbury Museum, and has been published by Griffiths (1996), containing one tool.

A further object from London has somehow entered the collections of the Royal Ontario Museum, Canada, and has been published by Hayes (1991). Whilst it is likely that a number of local Museums around London will contain material from the satellite settlements around *Londinium*, and possibly material from the main city deposited by local antiquaries, these collections have not been used in this project.

Commercial Units

Many London sites have been excavated by commercial units but have not yet been deposited with the LAARC. This material remains in the hands of the individual units that excavated these sites. Museum of London Archaeology (MOLA) holds material from a number of key sites, including 1 Poultry (ONE94), Bloomberg Place (BZY10), Moorgate (MOQ10) and Crossrail (XSM10). A search was made of MOLA's Oracle database, as well as of all publications in MOLA's Monograph and Archaeological Studies series. From this, 184 tools were identified and recorded. Other commercial units were not physically visited, but 12 objects were recorded from publications by Pre-Construct Archaeology (PCA) and Wessex Archaeology. Another key unpublished site, Drapers' Gardens (DGT06), is held by Pre-Construct Archaeology, but access to this material could not be arranged in time for the completion of this project.

The degree of contextual information available for the commercially excavated tools from London is surprisingly variable. An unpublished assessment of the available data conducted by MOLA (Wardle, 2005) looked at 64 developer funded excavation archives. Of these, only five had been fully published, 38 had some degree of dating evidence available, leaving 26 for which the phasing was unknown. MOLA's Oracle database contains the most detailed contextual data available for the London tools, for both published and unpublished sites. This includes information about the physical context, at multiple levels, and links to associated finds. However, the level of detail is lower for older excavations, whilst recent unpublished excavations may not have been fully analysed and entered onto Oracle yet. Very little information could be found to link the contexts of published tools to the archaeological features discussed in the text of the excavation reports.

A1.1.4 Recording Methods

The data for this project was recorded onto a Microsoft Access database, which was designed to mimic the MIMSY database used by the Museum of London (Figure 193). This allowed relevant information currently held on the MIMSY database to be extracted and inserted into the project database. At the end of the project it will be possible to extract the updated measurements and artefact descriptions from the project database and upload them directly onto the Museum's MIMSY system.

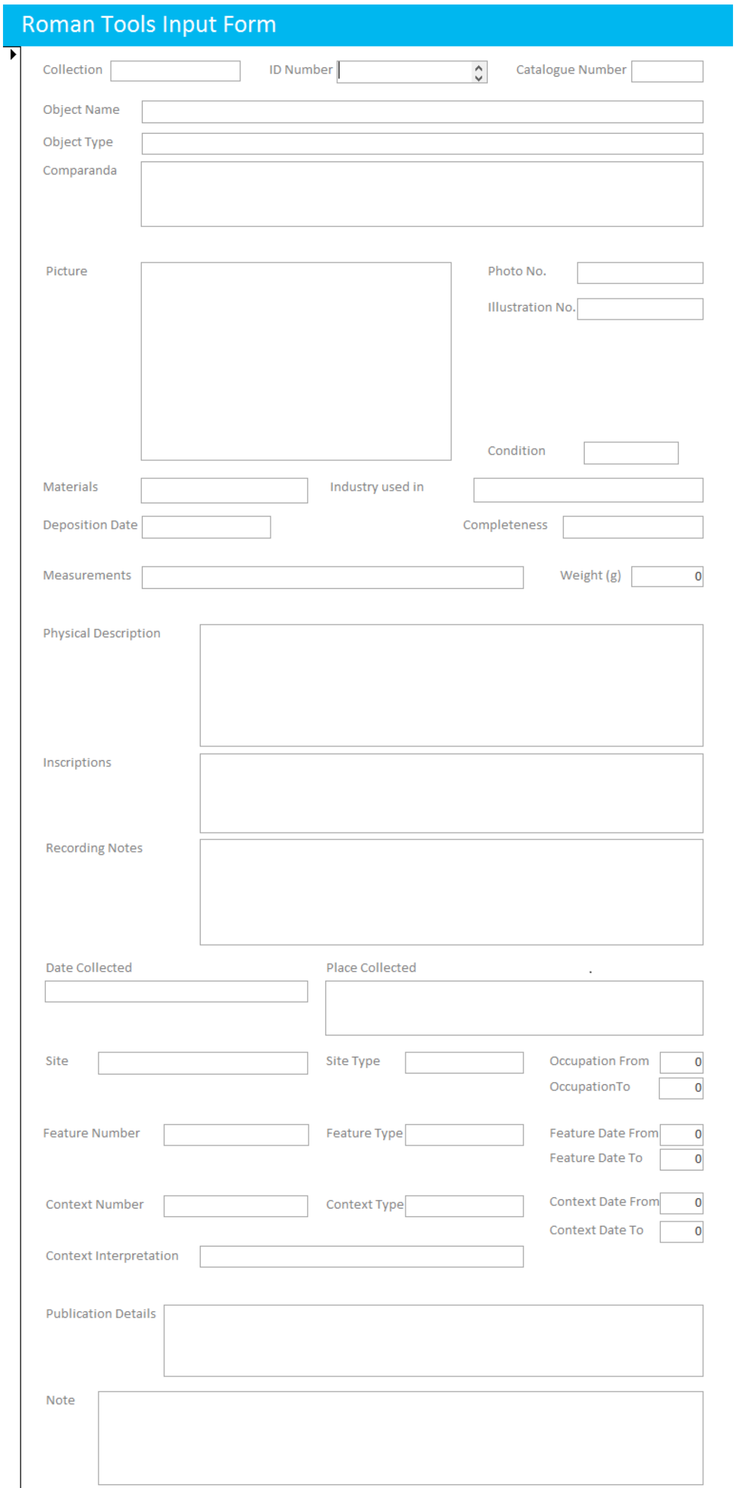


Figure 193 Recording form used in this project.

Artefact Recording

The vast majority of the objects used in this project were physically examined and recorded, with only a small number being recorded from published images. X-rays were consulted for all objects held by the LAARC and MOLA, but were not available for the tools in the Museum of London's Core Collection.

The form of the tools was described in detail, with measurements of size (in millimetres) and weight (in grams) being taken from each object and presented in line with Museum of London guidelines. The condition of the artefacts was recorded numerically using the following grading system:

1. **Perfect condition** – Very minor or no corrosion. Complete preservation of surface and fine details, including use wear.
2. **Good condition** – Light pitting and/or minor concretions. Some fine details still preserved.
3. **Fair condition** – Concretions and pitting resulting in loss of surface and detail. Recognition of form still easy.
4. **Poor condition** – Major details and surface lost to corrosion. Still recognisable and probably assignable to type.
5. **Very poor condition** – Concretions and distortions obscure all details. Recognition difficult. Perhaps not assignable to type.

All artefacts were photographed to a professional standard. Hand-drawn illustrations were only made for artefacts with subtle features (e.g. use-wear, decoration) which were not clearly visible in a photograph. No scientific examination techniques, such as metallography or x-ray analysis, were used, although five tools from London (BOR40, CHI34, CHI36, GOU10, WXS37) have had pieces cut away from them, presumably for metallographic sampling. Unfortunately, these could not be located in any published studies, and the Museum of London has no records of when these samples were taken, or by whom.

Context Recording

Basic contextual information is recorded in the 'date collected' and 'place collected' boxes. Information is recorded in the 'place collected' box in the following sequence:

- Site name (taken from LAARC online database) and postcode.
- Site phase (if known).
- Landuse number (if known, OA = Open Area, S = structure, B = building), otherwise group or subgroup number (if known).
- Phase date (if known).
- Context description.

- Spot date.

The date range given in the 'Deposition date' box is the narrowest possible secure date that could be assigned to its deposition (given in years AD unless otherwise specified). Stratigraphic dates have been used where possible, but were not available for most objects, even those which were professionally excavated. In some cases, where the site had been phased, only a *Terminus Post Quem* (TPQ) was given in the archive documents. Where this was the case, the date range is recorded as continuing up to the TPQ of the subsequent phase of the site (e.g. phase 1 = from 50 AD, phase 2 = from 75 AD, therefore phase 1 = 50-75 AD). Where phases are very broad (over 100 years), and both phase dates and spot dates are available, these have been combined to produce tighter dating. When the earliest possible spot date is later than the earliest phase date, the early spot date will be used (e.g. Phase date = 100-250, spot date = 140-200, date used = 140-250). This has not been carried out where narrow stratigraphic sub-periods have been defined. Spot dates have been used where no phase dates were given, and this is specified in the 'place collected' field.

Date of excavation is taken from the sitecode, although this does not always match the date given on the context sheets. Where context sheets were directly consulted, the correct year has been used. The BSF site had multiple years of excavation, archived under different site codes. Some finds could not be related to a site code, and so are assigned to the earliest year of excavation, 1981.

Archaeological context is also recorded in searchable boxes at three levels; site level, feature level, and context level. This was done in the hope that recording different levels of information would be helpful in assessing objects for which records were incomplete, although these fields were largely not used.

Site Level

The 'Site' box gives the simplified name or site code for an excavation. 'Site type' describes the location of the site within London, grouped into the following geographical regions:

- Cornhill
- Ludgate Hill
- Walbrook
    - Walbrook ; upper
    - Walbrook ; middle
    - Walbrook ; lower

- Waterfront
    - Waterfront ; Ludgate Hill
    - Waterfront ; Cornhill
- Eastern Cemetery
- Southwark
- Thames
- Greater London

Some street names used in catalogue entries by the Museum of London and British Museum are problematic. Thames Street originally ran the full length of the Thames waterfront, although it was later subdivided into Upper and Lower Thames Street, allowing greater geographical resolution within London. London Wall and Moorgate, however, remain long streets to this day. It is also unclear if the single-word site identifier 'Walbrook' refers to the street of that name, or to a site simply being in the Walbrook valley.

Feature Level

'Feature number' has been used flexibly here, to refer to archaeological units between 'parent context' and 'group' level. For objects derived from cut features, this box is used for the cut number and description of the feature. For objects recovered from buildings, it is used to describe the building itself. Where objects derive from structural cuts, such as postholes and wall trenches, the feature number describes the cut. For objects from watercourses, the feature number describes the watercourse. Objects derived from external layers are not assigned a feature number. Where possible, reference is made in the database to the original excavation (context/cut) number. Where this was not clear, the archive report or publication number has been used to identify features.

Context Level

'Context' refers to the direct deposit in which the object was found. Contextual information has been simplified in the 'context interpretation' field to one of 23 possible descriptors (Table 11).

Bank	Deposits used to construct raised banks.
Burial	Fills and grave goods from graves and cremations.
Dark earth	Soil-like deposits which may be formed in situ or dumped.
Demolition	Deposits of material primarily from destroyed buildings, either in-situ or redeposited.
Ditch	Fills of ditches.
Dump	Large deposits made in a single episode, including land-raising and levelling dumps, backfill behind revetments, and redeposited rubbish.
External surface	Deposits making up external surfaces, such as yards and roads, and occupation layers on external surfaces.
Hearth	Deposits associated with hearths.
Internal surface	Deposits making up floors and occupation layers on floors within buildings.
Lea	Any deposits from the River Lea or its foreshore.
Midden	Refuse deposits accumulated at surface level over time as a series of small deposits.
Pit	Fills of pits
Structural cut	Fills of construction cuts, postholes and robber cuts relating to above-ground structures.
Structure makeup	Dumped deposits laid down specifically to create sills and foundations for structures and floors.
Structural	Contexts making up the physical structure of a building, such as walls and roofs.
Tank	Fills of water tanks and industrial tanks.
Thames	Any deposits from the River Thames or its foreshore.
Unknown	Deposits for which some contextual information is available, but not enough to offer an interpretation.
Unstratified	Objects from modern layers and objects with no associated context.
Walbrook	Any deposits from within the Walbrook stream channel.
Wandle	Any deposits from the River Wandle or its foreshore.
Water-lain	Water-lain deposits not associated with a cut feature or watercourse, including flood deposits and redeposited alluvial material.
Well	Fills of the shafts and construction cuts of wells and water holes.

Table 11 Context interpretations used in this project.

Appendix 1.2- Typology

Introduction

This chapter presents the typological analysis of the tools from London. Tools are a very diverse category of object, with this section containing typological discussion of 56 different broad artefact types, some of which are split into several functional or stylistic subcategories. Following Gaitzsch (1980) and Pietsch (1983), the tools are arranged alphabetically, rather than by function. Each section is split between an introduction to the technological aspects and function of the tool type, a breakdown of the numbers of this type found in the different London collections, and a discussion of the discernible types. Where available, discussion of distribution and chronology is presented alongside the type discussion. Comparanda are included to give an easy access point to other known examples for future researchers, and are given in tabulated form where relevant. This comparanda is largely restricted to tools for which illustrations are available, and priority has been given to close matches for the London finds, examples not mentioned in previous surveys, and to examples from important Continental collections. Additional comparanda can be found for many of these objects by consulting the relevant sections by Manning (1985a) and Rees (1979). Hanemann (2014) provides extensive comparanda from a wide range of Continental sites.

The purpose of this section is to establish both the *function* of the tools, and their *stylistic* variations. Accurately establishing the functions of these tools is key to being able to use them in discussions of industrial and agricultural practice in the city (see Chapter 6). Swift (2017, p. 9) breaks artefact function down into 'proper function' (what a tool was designed to be used for) and 'system function' (how tools were used in practice). The discussion pursued here largely relates to proper function, with system functions receiving discussion in Chapter 6.

The specific practical and theoretical issues of assigning proper function to iron objects have been discussed several times in the past (Rees, 1981a; Ottaway, 1989; Fell, 1990, pp. 74–6; Swift, 2017), and do not need to be repeated here. Function can be assigned based on the physical properties of an object, but in reality this is almost always supplemented by analogy to similar objects used in the present day, even in works that demonstrate a considerable degree of theoretical awareness (Ottaway, 1989; Swift, 2017). The identification of objects in this discussion was greatly aided by the work of Salaman (1975, 1986) who has collected together the tools used in leatherworking and woodworking in recent centuries. A lack of comparable convenient resources for other industries, coupled with the time constraints imposed by the wide range of tool types in London, has meant that the identification of tools from other industries has relied heavily on interpretations from previous archaeological work and web resources about modern tools. This has doubtless hampered the interpretations of function.

Whilst tools are often seen as purely functional objects, they also demonstrate a range of stylistic variations (although there is clearly overlap between the two). By defining these, it may be possible to establish types which are limited to certain geographical locations, time periods or social groups. In the current project, this ambition is hampered by a sole focus on London. Extensive comparanda are provided where available, but this is not intended to be a complete survey of the known examples of these types, and does not form an adequate basis for social distribution. The complexities of these stylistic variations are used as the basis for the discussion of manufacturing practice in Chapter 5.

In any typological analysis it is necessary to establish at what point a scheme becomes 'too detailed'. As handmade objects, many iron tool types do not fit easily into restrictive typological schemes. However, I would argue strongly against the assumption that these objects do not deserve close attention. Swift (2017) has shown what level of functional variation can be observed when looking in extreme detail at a single class of object, in this case the shape of the blades of shears. Similarly, Hanemann (2014) and Pietsch (1983) have identified meaningful regional and chronological variations in tool form based on apparently minor form variations, such as the shape of Type 4 or Type 5 hoe blades (see p.503).

The analysis in this section therefore tends towards the assumption that minor variations are worth noting, although these cannot always be exploited to their fullest using the London data alone. The London assemblage is large, but shows perhaps less variation than a similarly sized assemblage drawn from a wider area would (see for example the lack of variation in shear blade form, p.570). As this is not a regional survey, it is difficult to fully appreciate the significance of these variations as indications of geographical, chronological or social patterning. It must also be recognised that as the majority of the material from London is unstratified, there is a high likelihood that non-Roman objects have been included in this catalogue, making typological classification even more complicated. It is nevertheless my contention that the patterns and complexities identified here would benefit from further detailed study, and would not be better served by a 'lumping' approach.

Adzes

Technology

Adzes are hafted woodworking tools characterised by having a horizontally-mounted cutting edge. This puts them in contrast with axes, which have a vertical edge. Like the axe, adzes are used in woodwork for removing large amounts of material and trimming surfaces. In the 17th century they were recommended for tasks where the plane was not strong enough, and the axe not delicate enough (Salaman, 1975, p. 23). The adze is rarely used in contemporary woodwork, but retains a place in coopering, wheel-making, and shipbuilding (Salaman, 1975, p. 23). Adzes also appear to have been used less than the axe in the middle ages (Salaman, 1975, p. 23), but took on highly specialised forms in the Roman period (below), including coopers' hollowing adzes.

These tools are sometimes referred to using the Latin term *ascia* (Pietsch, 1983, pp. 25–6), but as this term was also used to describe digging tools with horizontal blades (Pietsch, 1983, p. 18), this section will use the term 'adze' to refer to objects thought to be woodworking tools. Closely related objects used for tillage are discussed in a separate section as 'hoes' (see p.503).

Numbers

Eight adzes are discussed in this section. Two come from the Museum of London, but only one, ADZ06, was initially catalogued as a Roman object. The other, ADZ01, was catalogued as a medieval axe. It is possible that this object has been mis-numbered in the past, and that the catalogue entry refers to a different object, although confusing the word adze for an axe is not an impossible error. Its form is Iron Age. Another adze in the Museum of London, MOL 214, could not be located, and survives only as a register entry, although it is probable that this is the same object as HOE01 (see p.503).

Three possible adzes came from excavations by MOLA. One adze each comes from the collections of the Royal Ontario Museum, Canada (Hayes, 1991, pp. 75–6) and the British Museum (Manning, 1985, B16). A final adze comes from recent excavations by PCA at Drapers' Gardens. Although this assemblage was not examined for this project, this object entered the Museum of London and has been examined.

Typology

The adzes from London can be divided into two broad categories; 'Iron Age' types, some with small butt-projections, and 'Roman' adze-hammers, with a robust hammer head at the poll.

Iron-Age Adze Types

Darbyshire (1995, pp. 361–2) provides a detailed typology of Iron Age adzes, which consist of three principal types based on size (Form 1-3), subdivided into seven subtypes based on the form of the poll and socket (Figure 194). Although blade width was examined, it was not found to be related to the other formal elements of these tools. Objects of this form are also included in Hanemann's (2014, Abb.160) typology of Roman-period hoes, but this does not have the level of detail of Darbyshire's typology. Two of the adzes from London, ADZ01 and ADZ02 can be accommodated within this scheme, whilst a third possible adze, HOE01, is more problematic.

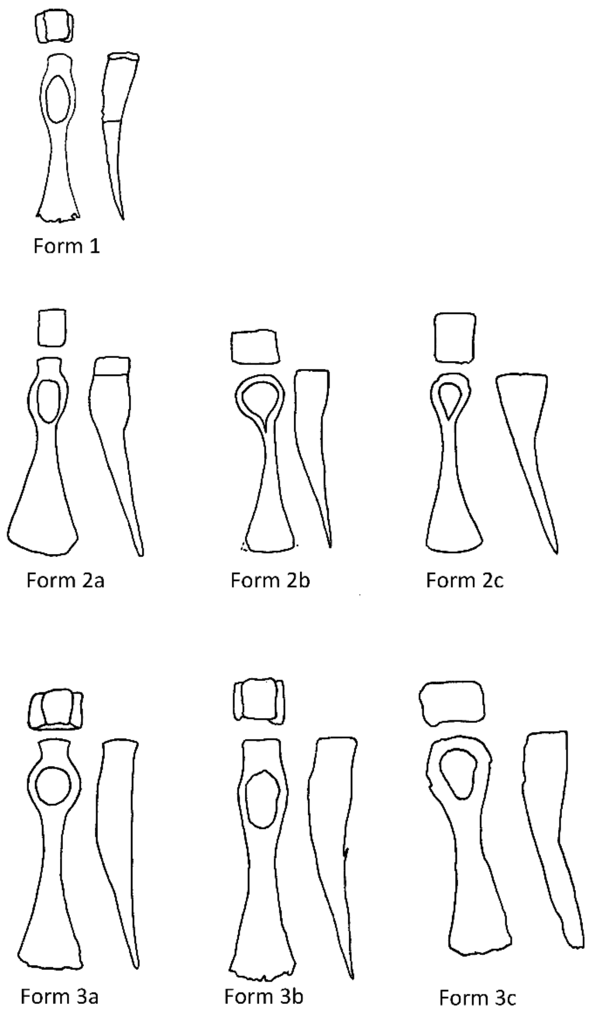


Figure 194 Darbyshire's typology of Iron Age adzes (after Darbyshire, 1995, J1, J12, J15, J18, J24, J30 and J32).

Although originally catalogued as a Medieval object, ADZ01 does not resemble any of the medieval adzes catalogued by Goodall (1980, figs 31, B28-31). It does, however, resemble Darbyshire's Form 2a. As such, it is interpreted as an Iron Age object. ADZ02 conforms to Darbyshire's Form 3a. These forms show high degrees of standardisation in terms of dimensions over a wide area of Britain, from Southern England to the Midlands (Darbyshire, 1995, p. 371), and both of the London objects conform to these standards, although ADZ02 is set at a much deeper angle than is usual. A third tool, HOE01, has a similar form, but does not clearly fit into Darbyshire's typology and has been interpreted as a hoe.

Both Form 2a and 3a have produced examples dating from potentially as early as 300 BC to the mid-1st century AD, with examples from Camerton and Ham Hill probably being deposited after the Roman invasion (Darbyshire, 1995, pp. 365, 71). An object of similar form from a Trajanic context comes from Conimbriga (Alarcão *et al.*, 1979, Pl. VIII, 106), but is considerably larger.

There is a some uncertainty as to whether these simple tools are woodworking adzes or agricultural hoes (Rees, 1979, pp. 308–9; Manning, 1985a, p. 16; Darbyshire, 1995, p. 360). It has been suggested that the rectangular projections at the butts of tools such as ADZ01 and ADZ02 would have been employed as hammers (Rees, 1979, p. 308), which is supported by evidence of flaring on some Iron Age examples (Darbyshire, 1995, p. 370), suggesting a woodworking function. The fact that some Type 3a adzes from Glastonbury had short ash shafts (Darbyshire, 1995, p. 370) also suggests that they were not agricultural tools.

Roman Adze-Hammer Types

Several authors have created typologies of Roman-period adze-hammers, all of which are sufficient to cover the small number of examples from London. Pietsch (1983, fig. 28) created the earliest four-part typology, which was later expanded into a six part typology (with an additional subtype) by Duvauchelle (1990, fig. 10) in order to accommodate the material from Avenches. Most recently, a larger typology comprising five types, broken into eight subtypes, has been proposed by Hanemann (2014, Abb.306). Table 12 shows how these types relate to each other. As Hanemann's typology covers the largest range of possible forms, this is the typology which will be employed to categorise the London material.

Hanemann 2014	Pietsch 1983	Duvauchelle 1990
Typ 1A Typ 1B	Typ ½ Typ ½	Type ½ Type ½
Typ 2	-	-
Typ 3A Typ 3B Typ 3C	Typ 3 Typ 4 -	Type 3 Type 4A/B Type 5
Typ 4	-	-
Typ 5	-	Type 6

Table 12 The correspondence between different adze typologies

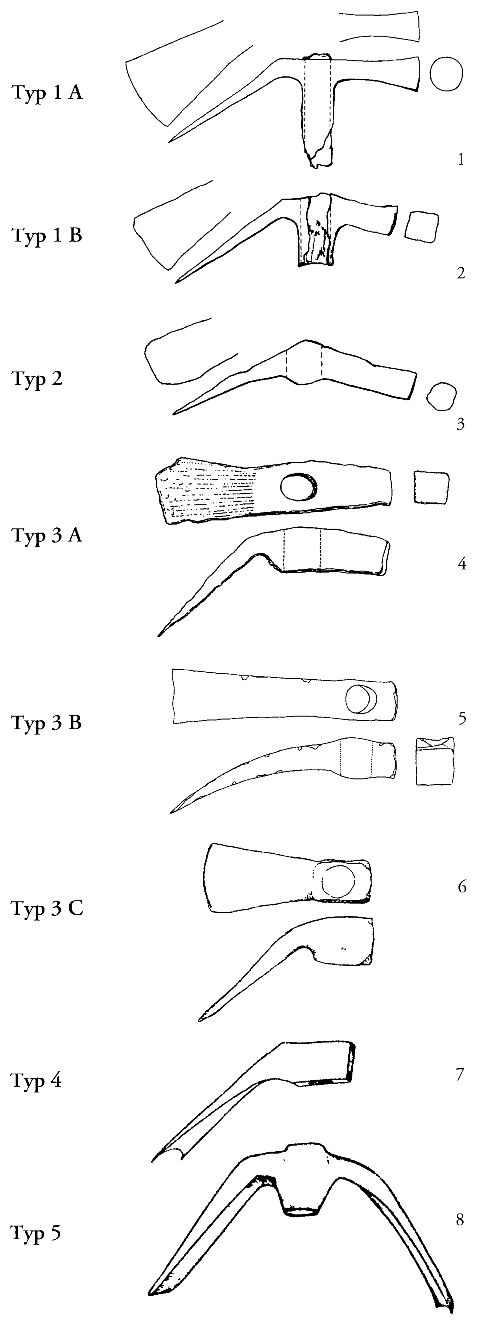


Figure 195 Hanemann's typology of Roman adzes

(Hanemann, 2014, Abb.306).

Type 1 adze-hammers are among the most recognisable Roman tools, having a sharply-angled adze blade on one side, balanced by a hammer head at the other, and an iron casing extending down the shaft in the centre. Hanemann (2014, p. 355) distinguishes between those with long (**Type 1A**) and short (**Type 1B**) shaft casings, but there is no clear distinction between them, and Manning (1985a, p. 18) considered them to be the same type. Pietsch (1983) distinguished instead between tools of different levels of craftsmanship, but again these distinctions are not always clear.

ADZ03 has the short shaft-hole casing of Hanemann's Type 1B, but is unusual in that the casing is square, rather than round, in external section. Manning (1985a, p. 18) comments on how well made this tool is, and considered it possibly the work of a military workshop. ADZ04 can also be classified as Type 1B, although it is unusual in having small lugs on the underside of the shaft-hole casing rather than the top. ADZ05 is heavily corroded and incomplete, and as such it is impossible to tell whether it was a Type 1A or 1B. Unusually, the shaft hole casing extends above the level of the adze blade, forming a small upper socket. This unusual form can also be seen on an axe from the Silchester 1890 hoard (Evans, 1894, fig. 11).

Pietsch (1983, p. 28) dates Type 1 adze-hammers with square lugs to the early 1st century, and this is supported by the tools from London. ADZ03 was found with fragments of Dragendorf 27 samianware and a fragment of samian stamped by *Patricius* (Painter, 1961, p. 116), both of which suggest a date in the second half of the 1st century (Painter, 1961, p. 116; Manning, 1985a, p. 18), whilst Manning (1985a, p. 18) considered the style of manufacture to be similar to that seen on late 1st century tools from Newstead. Unlugged examples have a much longer date range, although the only example from London, ADZ05, was found in a pre-Boudican quarry pit.

Site	Site Type	Context	Date	Reference
Bar Hill	Military	-	-	(Keppie, 1975, fig. 33, 21)
Carlingwark Loch	-	Hoard	70-200	(Piggott, 1952, fig. 9, C50)
Ingleby Barwick	Villa	Hoard	Late Roman?	(Hunter, 2013, fig. 4.23, a)
Kingsholm	Military	-	49-69	(Manning, 1985a, B14)
Lullingstone	Villa	Unstratified	-	(Meates, 1987, fig. 43, 237)
Nantwich (x2)	Industrial	Brine tank	180-90	(Cool, 2012, fig. 7.6, 4.28-29)
Silchester	Urban	Hoard	200-400	(Evans, 1894, p. 148)
Avenches	Urban	-	-	(Duvauchelle, 1990, No.53)
Feldburg	Military	-	150-260	(Pietsch, 1983, Taf. 7, 111)
Haltern (x7)	Military	-	1 BC - 9 AD	(Harnecker, 1997, Taf. 3.20-1, 23, 4.22, 5.24-6)
Königsforst	-	-	-	(Gaitzsch, 1980, Taf. 56, 279)
Neuss	Military	-	-	(Simpson, 2000, Pl. 39, 7)
Pompeii (x3)	Urban	-	Before 79	(Gaitzsch, 1980, Taf. 10, 42-4)
Saalburg (x4)	Military	-	85-260	(Pietsch, 1983, Taf. 7, 109, 110, 112b-c)
Seltz	-	Hoard	150-300	(Schaeffer, 1927, Pl. 1, k)
Zugmantel (x4)	Military	-	90-260	(Pietsch, 1983, Taf. 7, 110a-b, 112, 112a)

Table 13 Comparanda for Type 1 adze hammers.

Type 2 is very similar to Type 1, but lacks any form of shaft casing. One object of this form, ADZ06, comes from London. It is heavily corroded, but appears to have a round-faced hammer-head at the rear end, rather than a rectangular extended poll, and as such would conform to Type 2 rather than the simpler Type 3A. Although functionally the same as Type 3A, Type 2 is considerably rarer, but examples come from Pompeii (Gaitzsch, 1980, Taf. 10, 40) and Zugmantel (Pietsch, 1983, Taf. 7, 113).

ADZ07 is a fragment of an expanding round-faced striking surface. This is potentially a fragment of a tool such as a hammer, crowbar or field anvil, but the fact that the broken end is sloped, suggesting that this fragment was mounted at an angle, indicates that it is the slightly downward-angled hammer head from the butt of a Type 1 or 2 adze-hammer (Humphreys in Marshall and Wardle, forthcoming).

Types 3 consists of adzes with sharply angled blades, and sometimes with an extended rectangular-sectioned poll (Type 3A), but no clearly defined hammer head. No objects of this type come from London.

Type 4 are coopers' adzes, with dished blades. No objects of this type come from London.

Type 5 adzes are double-bladed. No objects of this type come from London.

A final object, ADZ08, appears to be the blade of a Roman-type adze. Burring to the broken edge of this object indicates that it was re-used after becoming detached, perhaps at a chisel or wedge.

Anvils

Technology

Anvils are robust blocks of iron used as striking surfaces in metalworking trades. Modern blacksmiths' anvils have a recognisable form, combining a flat striking surface with a tapering rounded horn at one end, and pritchel holes (to punch into) and hardie holes (in which smaller stake anvils and hardy tools are inserted) at the other (Manning, 1976a, p. 145) (Figure 196). In the Roman period, these functions were fulfilled with different anvils, including robust block anvils, smaller beaked anvils, and stake anvils. A fresco from the House of the *Vettii*, Pompeii, shows metalworking cupids forging at a (presumably woden) block with three stake anvils of different sizes set into it.

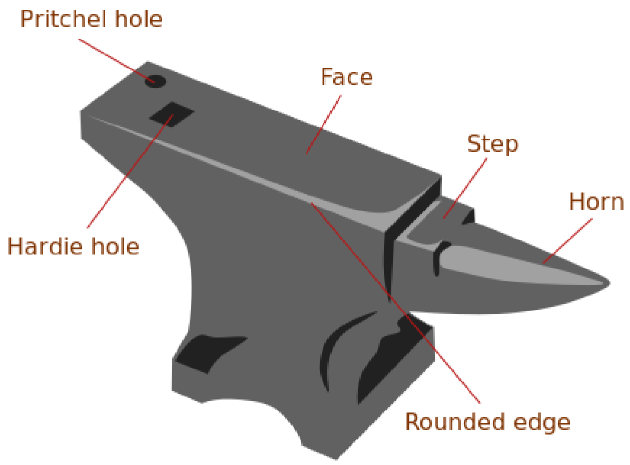


Figure 196 A modern anvil (https://en.wikipedia.org/wiki/Anvil#/media/File:Anvil,_labelled_en.svg).

Numbers

Three objects from London were identified as anvils, all from the Museum of London.

Typology

Large anvils

A typology of anvils by Hanemann (2014, Abb. 280) covers block anvils (Type 1), beaked anvils (Type 2) and iron shoemakers' lasts (Type 3). Manning (1985a, pp. 1–4) also discusses block anvils and beaked anvils. However, no anvils of these types is found in London.

The only full size anvil from London, ANV01 is a tanged 'stake anvil', with a slightly domed square-sectioned head. ANV01 was found with an iron collar, which shows that it was mounted in its own wooden block, rather than as a stake through a hardy hole (Manning, Price and Webster, 1995, p. 246) or as part of a group of anvils in a large block. It is currently mounted in a replica wooden block, but can be seen without this in a photograph from 1965 (Merrifield, 1965, Pl. 125). Although less common than other anvil types, several comparable examples can be found, with both flat and swage heads (Table 14). The plain, slightly domed head of ANV01 would have made it suitable for a broad range of tasks, from cold working and forging to delicate work and raising.

Site	Site Type	Context	Date	Reference
Avenches	Urban	-	-	(Duvauchelle, 1990, No. 2)
Compiegne	-	-	-	(Champion, 1916, Pl. V, 16197)
Haltern (x3)	Military	-	1 BC - 9AD	(Harnecker, 1997, Taf. 14, 108-10)
Niederbieber	Military	-	185-260	(Gaitzsch, 1980, Taf. 44, 201)
Pompeii	Urban	-	Before 79	(Gaitzsch, 1980, Taf. 1, 7)
Vertault	Urban	-	-	(Tisserand, 2010, Pl. 1, 7)
Zugmantel	Military	-	90-260	(Pietsch, 1983, Taf. 19, 446)

Table 14 Comparanda for ANV01.

Miniature anvils

ANV02 has the same form as ANV01, but is considerably smaller. It may be a non-functional miniature, but Pietsch (1983, p. 55) and Manning (1995, pp. 246–7) interpret similar objects (Table 15) as small anvils for delicate work, which could be inserted into hardy holes or wooden blocks.

Site	Site Type	Context	Date	Reference
Usk	Military	Pit	55-69	(Manning, Price and Webster, 1995, fig. 75, 1)
Compiegne (x2)	-	-	-	(Champion, 1916, Pl. V, 28996, 15913)
Saalburg	Military	-	85-260	(Pietsch, 1983, Taf. 18, 439)
Zugmantel	Military	-	90-260	(Pietsch, 1983, Taf. 18, 438)

Table 15 Comparanda for ANV02.

ANV03 is only tentatively identified as an anvil. It may be a fragment of a structural T-clamp, and Manning (1985a, R65-71) features a number of similar objects. However, none of these have the flaring, flat head of ANV03, and so it remains possible that it is a small anvil. If this is the case, it is unclear why it requires projecting arms.

Two other objects encountered in London may be small anvils, but neither can be identified with certainty. CID90[378]<268> was identified as a possible jeweller's anvil at the time of excavation, but is certainly a T clamp. BZY10[4573]<4593> resembles objects identified as anvils at Usk (Manning, Price and Webster, 1995, fig. 75) and Wilcote (Hands, 1998, figs 26, 113), but has been instead interpreted as a fragment of a logging ring (Humphreys in Marshall and Wardle, forthcoming).

Awls, Bradawls, Bodkins and Scribers

Technology

Awls are a notoriously difficult category of objects to analyse. As small objects they are particularly vulnerable to corrosion, and can easily become indistinguishable from other objects, such as nails or styli. A particularly thorny issue is the distinction between awls (for leatherworking) and bradawls (for woodwork). These issues are compounded by a tendency in archaeological literature to label any small pointed objects as awls regardless of their functional properties. A detailed study of the 111 possible Roman awls from London will therefore be of great value to the field of finds research.

Before we begin, it will be useful to clarify what objects we are talking about. Manning (1985a, p. 28) distinguishes between two types of object; awls and bradawls. However, this simple division masks a great deal of complexity in the tools employed today. Salaman (1986, p. 350), for example, indexes 50 different types of awls used for leatherwork alone. Before moving on to consider the Roman material, this section will briefly examine the different types of pointed tools currently produced, and their functions.

Stitching Awls

Stitching or sewing awls are used to pierce holes in leather prior to sewing, when a needle or hog's bristle is then used to pull the thread through the hole made by the awl (Salaman, 1986, p. 83). Awls for this purpose need to be strong enough to pierce the leather, which can vary considerably in thickness, but not so robust that they make a hole too large for the thread, or become difficult to push through. Modern stitching awls are invariably tanged, set in wooden (or plastic) handles and pressed into the leather with the hand. The blades vary considerably in shape. Saddler's awls, the most common type used in general leatherwork today, have a sharply pointed diamond-sectioned blade. Other types of awl described and illustrated by Salaman (1986) can be straight or bent into an S-curve (to aid the piercing of holes with a curved path), and be round-, oval- or diamond-shaped in section (Figure 197). These awls are used in varied tasks; sometimes all by the same person when working with different thicknesses of leather in a composite object, or by multiple craftspeople engaged in making different objects.

Figure 197 Modern saddler's awl (left) and S-curved sewing awl (right) (www.rmleathersupply.com).

Scribers, Scratch Awls and Marking Awls

Scribers and scratch awls are used to scratch out patterns or measurements on an object. Scribers, used in metalwork, are commonly made of a single piece of slender metal of pencil-like dimensions, with a sharp round- or square-sectioned tip. Some modern scribers are double ended, with a second sharp tip bent at a right angle. Scratch awls and marking awls, used in woodwork, are usually long, tanged, round-sectioned spikes set into short, bulbous wooden handles (Salaman, 1975, p. 269). Salaman (1986, p. 84) also describes the use of sharp or blunt round-sectioned awls for marking patterns on leather. As these are not piercing tools they can be considerably thicker than stitching awls, although they do not have to be.

Figure 198 Modern scratch awl (left, www.thepaintstore.com) and scriber (right, www.toolstop.co.uk).

Bradawls, Birdcage Awls and Reamers

Bradawls and birdcage awls are used as simple boring tools to drill small holes in wood, often in preparation for nailing. Both are held in one hand and operated by pressing the tip down into the wood and twisting or wiggling the blade. Confusingly, multiple and interchangeable names are used to describe tools that are operated in the same way, but differ in form.

The term ‘bradawl’ normally refers to tools consisting of a round-sectioned blade set into a wooden (or plastic) handle, tapering to a chisel-like tip similar to that of a screwdriver (Salaman, 1975, p. 46). ‘Birdcage awls’ are tools with square-sectioned blades which taper to a sharp square-sectioned point. Unlike a bradawl, in which the tip alone does the work of cutting, the sharp edges of the birdcage awl’s square-sectioned shaft also cut and enlarge the hole (Salaman, 1975, pp. 44, 46). These tools are also sometimes sold today as ‘bradawls’. Salaman (1986, pp. 84, 86) describes the use of various other square, diamond and oval-sectioned awls for drilling holes in wood.

Reamer’s differ in function; their purpose is to enlarge (‘ream’) previously bored holes (Salaman, 1975, p. 390). Modern reamers are tapered and fluted, and often machine driven, but older types resemble a continually expanding square-sectioned birdcage awl (Salaman, 1975, p. 391, fig.580).

Figure 199 Modern ‘bradawls’ with (left) a screwdriver-like tip and (right) a square-sectioned point (www.toolstop.co.uk).

Bodkins

Bodkins are tools used in basket-making, rope-making, and various textiles-related crafts to enlarge holes in cloth or open up the weave of a basket prior to passing a new element through the hole. They are characterised by a polished, expanding round-sectioned blade, and can be considerably wider than stitching awls, depending on the type of work being carried out. Similar tools used by upholsterers to enlarge holes in leatherwork are sometimes called garnish awls (Salaman, 1975, p. 46).

Figure 200 – A modern basket-making bodkin (www.englishwillowbaskets.co.uk).

From this brief overview, it is clear that a number of tools of quite different function have the same basic form of a slim piece of tanged metal. Differences clearly exist between these forms, and it should be possible to distinguish between some of them on the basis of form. However, this will not always be possible; how would one differentiate between a large diamond-sectioned saddler's awl and a small diamond-sectioned bradawl, for example? The main questions that need to be answered with the London awls are therefore; what is the variation in 'awl' form seen in the Roman period? And can this variation be related to differences in function and use?

The term 'awl' will be used in this section to denote any of the numerous types of object described above. When a more specific identification is made, terms such as 'stitching awl', 'bradawl' etc. will be employed. The objects described here were originally catalogued under various names. Those described as 'awls', 'bradawls', 'reamers' or 'scribers' were identified in the original search of the Museum of London's MIMSY database. However, when the Museum's stores were physically searched a number of objects were found which had been labelled as 'rimers' or 'rimmers'. These terms appear to be synonymous with 'reamer'. Some objects were misidentified, most commonly as 'drills' or 'punches'.

The terminology used to describe the constituent parts of the various types of awls is summarised below (Figure 201). In many cases the distinction between handle and blade was unclear. In most cases the handle has been measured to the point where there was an obvious change in angle towards the blade. Where the handle had edge bevels but the blade did not, handle measurements go to the end of the bevelled section. Where no distinction could be made, separate measurements for blade and handle are not given. The term 'tang' is used here to describe the part of the object that tapers away from the blade. In reality a larger amount of the tool may have been inserted into the handle, but this is impossible to assess as so few organic handles survive. The points of the tools from London are described as 'round-sectioned', 'square-sectioned', 'faceted', 'flat', 'diamond-sectioned', 'rounded' and 'chisel-like'.

Numbers

111 possible awls, bradawls, scribers and bodkins are discussed here. The majority, 67, come from the Museum of London. 19 come from recent excavations by MOLA, 9 from excavations archived by the LAARC. 10 come from the British Museum, 3 from the Bank of England Museum, and one each from the Pitt Rivers Museum and excavations by PCA.

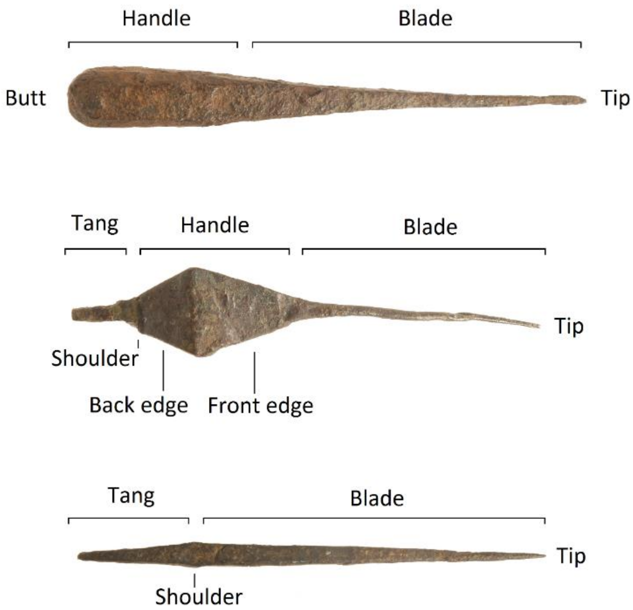


Figure 201 Terminology used to describe awls and bradawls.

Typology

Manning (1985a, fig. 9) studied 26 awls in the British Museum, and broke them down into five types, with two additional sub-types. This typology has since become the standard tool for describing awls, and is widely used in Britain and abroad (Duvauchelle, 1990, pp. 38–9). An alternative typology by Hanemann (2014, Abb. 337) covers four types of solid-handled awl.

		Previous typologies	
Group	Type	Manning 1985	Hanemann 2014
Solid-Handled	1.1	Type 2	Type 2
	1.2	-	Type 1
	1.3	Type 3a	Type 3
	1.4	Type 3a	-
	1.5	Type 3a	-
	2.1	-	-
	2.2	-	-
	2.3	-	-
	2.4	-	-
	3	-	Type 4
	4	-	Type 4
Nail-form	5	-	-
Tanged	6	Type 1	-
	7	Type 4b	-
	8.1	Type 4b	-
	8.2	Type 4b	-
	8.3	Type 4b	-
Double-Ended	9.1	Type 4b	-
	9.2	Type 4b	-
	9.3	-	-
Socketed	10	Type 5	-

Table 16 Correspondence between different awl typologies

However, neither typology covers the full variety of tools encountered in London. As such, a new typology has been constructed (Figure 202). This typology will deliberately encompass both solid-handled and tanged stitching awls, bradawls, reamers, scribers, and other pointed tools in order to seek better ways of differentiating between them, although it is recognised that they would have had no functional relationship. As the tips of these tools rarely survive, this typology will initially be based on the form of the handles and tangs, after which tip form and function will be considered. Because of this, the typology is large, and requires splitting down into more manageable groups. In the first instance, a distinction can be made between solid-handled, nail-form, tanged, and socketed awls. Table 16 shows how previous awl types are accommodated in this new typology.

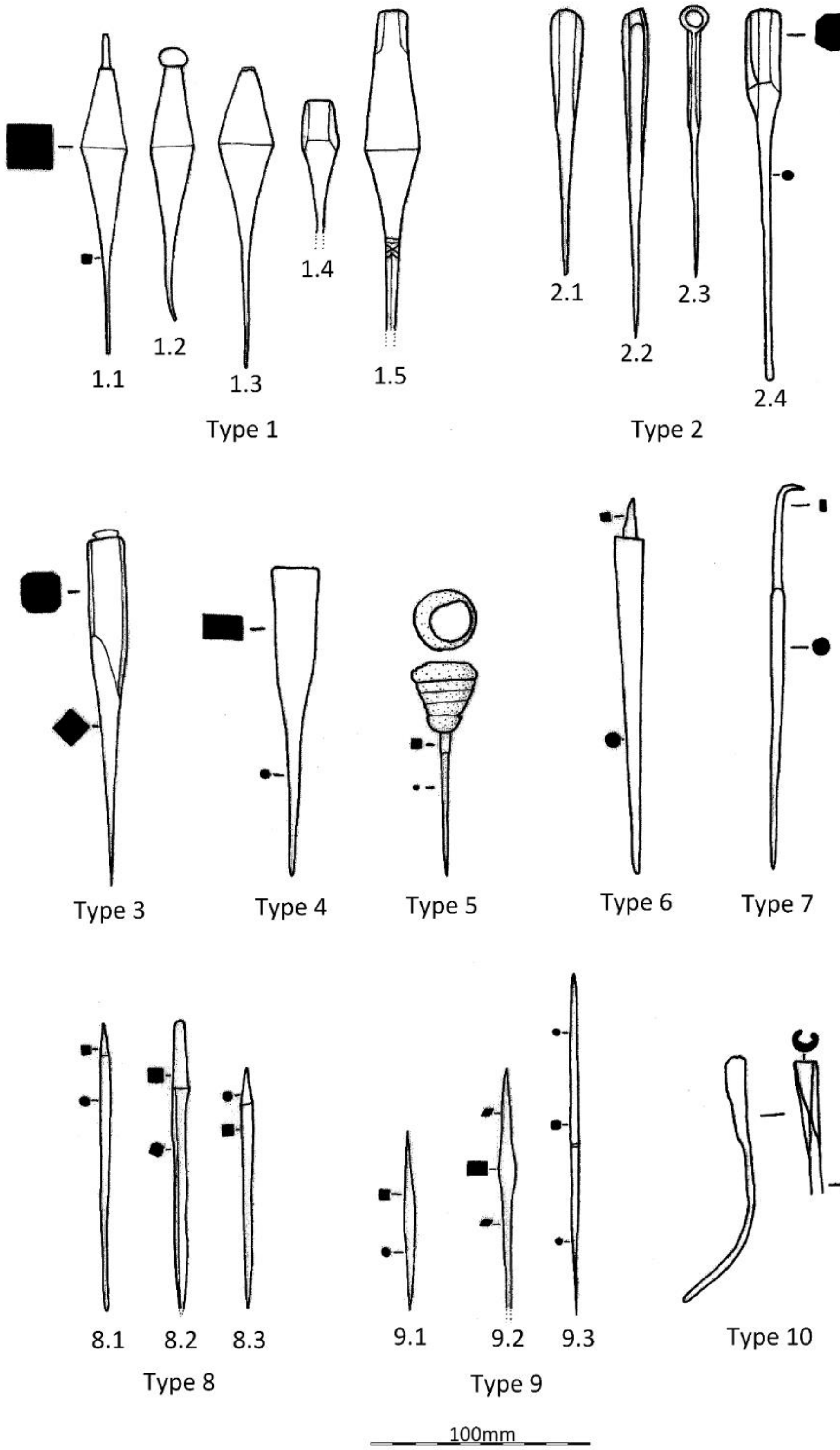


Figure 202 Typology of Roman awls, bradawls, bodkins and scribers from London (Types 2.3, 6, 7 and 10 after Manning 1985, B78, E5, E12, and E28).

Solid-Handled Forms

Awls with solid handles can be divided into diamond forms (Type 1), octagonal forms (Type 2), square forms (Type 3), and rectangular forms (Type 4).

Type 1 - Diamond forms

The most distinctive Roman awls are those with expanded handles, commonly referred to as diamond shaped, but more correctly termed octahedral, which have the form of two square-based pyramids joined together. Similar handle forms are also seen on Type 4 chisels (see p.449). This type can be divided into five sub-types (Figure 203).

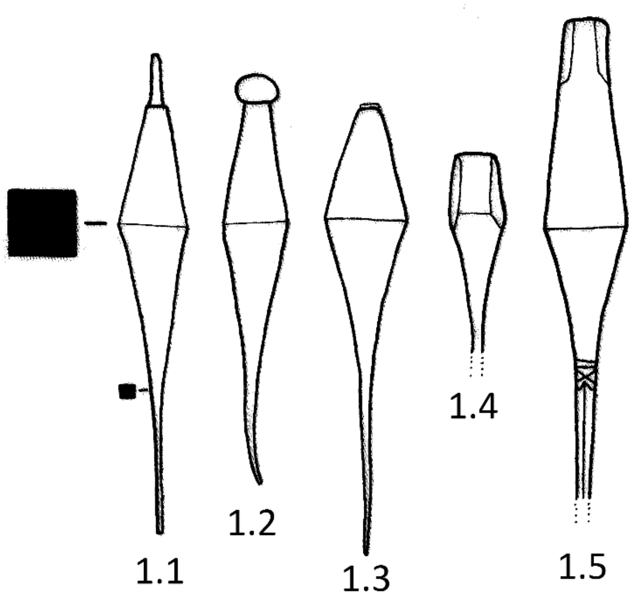


Figure 203 Type 1 diamond-handled awl subtypes (1.1, AWL001; 1.2, AWL005; 1.3, AWL018; 1.4, AWL016; 1.5, AWL021).

Type 1.1 has a tang at the butt, and would have had an organic handle fitted. The tangs can be round or square in section. An example from Augsburg-Oberhausen (Deschler-Erb, 2014, O/1146) has a peened-over tang, indicating that these handles were not very long. It is presumed that these handles would have resembled the mushroom domes at the butts of Type 1.2 (Manning, 1985a, p. 40), and it is in this way that they have been reconstructed in the Museum of London (Figure 204). However, two awls from Vertault instead have flat, curved tabs at the butt (Tisserand, 2010, Pl. 2, 20-1).

Figure 204 Type 1.1 awl with reconstructed handle (AWL002).

Four objects of this form, AWL001-4, come from London. AWL004 comes to a sharp square-sectioned point, whilst the other three all end in narrow chisel-like points. For this reason they are primarily interpreted here as bradawls. However, as the chisel-like tips of these tools are very narrow, it is possible that they are in fact broken stitching awls.

This type is rare in Britain outside of London, coming only from military sites (Table 17). It is conspicuously absent from the later Limes forts (Pietsch, 1983), indicating that it is an early type (Deschler-Erb, 2014, p. 15; Hanemann, 2014, p. 405). Because of this early dating, Type 1.2 can be seen as a later modification of Type 1.1.

Site	Site Type	Context	Date	Reference
Brecon Gaer	Military	-	75+	(National Museum Wales)
Hod Hill	Military	-	43-51	(Manning, 1985a, E7)
Augsburg-Oberhausen (x3)	Military	-	27 BC - AD 16	(Deschler-Erb, 2014, O/1129, O/1140, O/1146)
Haltern (x2)	Military	-	1 BC - 9 AD	(Harnecker, 1997, Taf. 21, 223-4)
Hofheim (x6)	Military	-	40-260	(Ritterling, 1913, Taf.XX, 18-22, 24)

Table 17 Comparanda for Type 1.1 awls.

Type 1.2 has a mushroom-like dome at the butt. Three objects of this form, AWL005-7, come from London, although it is possible that the handle of the highly corroded AWL006 was not originally a well formed octahedron. None have surviving tips. The flat heads of AWL006 and AWL007 may indicate that these tools were struck with hammers, although they are not obviously burred.

This type is found on both urban and military sites, from the Limes to South West France (Table 18). It has a long period of use, with examples potentially dating from the 1st to 6th centuries, with the form perhaps becoming more elongated with time (Pietsch, 1983, p. 40; Hanemann, 2014, p. 405).

Site	Site Type	Context	Date	Reference
Alcester	Urban/Military	-	353+	(Mould, 1994, fig. 93, 7)
Vindolanda	Military	-	160-80	(Blake, 1999, No. 3668)
Avenches (x3)	Urban	-	-	(Duvauchelle, 1990, No. 21-3)
Bordeaux	Urban	-	500-600	(Feugère and Charpentier, 2012, fig. 12, 110)
Feldberg	Military	-	150-260	(Pietsch, 1983, Taf. 12, 280b)
Niederbieber (x2)	Military	-	185-260	(Gaitzsch, 1980, Taf. 47, 240-1)
Saalburg (x11)	Military	-	85-260	(Pietsch, 1983, Taf. 12, 277, 279, 279a-b, 280, 280a, 280c, 281b, 282, 282a)
Valentine	Villa	Hypocaust	-	(Feugère, 2000, fig. 6, 9)
Vertault	Urban	-	-	(Tisserand, 2010, Pl. 2, 23)
Waldfishbach	-	Hoard	300-400	(Hanemann, 2014, Wa/H1/51)
Zugmantel (x4)	Military	-	90-260	(Pietsch, 1983, Taf. 12, 278, 280b, 281a, 281c)

Table 18 Comparanda for Type 1.2 awls.

Type 1.3 has a plain octahedral handle and a flat butt, although three (AWL008-10) possess a very low round-sectioned extension on the butt. These often show signs of burring, indicating that the tools were struck with hammers. The presence of these extensions is difficult to explain, but it is possible that they represent the stubs of tangs that have been removed. Six examples of this type, AWL008-13, come from London. Only three of these tools have surviving tips. AWL008 comes to a sharp faceted point, AWL012 has a narrow chisel-like edge, whilst AWL010 has a flaring chisel-like edge. AWL010 and AWL012 therefore probably functioned as bradawls. This type is found on a range of site types, with dates ranging from the early 1st to late 3rd centuries.

Site	Site Type	Context	Date	Reference
Hill Farm	Villa	Ditch (hoard?)	138-400	(Manning, 1985b, fig. 21, 168)
Newstead	Military	Pit	80-211	(Curle, 1911, Pl. LIX, 16)
Vindolanda	Military	-	160-80	(Blake, 1999, No. 3639)
Wilderspool	Urban/Industrial	-	-	(Thompson, 1965, fig. 21, 3)
Avenches	Urban	-	-	(Duvauchelle, 1990, No. 161)
Rocherou	Military	Drain	20-30	(Feugère, Thauré and Vienne, 1992, No. 158)
Saalburg	Military	-	85-260	(Pietsch, 1983, Taf. 12, 284)
Zugmantel (x7)	Military	-	90-260	(Pietsch, 1983, Taf. 12, 275-6, 284a, 285)

Table 19 Comparanda for Type 1.3 awls.

Type 1.4 has a flat butt, the rear edges of which are bevelled, creating an octagonal-sectioned butt. These tools have the least exaggerated handle forms, and are similar to Type 2.1 octagonal forms. Six examples of this type (AWL014-9) come from London, none of which have surviving tips. AWL014 becomes rectangular in section as it tapers, indicating that it must have had either a chisel-like tip or a flat point. This type is difficult to find parallels for, as without good preservation and illustration it would be indistinguishable from Type 1.3. Two examples from military sites include one from Cowbridge (Scott, 1996, figs 63, 7) and a late 2nd century example from Vindolanda (Blake, 1999, No. 4339).

Type 1.5 has an octahedral handle and flat butt, resembling Type 1.3, but is distinguished by having an exaggeratedly elongated, wasited butt. Two objects of this form, AWL020 and AWL021, come from London. AWL021 is unique in being heavily decorated, with a faceted butt. Although the tip is broken, the thick, flattening form of the blade at the break suggests that it had a chisel-like bradawl tip. Other examples of this form come from the Limes forts of Niederbieber (Gaitzsch, 1980, Taf. 47, 239) and Saalburg (Pietsch, 1983, Taf. 12, 286).

Two further tools cannot be assigned to a subtype. AWL022 is unique in having bevelled front rather than back edges. AWL023 is too corroded to assign to a subtype.

Of the 21 Type 1 awls from London, only eight have surviving tips (Table 20). The fact that six of these are chisel-like tips, and that some show burring to the butt, indicates that these objects were primarily woodworking bradawls. The expanded square-sectioned handles of these objects may therefore have been to aid the hand in getting a firm grip when they were twisted. Type 1.1 and 1.2 awls with mushroom domes at the butt would have rotated comfortably in the palm. However, this may not have been the case for all of these tools; two come to sharp points and therefore could have functioned as stitching awls. Others, such as AWL010, have very narrow chisel-like tips, and may be broken stitching awls rather than bradawls.

	Tip form								
Type	Pointed						Chisel-like	Unknown	Total
	Round	Square	Faceted	Flat	Diamond	Rounded			
1	-	-	-	-	-	-	-	AWL022-23	2
1.1	-	AWL004	-	-	-	-	AWL001-3	-	4
1.2	-	-	-	-	-	-	-	AWL005-7	3
1.3	-	-	AWL008	-	-	-	AWL010, AWL012	AWL009, AWL011, AWL013	6
1.4	-	-	-	-	-	-	-	AWL014-19	6
1.5	-	-	-	-	-	-	AWL021	AWL020	2
Total	0	1	1	0	0	0	6	15	23

Table 20 Tip form of the Type 1 awls from London

Elsewhere, it has been suggested that objects of this form functioned as punches (Duvauchelle, 1990, p. 51; Mould, 1994, p. 196; Blake, 1999, p. 40). An example from Vindolanda with a square-sectioned tip was interpreted as a leather punch (Blake, 1999, p. 40), but this misunderstands how leather punches work. A punch for decorating leather needs to be blunt, and the size of the hole will not increase with the force of the blow. Robust examples from Avenches (Duvauchelle, 1990, p. 51), Valentine (Feugère, 2000, p. 173) and Hill Farm (Manning, 1985b, p. 46) were seen as metalworking punches. However, objects of this type from London taper to slender stems, implying that they are a form of awl rather than a form of punch.

Type 2 – Octagonal forms

Type 2 awls and bradawls are characterised by octagonal-sectioned handles. This type can be further divided into four subtypes (Figure 205).

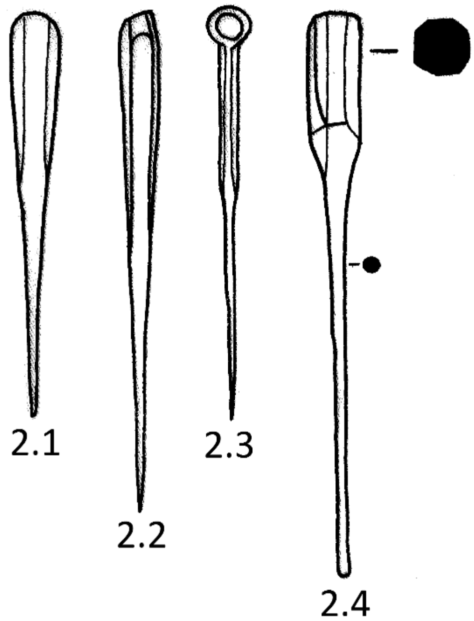


Figure 205 Type 2 awl subtypes (2.1, AWL024; 2.2, AWL030; 2.3, AWL032; 2.4, AWL035).

Type 2.1 is the largest type, with a chunky octagonal-sectioned handle which tapers towards the blade, gradually losing its bevels. Three examples of this type, AWL024-26, come from London. AWL024 and AWL025 have faceted or rounded butts and chisel-like tips. AWL026 is somewhat different, having a flat butt and shorter handle, as well as a broken tip. Only a handful of comparable objects are known (Table 21). An example from Avenches was interpreted as a punch, but in light of the chisel-like tips of the London tools it seems more likely that objects of this type are bradawls.

Site	Site Type	Context	Date	Reference
Avenches	Urban	-	-	(Duvauchelle, 1990, No. 19)
Saalburg	Military	-	85-260	(Pietsch, 1983, Taf. 13, 299, 300, 302a-b, 304, 304a)
Zugmantel (x3)	Military	-	90-260	(Pietsch, 1983, Taf. 13, 299a, 302c, 304b)

Table 21 Comparanda for Type 2.1 awls.

Type 2.2 also has a rounded or faceted butt at the end of an octagonal-sectioned handle, which tapers continuously to the point, but is markedly narrower than Type 2.1. Five objects of this type, AWL027-31, come from London. AWL028 may not truly belong here, as it is very roughly made compared to the other examples. Three of these objects have round-sectioned points, one ends in a flat point, whilst one is broken. Most of these objects were originally described in the Museum of London as 'scribers'. This is a plausible interpretation as these objects come to simple points and have the pencil-like dimensions of modern scribers. It is therefore possible that they were intended to be metalworking tools, although they may also have been carpenter's scratch awls, whilst some seem sharp enough to have functioned as stitching awls. A comparable object from Verulamium was interpreted as a punch (Manning, 1972b, p. 163), but none of the objects from London are obviously burred.

Site	Site Type	Context	Date	Reference
Verulamium	Urban	Wall trench	155-60	(Manning, 1972b, fig. 60, 4)
Marzoll	Villa	-	-	(Gaitzsch, 1980, Taf. 57, 287)
Saalburg (x2)	Military	-	85-260	(Pietsch, 1983, Taf.13, 298a, 298c)
Zugmantel (x2)	Military	-	90-260	(Pietsch, 1983, Taf.13, 298, 298b)

Table 22 Comparanda for Type 2.2 awls.

Type 2.3 consists of a narrow, parallel-sided octagonal handle, with an integral iron loop on the butt, tapering into a pointed blade. Two examples, AWL032-33, come from London, but they differ markedly in size. AWL032 has a sharply pointed diamond sectioned blade, whilst AWL033 comes to a sharp round sectioned point.

No exact parallels for these objects could be found, and it may therefore be relevant that they do not closely resemble each other. An object resembling AWL032, but with a square-sectioned handle, from Whitton, was interpreted as the handle of a lift key (Manning, 1981, figs 76, 54). However, this object was considerably better executed than the more complete lift keys from that site. This arrangement of octagonal-sectioned handle and integral loop is also seen on Manning's Type 4 knives (which may be razors (Manning, 1985a, p. 110)), suggesting that they were made by the same people.

These objects could nevertheless have functioned as stitching awls. AWL032 has the classic blade shape seen in modern saddler's awls, whilst AWL033's blade could be deliberately bent to aid stitching. The loops may be for suspension, although why this would be needed is unclear.

Type 2.4 has a very short octagonal-sectioned handle, which tapers sharply into a long, narrow blade. Two examples are known from London. AWL034 is broken, whilst AWL035 has a narrow chisel-like tip, indicating that it is a bradawl. Elsewhere, similar objects have been interpreted as small anvils for fine metalworking (Howard-Davis and Whitworth, 2000, p. 271; Deschler-Erb, 2014, p. 15). Since AWL035 has a well preserved bradawl tip, this interpretation is not favoured here.

Site	Site Type	Context	Date	Reference
Ribchester	Military	-	-	(Howard-Davis and Whitworth, 2000, fig. 73, 141-2)
Usk	Military	Rubble	Roman?	(Manning, Price and Webster, 1995, fig. 78, 7)
Verulamium	Urban	Occupation	130-60	(Manning, 1984a, fig. 37, 11)
Augsburg-Oberhausen	Military	-	27 BC - AD 16	(Deschler-Erb, 2014, O/1049)
Hofheim	Military	-	40-260	(Ritterling, 1913, Taf. XX, 29, 35)

Table 23 Comparanda for Type 2.4 awls.

Type 2 is a more disparate group of tools than Type 1, encompassing objects with a potentially wide range of functions. Type 2.2 appear to have been scribers. Type 2.3 could have functioned as awls. All identifiable examples of Types 2.1 and 2.4 could have been bradawls (Table 24).

	Tip form								
Type	Pointed						Chisel-like	Unknown	Total
	Round	Square	Faceted	Flat	Diamond	Rounded			
2.1	-	-	-	-	-	-	AWL024-25	AWL026	3
2.2	AWL029-31	-	-	AWL028	-	-	-	AWL027	5
2.3	AWL033	-	-	-	AWL032	-	-	-	2
2.4	-						AWL035	AWL034	2
Total	4	0	0	1	1	0	3	3	12

Table 24 Tip form of the Type 2 awls from London.

Type 3 – Square-handled forms

Type 3 awls have robust, parallel-sided square-sectioned handles with bevelled edges. Three objects, AWL036-38, are assignable to this type, but beyond these basic features they are quite different.

AWL036 has a flat butt and tapers simply towards a narrow chisel-like tip, whilst AWL038 tapers to a round-sectioned point. AWL037 has a more complex blade, which turns through multiple facets as it tapers towards the chisel-like tip. As a result, this tool sits very comfortably in the hand. Presumably this strong comfortable grip allows more pressure to be exerted when using the tool with a twist motion. Both AWL036 and AWL037 would probably have been used as bradawls, although AWL037 also has a heavily burred projecting head, suggesting that it was struck with a hammer, and potentially used as a fine chisel. AWL038 seems too thick to have been a stitching awl, and may have functioned as a marking awl or scriber.

The closest parallels come from the Limes forts. A close parallel of AWL037, with an un-burred head, comes from Saalburg (Pietsch, 1983 Taf.13, 296). A parallel for AWL036 comes from Zugmantel (Pietsch, 1983 Taf.13, 297), and both sites have produced similar tools with unbevelled handles (Pietsch, 1983 Taf.13, 288-9).

Type 4 – Rectangular handled forms

The remaining four solid-handled awls, AWL039-42, categorised here as **Type 4**, have few features in common except that they have solid rectangular-sectioned handles. AWL039 comes to a flat point and may have been an awl. AWL040 may also have been an awl, but the point is now corroded and rounded, whilst AWL041 and AWL042 both end in breaks.

Type 5 - Nail Forms

Seven tools, AWL044-50, have been found in London which consist of a long round-headed iron nail, on to which have been threaded round leather washers, which are then cut flush in a series of facets to create tapering handles (Figure 206).

Figure 206 Nail form awl from London (AWL045).

Although the 'nail' used in AWL049 is a simple square-sectioned nail of the normal type, others are not. The majority (AWL043-44, AWL046, AWL048) become round in section as they emerge from the leather handle. AWL045 and AWL050 are unusual in that the nail then becomes diamond-shaped in section as it tapers to a point. This suggests that some of the 'nails' are either purpose-made or deliberately modified components of a recognised tool form. Of the seven objects of this form, three taper to points, whilst the others end in breaks.

Another object in the Museum of London, MOL 78.305, may represent a variant form of this tool. It consists of a square-sectioned nail, threaded with two square leather washers (Figure 207). The tip of the nail is flattened into a sharp, round head. It is possible that this is a form of bradawl. However, if this object originally had a larger handle made of leather washers it is odd that only two washers have survived, especially considering the good condition of the surviving pair. It is also notable that these washers have not been cut flush to each other. It is therefore probable that this is simply a nail threaded with washers for some unknown purpose.

Figure 207 Iron nail MOL 78.305, threaded with leather washers.

The only comparable object known to the author is an awl from Feldburg (Pietsch, 1983, 306), which appears to have a nail-shaped iron component in a cone-shaped horn handle. However, without the organic handles such tools would be indistinguishable from normal Roman nails, and so their survival and identification here owes much to the preserving properties of the Walbrook valley.

The slenderness of the blades of these objects, married with their sharp points and the fact that one has a diamond-section, suggests that these objects are stitching awls.

Tanged Forms

Manning (1985a, pp. 39–41) grouped the tanged awls from the British Museum as Types 1, 4a, and 4b, with 4b being by far the largest and most diverse category. However, within the larger sample of awls from London it is possible to break these down into a larger number of more cohesive groups.

Type 6 – Carrot-Shaped Awls

Type 6 awls are 'carrot-shaped', with a continually tapering round-sectioned blade which is markedly wider than the square-sectioned tang at the other end. This form corresponds to Manning's (1985a, fig. 9) Type 1. Beyond these shared features the four objects of this type from London, AWL051-54, show considerable variety in form. The majority taper continually from the shoulder, but AWL052 swells slightly before tapering, whilst AWL051 tapers continuously from the shoulder. AWL054 is much larger than the others, and has a heavily burred tang with a sloped shoulder, whilst the other two have sharp shoulders separating the tang and blade. Most end in blunt, rounded, round-sectioned points, but the point of AWL052 is much blunter than those of the others, whilst AWL051 has a no tip, coming instead to a flat end.

None of these objects could have functioned as stitching awls. Their blunt tips and continually expanding bodies make them good candidates for being bodkins or fids for basketry or ropework. AWL054 is unusual in having a heavily burred head. This may indicate that it had been peened over a very short handle, but it is also possibly an indicator that it was used as a punch or drift. Objects of this type are not common, but a number are known from France and Switzerland (Table 25).

Site	Site Type	Context	Date	Reference
Colchester	Urban	-	-	(Manning, 1985a, E6)
Verulamium	Urban	Building	140-50	(Manning, 1972b, fig. 61, 15)
Avenches (x2)	Urban	-	-	(Duvauchelle, 1990, No. 156-7)
Chassey-les-Montbozon	Rural	-	200-300	(Feugère, 1997, fig. 14, 1552)
Rocherou	Military	-	20-30	(Feugère, Thauré and Vienne, 1992, No. 159)
Saintes	Urban	-	100-400	(Feugère, Thauré and Vienne, 1992, No. 160)

Table 25 Comparanda for Type 6 awls.

Type 7 – Awls with clenched tangs

Type 7 awls have round- or rounded-square-sectioned blades and long, usually square-sectioned tangs, which are clenched at the ends, indicating that they projected from the backs of their handles. AWL056 retains its wooden handle, showing how it would have been attached (Figure 208). The blade is wider than the tang, sometimes significantly, separated by a sloping shoulder.

Figure 208 Type 7 awl with wooden handle (AWL055).

Fourteen objects of this type, AWL55-69, come from London. There is some variety in the objects of this form. AWL068 is square-sectioned throughout and lacks a shoulder, but has a long clenched tang. Two objects, AWL062 and AWL063, become rectangular in section as they taper to the tip, although only AWL63 is complete, coming to a flat point rather than a chisel-like edge. AWL068 comes to a square-sectioned point. The remaining six objects with complete tips come to round points (Table 26). It is possible that the clenched tangs exposed at the butt of the handles of these tools would have made them uncomfortable to push into leather, and for that reason they may be seen as scratch awls. However, despite being wide at the shoulder, the points of these objects are mostly quite slender, and it is possible that they were used as stitching awls.

	Tip form								
Type	Pointed						Chisel-like	Unknown	Total
	Round	Square	Faceted	Flat	Diamond	Rounded			
7	AWL055-59, AWL064	AWL068	-	AWL063	-	-	-	AWL060-62, AWL065-67	14
Total	6	1	0	1	0	0	0	6	14

Table 26 Tip form of the Type 7 awls from London.

A further object, FIN18, resembles the awls described here, but is unusual in having a rounded chisel-like tip and a flared, burred butt at the end of the tang. Because of these features the object has been interpreted as a punch, but it is possible that it was made from a broken type 7 awl.

Few comparisons for these objects could be found, perhaps because fragments would closely resemble other awl types, or fragments of styli, etc. Nevertheless, three good examples come with Late Roman dates (Table 27). The only certain example of this form from London with a context date, AWL065, is early Roman, although a fragmentary object, AWL066, has a later date.

Site	Site Type	Context	Date	Reference
Neatham	Urban	Pit	250-350	(Redknap, 1986, fig. 80, 276)
Usk	Military	Surface	Late Roman / Medieval	(Manning, Price and Webster, 1995, fig. 78, 4)
Chassey-les-Montbozon	Rural	-	200-300	(Feugère, 1997, fig. 14, 1553)

Table 27 Comparanda for Type 7 awls.

Type 8 – Short-tanged awls

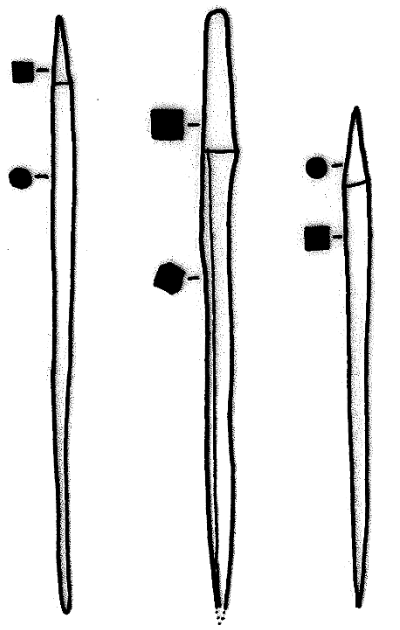


Figure 209 Type 8 short-tanged awl subtypes (8.1, AWL069; 8.2, AWL080; 8.3,

Type 8 awls have short, unclenched tangs. Unlike Type 7, there is rarely a step between the blade and the tang at the shoulder. Type 8 can be broken into three subtypes based on the form of the blade and tang (Figure 209).

Type 8.1 has a square- or rectangular-sectioned tang and a round-sectioned blade. It is by far the most common variant of Type 8, with eleven examples from London (AWL069-79). Unlike Type 7, there is not usually a step between the blade and tang. AWL078 has a longer, thinner tang than most examples of this types, separated from the blade with a stepped shoulder. For these reasons it could be considered an unclenched example of Type 7, although it is classed here as Type 8.1. Two objects, AWL073 and AWL074 are made of copper alloy rather than iron.

This type shows considerable diversity in tip form. Three have round-sectioned points, and one has a flat point. These may have been stitching awls. Two have blunt tips, and may therefore have been scratch awls. AWL076 is unusual in having a chisel-like tip, and in being longer than the majority of the Type 8.1 awls. It is possibly a bradawl, but the tip is slender enough that it may have been capable of piercing leather. We can therefore see this as a basic awl type used for many different functions. Type 8.1 is seen on a wide range of site types (Table 28).

Site	Site Type	Context	Date	Reference
Alcester	Urban/Military	-	300-350	(Mould, 1994, fig. 94, 25)
Alcester	Urban/Military	-	350-400	(Mould, 1994, fig. 95, 27)
Bar Hill	Military	-	-	(Keppie, 1975, fig. 34, 23)
Great Witcombe	Villa	-	-	(Bevan, 1998, fig. 39, 17)
Hod Hill	Military	-	Iron Age / Roman	(Manning, 1985a, E17)
Ickham	Industrial	Midden	300-450	(Riddler and Mould, 2010, fig. 121, 1280)
Ickham	Industrial	-	-	(Riddler and Mould, 2010, fig. 121, 1281)
Ribchester	Military	-	-	(Howard-Davis and Whitworth, 2000, fig. 73, 135)
Stansted airport	Rural	Pit	-	(Major, 2004, fig. 90, 13)
Stansted airport	Rural	Ditch	-	(Major, 2004, fig. 90, 27)

Table 28 Comparanda for Type 8.1 awls.

Type 8.2 has a square- or rectangular-sectioned tang and a square-sectioned blade with bevelled edges. Only three examples, AWL080-82, come from London. Whilst AWL081 and AWL082 are slender enough to have pierced leather, AWL080 is considerably more robust. These objects could be birdcage awls, but this is unlikely as the bevelled edges would limit their ability to cut. They may therefore be scratch awls or scribers. No comparable objects are known, but without good preservation they would be indistinguishable from Type 8.1.

Type 8.3 has a short round-sectioned tang and a square-sectioned blade. Two objects of this type, AWL083 and AWL084, come from London. No comparable objects are known, although without good preservation they would be impossible to distinguish from Type 8.1. The function of these objects is not clear. Their square-sectioned blades would make them suitable for use as birdcage awls, although their round-sectioned tangs would mean they would be liable to come loose and rotate in their wooden handles.

Two further objects also have short square-sectioned tangs. AWL085 has a square-sectioned blade. Unfortunately this object is heavily encrusted, and it is impossible to see whether it has the bevelled edges of Type 8.2. It may have been a birdcage awl, but the tip is broken. AWL086 comes to a neat chisel-like tip, and would have functioned as a bradawl.

Type 9 – Double-ended awls

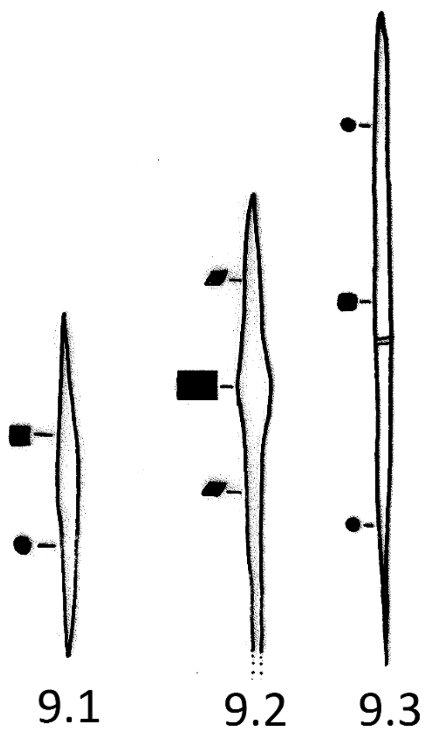


Figure 210 Type 9 double-ended awl subtypes (9.1, AWL093; 9.2, AWL094; 9.3, AWL096).

Type 9 awls are tanged awls in which the blade and tang are roughly identical in length. Three subtypes can be seen in the London collection.

Type 9.1 is widest in the centre, tapering to a round-sectioned point at one end and a square-sectioned point at the other. This can be interpreted as a square-sectioned tang and a round-sectioned blade, as the round-sectioned end is always sharply pointed, whilst the square-sectioned end is sometimes blunt. This is the most common type of double-ended awl in London, with six examples (AWL087-92). AWL092 differs somewhat in having a long parallel-sided square-sectioned segment between the blade and tang. AWL093 is similar except that both ends are square in section. All complete awls of this type come to sharp points, and these were probably leatherworking awls. Comparable objects come from Hill Farm (Manning, 1985b, fig. 21, 167) and Hod Hill (Manning, 1985a, E17-18).

Type 9.2 awls have a central square- or rectangular-sectioned block, with stepped-in arms projecting from each side. Two objects of this type, AWL094 and AWL095, come from London. AWL094 has diamond-sectioned arms, whilst AWL095 has round-sectioned arms. Both Type 9.2 awls from London end in breaks, although the diamond-sectioned tips of AWL094 suggests that it was a stitching awl. However, more complete examples from Bar Hill and Dorchester (Table 29) have been interpreted as bradawls.

Site	Site Type	Context	Date	Reference
Bar Hill	Military	-	-	(Keppie, 1975, fig. 34, 24)
Catterick	Military/Urban	-	160-200	(Mould, 2002b, fig. 271, 37)
Dorchester	Urban	Pit	Late Roman?	(Manning, 2014a, fig. 142, 54)
Dorchester (x2)	Urban	Building	-	(Manning, 2014a, fig. 142, 55-6)
Ickham	Industrial	-	-	(Riddler and Mould, 2010, fig. 121, 1277)
Ilcester	Urban	-	Medieval?	(Leach, 1982, fig. 125, 46)
Richborough	Military/Urban	-	-	(Manning, 1985a, E21)

Table 29 Comparanda for Type 9.2 awls.

Type 9.3 is markedly more slender than the other types, consisting of a square-sectioned bar which tapers gradually to round sectioned points at either end. Two objects of this kind, AWL096 and AWL097, come from London. Comparanda for this delicate form is hard to find, and since neither of the London objects are stratified it is possible that these objects are not Roman awls.

Eight examples of a fourth type of double-ended awl (AWL098, MOL 1584-5, 1619, 13404, A3030 and A19167) were found, all but one in the Roman collections of the Museum of London. This type has a diamond-shaped section, tapering to sharp tips at either end from its widest point in the centre. Objects of this form are found from the early middle ages onwards (Mould, Carlisle and Cameron, 2003, fig. 15742725, 2731), and are the standard form of leatherworking awl on sale today. The author is aware of no examples of this form from securely dated Roman contexts, although a triangular-sectioned awl from Ickham is otherwise very similar (Riddler and Mould, 2010, fig. 121, 1283). It therefore seems likely that these objects are post-Roman, and they will not be included in further discussion. One of these awls, AWL098, does come from a stratified Late Roman context. However, this object is fragmentary, and was recorded from a published illustration. It is therefore possible that it is not truly of this type. The others are all unstratified.

Type 10 – Socketed Forms

The final type of awl is the socketed type. This is a rare form (Manning, 1985a, p. 41), and is represented by only one example from London, AWL099. Other examples come from Catterick (Mould, 2002b, fig. 272, 57) and Verulamium (Manning, 1972b, fig. 69, 121).

Awls with Surviving Handles

Four awl from London have surviving organic handles. They may belong to some of the types described above, but cannot be categorised as their tangs are obscured by the handles.

AWL100 has a simple handle made from an unshaped bone, and a square sectioned blade. It is therefore more likely to be a birdcage awl or scratch awl than a leatherworking awl.

AWL101 has a handle made from an antler tine. However, the blade is of a form not seen elsewhere in the assemblage, and as the object lacks provenance it may not in fact be Roman.

AWL102 has an elaborately formed handle, but doubt must be raised as to whether it is actually Roman. Very similar awls, described as being 'in the English style', are visible in an 18th century French engraving figured by Salaman (1986, fig. 2:6). As this object has no provenance other than 'London', it is probable that it is in fact a Post-Medieval awl.

Figure 211 Left, AWL102 from the British Museum. Right, 'English style' awls from the 18th century (Salaman, 1986, fig. 2:6).

AWL103 has a small pear-shaped handle. In both the robustness of the blade and the shape of the handle it strongly resembles modern basket-making bodkins (Humphreys in Marshall and Wardle, forthcoming). With the naked eye, there appears to be a sharp shoulder between the blade and tang, although this is not visible on x-ray and may be the result of corrosion. It is therefore not clear whether this tool should be seen as a Type 8.1 or Type 9.2. A tool with a similarly-shaped handle comes from Ilchester (Leach, 1982, fig. 126, 100).

Miscellaneous 'Awls'

Finally, a number of pointed metal objects were found which cannot be neatly included in the types described above. These objects are described here for convenience, although it is unlikely that most of them functioned as 'awls'. Most of these objects are tanged and would have been inserted into organic handles.

AWL104 is a round-sectioned bar, tapering to a sharp point. It has no distinct tang, instead tapering slightly towards a flat butt. When mounted in a wooden handle, this object would be indistinguishable from a Type 8.1 awl.

AWL105 is similar to Type 9.2, having an expanded central section, but is unique in several respects. The blade is extremely narrow, and unusual in having a washer. The tang is rectangular in section.

AWL106 has two square-sectioned ends of equal length, although one is much thicker than the other. It is not clear which is the blade and which is the tang, but it is likely that either end would have functioned as the blade of a birdcage awl or reamer.

AWL107 is an unusual object, with a short square-sectioned tang and long round-sectioned blade separated by a small feathered block at the shoulder. Its function is not obvious, and its uniqueness means that there must be doubt as to whether it is Roman.

AWL108 has a straight, chisel-edged tang, stepping out to a round-sectioned blade. It is somewhat similar to Type 7, but lacks a clenched tang and is unusual in being made of copper alloy. It is possibly a small stylus rather than an awl.

AWL109 has a flat scale tang and decorated shaft. It seems unlikely to have been a craft tool, and may not be Roman.

AWL110 is a neatly made copper alloy piercing tool which would probably not have been mounted in a handle. It seems unlikely that it was used in leatherwork, although its function is unknown.

AWL111 is similar to a more roughly-made iron version of AWL110.

Axes

Technology

Axes are hafted tools with a vertical blade in line with the handle. Tools with horizontal blades are discussed elsewhere as adzes (see p.369) and hoes (see p.503). Axes in the Roman period were universally shaft-hole tools (although see p.416 for socketed billhooks that could have functioned as axes), which had supplanted socketed axes in Britain in the Late Iron Age (Manning and Saunders, 1972; Darbyshire, 1995, pp. 290–359). The terms used to describe shaft hole axes are taken from Manning (1985a), and are summarised in Figure 212.

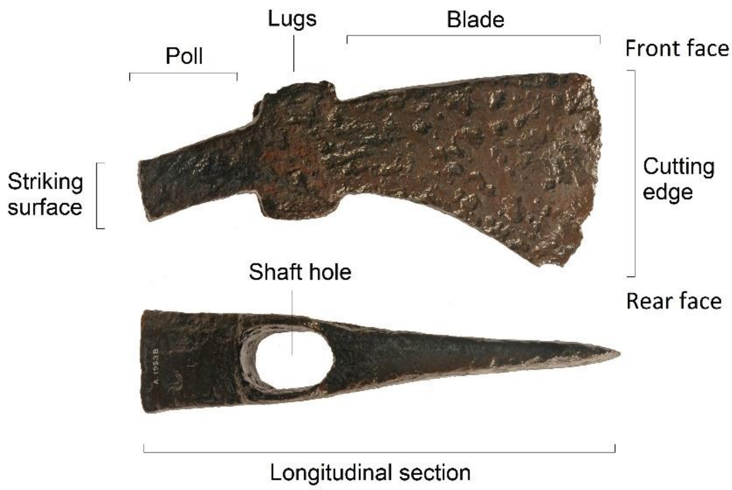


Figure 212 The terminology used to describe axes.

Most Roman axes have a wedge-like triangular longitudinal section and round or oval shaft hole, in contrast to the triangular shaft hole seen in Medieval and later tools (Figure 213). They often have an extended poll, sometimes described as a 'hammer poll', which can show signs of burring. A few have polls shaped like hammer heads (Champion, 1916, No. 18173; Goodman, 1964, fig. 14b; Pietsch, 1983, Taf. 2, 31; Holmes, 2003, Illus. 107), although most are simply rectangular-sectioned extensions of the main tool body. These may have been used as hammers for driving in nails, or as striking surfaces to drive an axe like a wedge through a heavy timber. Some have lugs around the shaft hole, which gave the haft extra stability and can be used for dating (see p.412).

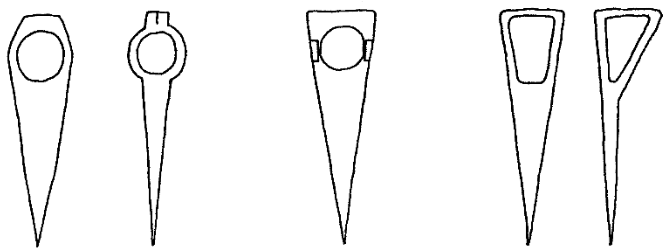


Figure 213 Late Iron Age (left), Roman (centre) and Medieval (right) axe section and shaft-hole shapes (Hanemann, 2014, Abb. 293).

Modern and Medieval axes can have a wide variety of blade shapes, lengths and widths specialised for a wide range of different tasks (Goodman, 1964, pp. 27–38; Salaman, 1975, pp. 46–66). They can be narrow-bladed, bearded (in which the rear face curves downwards substantially) or T-shaped (in which both the front and rear faces curve dramatically away from the shaft hole). They can be symmetrical or set to one side (side axes), with an offset shaft hole and a sharpening bevel on one side only, creating a flat, plane-like surface on the other (Figure 214). The majority of axes in the Roman period show little evidence of specialisation of thes types, although there is some evidence in London for a Late Roman change towards medieval style axe technologies (see p.107).

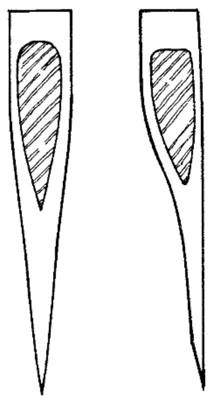


Figure 214 Symmetrical axe section (left) and side axe section (right) (Salaman, 1975, fig. 91).

Numbers

27 axes from London are discussed here; 21 from the Museum of London, three from the LAARC, two from MOLA and two from the British Museum.

Typology

Manning's (1985a, fig. 3) four-part typology of Roman axes in the British Museum is widely used in British archaeology. However, this is a limited tool for assessing Roman axes on an international scale as numerous supplementary forms exist on British and Continental sites. Several authors have created alternative axe typologies to satisfy the needs of their assemblages (Pohanka, 1986, pp. 229–30; Duvauchelle, 1990, p. 16; Tisserand, 2001, fig. 13), with a summary of the various types provided by Rupnik (2014, Abb. 2), whilst Pietsch (1983, p. 12) considered them to be too variable to create a typology, instead focussing on a discussion of their individual characteristics.

An ambitious recent typology by Hanemann (2014, Abb.294) has sought to account for all known Roman axe forms. This typology, in 21 parts (39 including subtypes), is broken into three main categories; *Blattäxten* (narrow-bladed axes), *Bartäxten* (bearded axes) and *Breitäxten* (T-shaped axes). Although initially confusing to look at, this typology accounts quite well for both the variation in axe form and the similarity between some distinct types. The types are presented in columns, and are arranged in such a way that similar types with narrow, bearded or T-shaped blades are on the same level.

This typology is complicated by the inclusion of some non-Roman axe types. Type 8 axes are early medieval *franciscae*, although these were deliberately included to highlight how they may have evolved gradually from Roman-period Type 7 axes (Hanemann, 2014, p. 340). More problematic is the inclusion of Type 6 and Type 16 socketed axes. The date of these axes is debated, with some (Mossler, 1974, Abb. 34; Pietsch, 1983, Taf. 2, 37-41) interpreting them as Roman, and the Museum of London cataloguing them as medieval (Ward-Perkins, 1940, figs 12, 5-6). They may even be post medieval (Goodall, 1980, p. 20). These tools have triangular shaft-holes, whilst Roman tools almost universally have round or oval shaft holes (Hanemann, 2014, Abb. 293). Some, including examples from the Museum of London (Ward-Perkins, 1940, fig. 14, 1) and Saalburg (Pietsch, 1983, Taf. 2, 38), have small maker's stamps resembling flowers, which differ significantly from the usual rectangular Roman makers' marks (see p.621). Goodman (1964, figs 21-2) figures examples of these tools from the Swedish *Nordiska Museet*, which are extremely unlikely to be Roman, whilst the depiction of a Type 16B axe in the early 15th century Merode Altarpiece (Goodman, 1964, p. 30), complete with maker's stamps (Figure 215), confirms their late-medieval date. Nevertheless, Hanemann's typology is easily the most comprehensive available, and is the most appropriate for categorising the diverse collection of axes from London.

Figure 215 Detail of the Merode Altarpiece, showing a Type 16B axe (https://commons.wikimedia.org/wiki/File:Robert_Campin_-_M%C3%A9rode_Altarpiece_(right_wing)_-_WGA14422.jpg).

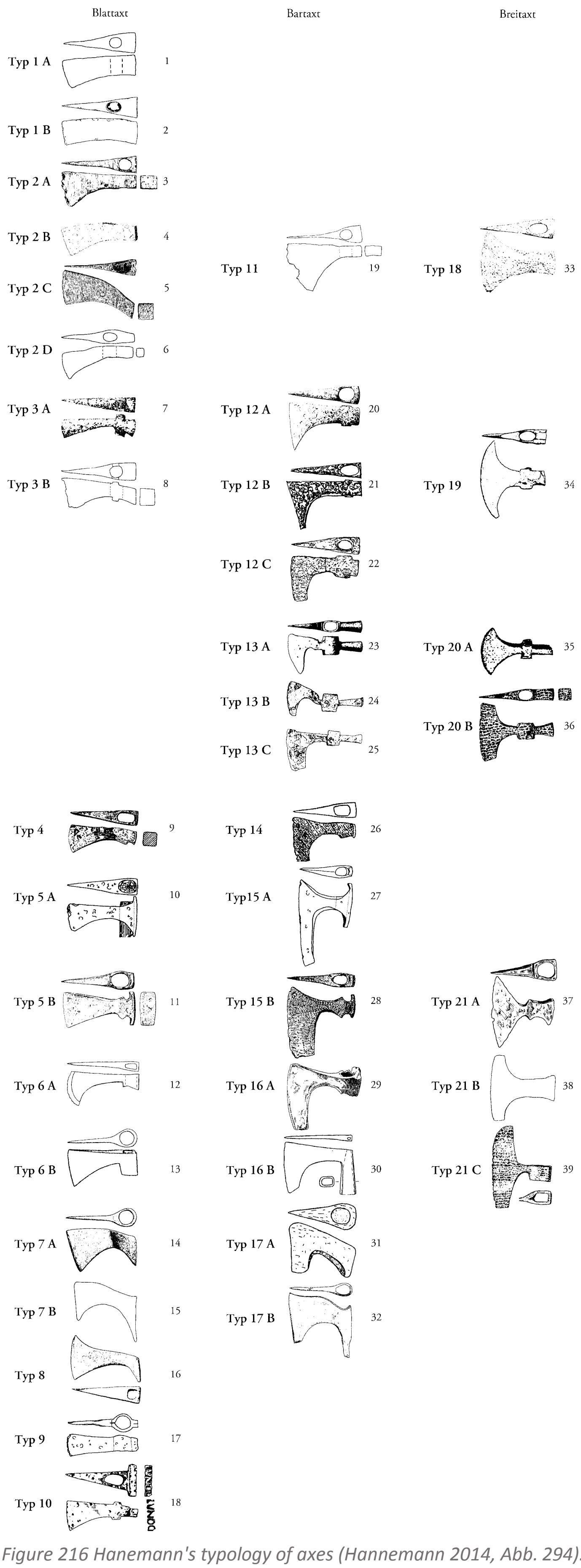


Figure 216 Hanemann's typology of axes (Hannemann 2014, Abb. 294).

Discussion here will be limited to the types of axes found in London, all of which are characterised by a triangular longitudinal section and oval shaft hole.

Narrow-Bladed Axes (Types 1-10)

Types 1-3 correspond to Manning's Types 1-4, and represent the most common types in Britain.

Type 1 axes have blades which increase in size only a little or not at all from the poll to the tip. **Type 1A** has a straight front face and a curving rear face, whilst both faces of **Type 1B** curve downwards slightly. One axe of each subtype, AXE01 and AXE02, come from London. These types are not common in Britain, with only two Type 1As known to the author, from Verulamium (Manning, 1972b, figs 60, 7) and Camerton (Jackson, 1990, figs 22, 232), although both are more common in Germany (Manning, 1985a, p. 15; Hanemann, 2014, p. 337). Manning (1985a, p. 15) notes that this type is similar to the medieval woodsman's axe (Ward-Perkins, 1940, pp. 55–6), and AXE01 was originally catalogued as such in the Museum of London. Its heavy, narrow blade would be ideally suited to felling.

Type 2 in Hanemann's typology encompasses a range of forms. Two axes, AXE14 and AXE15, survive only as fragments, and as such cannot be categorised beyond saying that they conform to Type 2. Types 2B-D are all variations on the objects described by Manning as Type 4, and are not always easy to distinguish from each other.

Type 2A is clearly distinct from the others, having a straight front face and heavily curved rear face, corresponding to Manning's Type 2. Three objects of this type, AXE03-05, come from London. Although a number of examples are known (Table 30), this type is less common than the lugged variant, Type 3A (Manning, 1985a, pp. 15–6).

Site	Site Type	Context	Date	Reference
Beadlam	Villa	Topsoil	-	(Neal, 1996, fig. 41, 115)
Combend	Villa	-	-	(Manning, 1985a, B2)
Saalburg (x3)	Military	-	85-260	(Pietsch, 1983, Taf. 1, 11, 11a, 13)
Soulce-Cernay	Rural	Hoard	400-450?	(Mazimann, 2012, fig. 21)
Zugmantal (x3)	Military	-	90-260	(Pietsch, 1983, Taf. 1, 11b-c, 13a)
Xanten (x2)	Urban	River	-	(Schalles and Schreiter, 1993, Taf. 63, Ger 1, 2)

Table 30 Comparanda for Type 2A axes.

Type 2B curves gently from both sides, with an extended poll at the rear. Five objects of this type, AXE06-10, come from London. This subtype is not common in Britain, although examples come from Late Roman hoards at Silchester (Evans, 1894, fig. 12) and Dorchester (Frere, 1984, figs 35, 42).

Type 2C has heavily curved upper and front face, with a shaft hole set very close to a low-slung poll. No objects of this type come from London, although the type is common in Britain, particularly from later Roman contexts (Table 31). This type is very similar to the early medieval *francisca* (Type 8), and the examples from Hill Farm may in fact be early medieval (Manning, 1985b, pp. 46–8). Three similar objects from London, MOL A13926, A19539, and O2096a, have upturned toes, and so are interpreted as *franciscae* rather than Type 2C axes, and are not discussed here. The type 2A AXE06 currently strongly resembles this form, but X-rays show that this is due to the loss of material to corrosion.

Site	Site Type	Context	Date	Reference
Burgh Castle	Military	-	350-500	(Hayes, 1991, No. 169)
Coldham Common	-	Hoard?	300-400?	(Manning, 1985a, B5)
Great Holts Farm	Villa	Pit	250-410	(Major, 2003, fig. 61, 15)
Hill Farm (x2)	Villa	Unstratified	-	(Manning, 1985b, fig. 20, 161-2)
Richborough (x2)	Military/ Urban	Unstratified	-	(Henderson, 1949, Pl. LXI, 341-2)
Great Chesterford	Urban	Hoard	200-400?	(Neville, 1856, Pl. 1, 9)

Table 31 Comparanda for Type 2C axes.

Type 2D has a long, heavily curved blade and a long extended poll. Three objects of this type, AXE11-13, come from London. Another example comes from Housesteads (Manning, 1976b, figs 15, 55)

Type 3 axes are variants on Type 2 axes, distinguished by having lugs surrounding the shaft hole on the front and rear faces**. Type 3A** is the lugged variant of type 2A, and is represented by one example from London, AXE16. This type is more common than the unlugged Type 2A (Manning, 1985a, pp. 15–6), although British examples come almost exclusively from military sites (Table 32).

Site	Site Type	Context	Date	Reference
Brampton	Military /Industrial	Hoard	100-125	(Manning, 1966, No. 6)
Camerton	Military?	-	100 BC-AD 100?	(Jackson, 1990 Pl. 21, 231)
Carlingwark Loch	-	Hoard	70-200	(Piggott, 1952, fig. 9, C51)
Housesteads	Military	-	124-410	(Manning, 1976b, fig. 15, 54)
Newstead	Military	Pit	140-211	(Curle, 1911, Pl. LXI, 1)
Newstead	Military	Pit	80-105	(Curle, 1911, Pl. LXI, 4)
Strageath	Military	Hoard	69-96	(Grew and Frere, 1989, fig. 82, 117)
Wilderspool	Urban/Industrial	-	-	(Thompson, 1965, fig. 22, 2)
Avenches	Urban	-	-	(Duvauchelle, 1990, No. 34)
Feldburg	Miltiary	-	150-260	(Pietsch, 1983, Taf. 1, 17)
Haltern	Military	-	1 BC-AD 9	(Harnecker, 1997, Taf. 2, 5-6)
Saalburg (x8)	Military	-	85-260	(Pietsch, 1983, Taf. 1.18, 18a, 2.19a, 19c, 20, 20b-d)
Zugmantel (x8)	Miltiary	-	90-260	(Pietsch, 1983, Taf. 1.17a-b, 18b, 2.19, 19b, 20a, 20e-f)

Table 32 Comparanda for Type 3A axes.

Type 3B represents lugged variants on Types 2B-D, and is represented by six objects from London, AXE17-22. This type appears to be less common that the unlugged Types 2B-D.

Site	Site Type	Context	Date	Reference
Dinorben	Hillfort	Rampart	100 BC-AD 50?	(Gardner and Savory, 1964, fig. 24, 1)
Housesteads	Military	-	124-410	(Manning, 1976b, fig. 15, 56)
Vindolanda	Military	-	120-40	(Blake, 1999, No. 5904)
Niederbieber	Military	-	185-260	(Gaitzsch, 1980, Taf. 48, 246)
Saalburg (x4)	Military	-	85-260	(Pietsch, 1983, Taf. 2, 23a-c, 24)
Vetera	Military	-	12 BC-AD 276	(Gaitzsch, 1980, Taf. 52, 258)
Zugmantel (x2)	Military	-	90-260	(Pietsch, 1983, Taf. 2, 23, 24a)

Table 33 Comparanda for Type 3B axes.

Type 4 axes resemble Types 2A-D, but have triangular lugs on the underside of the shaft hole only. Those discussed by Hanemann have a straight front face, but there appears to have been two variants on this object, as the London example, AXE23, has heavily curved front and rear faces. Other examples of this curved type come from Avenches (Duvauchelle, 1990, No. 37-8), Beadlam (Neal, 1996, figs 41, 114), and the Yorkshire Museum. Hanemann (2014, p. 345) considered the straight-topped Type 4 to be a Germanic form, which is mostly concentrated in free Germany from the 3rd to 5th centuries (Figure 217). This is supported by the fact that an example Dorchester on Thames comes from the grave of a man with Continental type military equipment, who may be a Germanic immigrant (Booth, 2014). Another comes from the Saxon

Short fort at Richborough (Böhme, 1986, Abb. 40). It is not clear if the same is true of the curved examples, however.

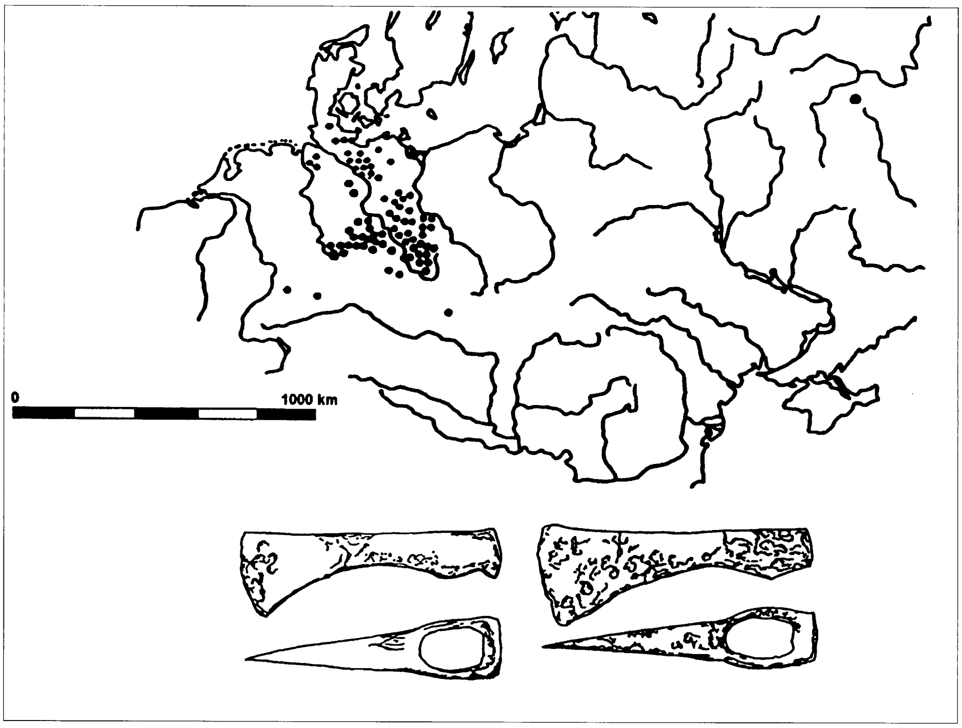


Figure 217 Distribution map of Type 4 axes (Hanemann 2014, Abb. 299).

Type 5 axes are characterised by a rectangular plate extending up and down the shaft from the end of the poll. This type can be subdivided into those with triangular lugs around the eye (**Type 5B**) and those without (**Type 5A**). One object of this type, AXE24, comes from London. This object may have rectangular rather than triangular lugs, but this is obscured by heavy corrosion. This object also has a small beard, and may therefore belong to the bearded variation, Type 15B. The beard on AXE24 is, however, much smaller than that on the bearded AXE25, or those figured by Hanemann (2014, Abb. 294, 27-8).

Site	Site Type	Context	Date	Reference
Albing	Military	-	174-200	(Pohanka, 1986, Taf. 43, 184)
Baumgarten am Tullnerfeld	-	Burial	350-400	(Pohanka, 1986, Taf. 43, 178)
Carnuntum	Urban	-	-	(Pohanka, 1986, Taf. 46, 204)
Keszthely-Fenékpuszta (x11)	Military	-	Late Roman	(Rupnik, 2014, Taf. 1.5-7, 2.1-8)
Lauriacum	Military	-	200-400	(Pohanka, 1986, Taf. 43, 185)
Lety	-	Hoard?	-	(Hanemann, 2014, n. 280)
Mauer an der Url (x5)	-	Hoard	200-250	(Pohanka, 1986, Taf. 43.179-80, 46.201-3)
Straubing	Military	-	-	(Hanemann, 2014, n. 280)
Vertault	Urban	-	-	(Tisserand, 2010, Pl. 5, 58)
Xanten-Wardt	Urban	River	-	(Schalles and Schreiter, 1993, Taf. 63, Ger 3)

Table 34 Comparanda for Type 5B axes

Bearded Axes (Types 11-17)

Type 15 is the bearded variant of Type 5, characterised by a rectangular plate at the back of the poll. Like Type 5, it can be subdivided into those with (**Type 15B**) and without (**Type 15A**) triangular lugs. Although originally catalogued as a medieval battle axe (Ward-Perkins, 1940, fig. 15, 1), AXE25 conforms to Type 15B, and is probably a Roman object.

Site	Site Type	Context	Date	Reference
Alach	-	-	-	(Hanemann, 2014, n. 302)
Keszthely-Fenékpuszta (x2)	Military	-	Late Roman	(Rupnik, 2014, Taf. 3, 4-5)
Tuttlingen	-	Hoard?	-	(Hanemann, 2014, n. 302)
Urach	-	-	-	(Hanemann, 2014, n. 302)

Table 35 Comparanda for Type 15B axes.

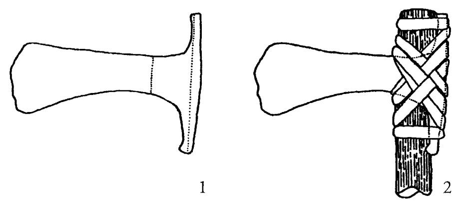


Figure 218 Method of mounting Type 5 and Type 15 axes (Hanemann 2014, Abb. 295).

The rectangular plates at the polls of these objects are thought to have been used to more securely attach the blade to the handle (Figure 218), although the plate on AXE25 is set back from the shaft hole. This also appears to be the case with AXE24, although this is obscured by corrosion.

AXE24 and AXE25 appear to be unique in Britain. Axes of these types have a limited distribution and date range, being found in large numbers in the area around modern day Austria, in the Roman provinces of Pannonia and Noricum, from the beginning to the second half of the 3rd century AD (Hanemann, 2014, p. 346). This indicates the presence of regional workshops producing tools in a provincial style (ibid). Notable outliers come from Alach, Xanten and Vertault (Table 34, Table 35). Unlugged versions of these axes are also found in Avenches (Duvauchelle, 1990, No. 43, 45).

T-Shaped Axes (Types 18-21)

Hanemann's **Type 21** nominally comprises T-shaped variants on Types 5-6, although the only subtype represented in London, **Type 21B**, is not obviously related to the others. Tools of this type have the triangular longitudinal section, flat butt and round shaft hole of other Roman axe types, and a blade which flares out on both sides, terminating in flat ends rather than pointed tips. This type is not common in the Roman period, with Hanemann (2014, p. 342) citing only three examples, one from Cologne and two from the 3rd century Neupotz hoard. Champion (1916, Pl.II, 28990) publishes another from Compiègne. Other examples may be early medieval; Hayes (1991, No. 174-5) publishes two from 'near Mainz', ascribing a 6th century or earlier date to them, and six more come from the Merrovingian cemetery at Ennery (Hoffman, 1985, Pl.X, 1-3, 5-7). One object from London, AXE26, conforms to this type. This was originally catalogued as an early medieval object, although it has no provenance associated with it. If it is indeed a Roman axe, it appears to be unique in Britain.

Another axe from London, AXE27, does not fit anywhere in Hanemann's typology. This tool has no associated dating evidence and is not paralleled in any object known to the author. The T-shaped blade attached by means of an octagonal-sectioned bar is highly unusual. Nevertheless, it is possible that this tool is Roman. AXE27's poll extends down the shaft in the manner of a Type 7 or 17 axe, and it could be seen as a T-shaped variant on these forms, which could be added to Hanemann's typology as a Type 22. Alternatively, this may be an early medieval tool derived from a Type 8 *francisca*.

Double-Bladed Axes

A final axe from London, AXE28, is double-bladed. Although recorded as a Roman object, the date of this tool is uncertain. Double-bladed axes are rare, but not totally unknown in the Roman period. An un-lugged double-bladed axe similar to AXE28 is shown amongst a group of carpenter's tools on an altar dedicated to Minerva from Rome (Figure 289), and an example of possible Roman date comes from Cimiez, France (Hayes, 1991, No. 161). An example from Avenches (Duvauchelle, 1990, No. 40) has recttangular lugs around the eye. Double-bladed axes may have been used for shaping stone blocks (Blagg, 1976, p. 156).

Metric Analysis

Beyond classifying objects by form, several authors have sought to differentiate between axes on metric grounds. Manning (1985a, p. 15) breaks his six axes into two classes by weight, clustered around 770g and 1600g, whilst Pohanka (1986, pp. 261–2) notes a cluster in the data for Austrian axes between 180-190mm long. This is suggested to represent a standardisation of axes at 10 *digiti* (185mm). However, the majority of authors follow Pietsch (1983, fig. 12) in using both length and weight to determine their clusters. Pietsch divided his 56 axes into four categories; one category of miniature axes, and three clusters of full-size axes at 100mm/250-470g, 150mm/700-1000g, and 200mm/1000-1300g. Pietsch (1983, fig. 12) also suggested that a cluster of axes at around 300g represented the manufacture of axes to one Roman pound. Rupnik (2014, fig. 185) divided their axes into three groups, with clusters at 110-120mm/150-200g, 150-160mm/500g, and 190-240mm/950-1300g. Finally, Duvauchelle (1990, fig. 17) breaks the axes from Avenches into two groups, at 90-160mm/250-600g and 145-180mm/500-1300g.

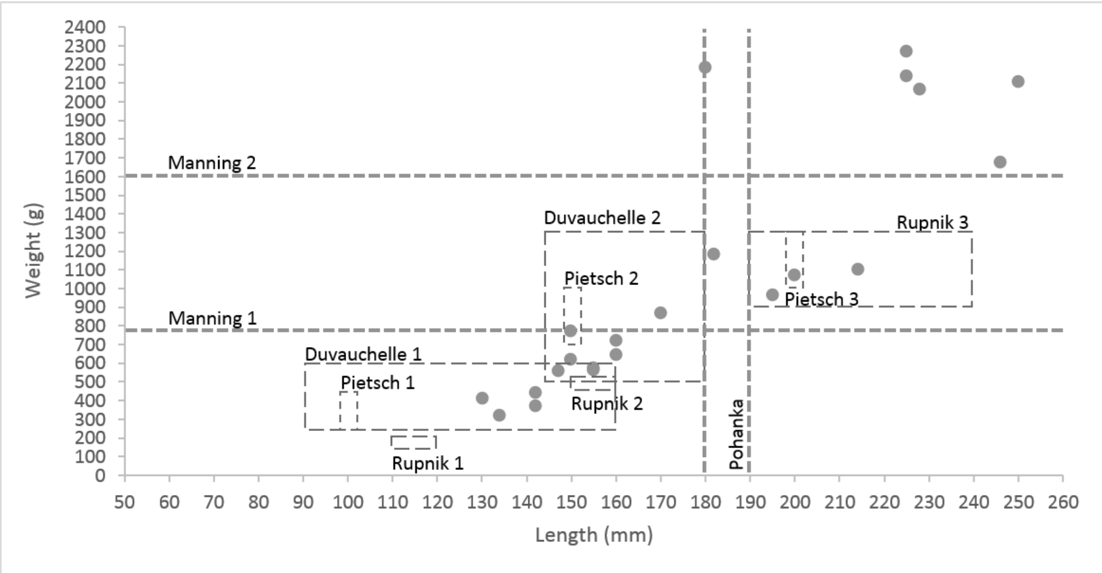


Figure 219 The lengths and weights of the complete axes from London (total = 22) plotted against the clusters suggested by Pietsch (1983, fig. 12), Manning (1985, p. 15), Pohanka (1986, pp. 261-2), Duvauchelle (1990, fig. 17) and Rupnik (2014, fig. 185).

From Figure 219 it is clear that none of these schemes are relevant to the axes from Roman London. The majority of the axes from London closely follow a simple pattern or getting heavier as they get longer (Figure 220). Several axes are lighter than would be expected for their length. Some of these will have lost weight to corrosion or missing elements. AXE25 is the only axe that is significantly heavier than expected. This is because the beard would create extra weight without affecting the length.

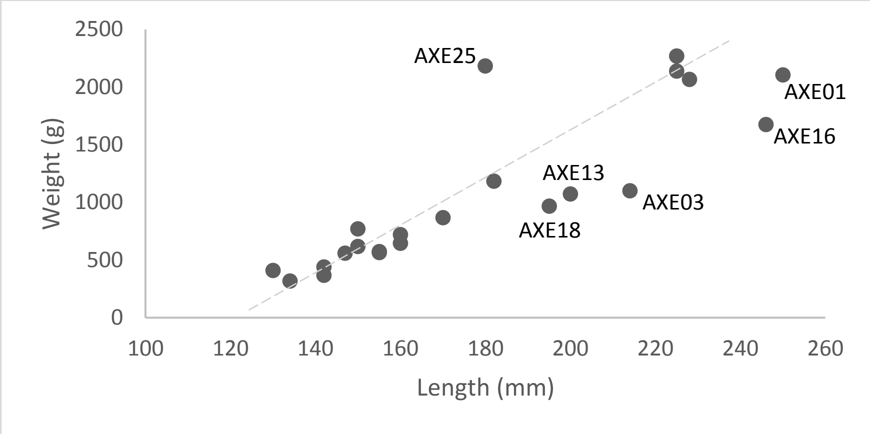


Figure 220 The lengths and weights of the complete axes from London (total = 22).

Looking at only weight, most of the axes from London form a continuous group from 317g (AXE12) to 1183g (AXE07), with no internal clustering or standardisation. However, there is an outlying group of six exceptionally large axes over 2kg in weight (AXE01, 02, 09, 10, 22, 25). Whether or not this constitutes a 'large type' that would have been recognisable in the Roman period is uncertain. Three of these axes have the same length-to-weight ratio as the other London axes (Figure 220), and it is possible that, given the small sample size, other axes would have existed that would have filled in the gap between 'light' and 'heavy' axes. Only AXE16 (1676g) currently sits between these two groups. Weight will also have been greatly affected by taphonomy, with concretions adding to weight, and corrosion and conservation removing it. Nevertheless there is no indication from this data that the axes from London were made to standard Roman weights.

Axes do not form obvious groups based on length, nor are clear clusters visible at standardised measurements. Most axes, regardless of overall length, fit into a narrow window of blade widths between 46 and 79mm wide, with the double-bladed AXE28 being a slight outlier at 92mm wide, and the bearded AXE25 and T-shaped AXE26-7 deviating from this considerably (Figure 221).

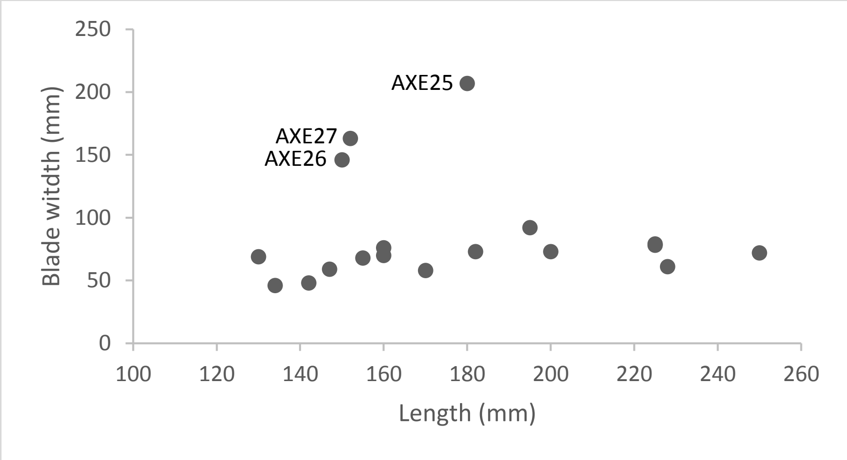


Figure 221 Weight and length measurements of the complete axes from London (total = 18).

Although many of the narrow-bladed axes cluster around the 3 *unciae* (73.8mm) / 4 *digiti* (74mm) width mark (Figure 222), their deviation from this point is so wide that this is unlikely to represent standardisation. Some standardisation in blade width may be evidenced in the wider bearded and T-shaped axes, although this is far from certain. AXE26 is 146mm wide; close to the 6 *unciae* (147.6mm) / 8 *digiti* (148mm) mark. AXE27 is 163mm wide, which is close to the 9 *digiti* (166.5mm) mark. AXE25 is 207mm wide, which is somewhat close to the 11 *digiti* (203.5mm).

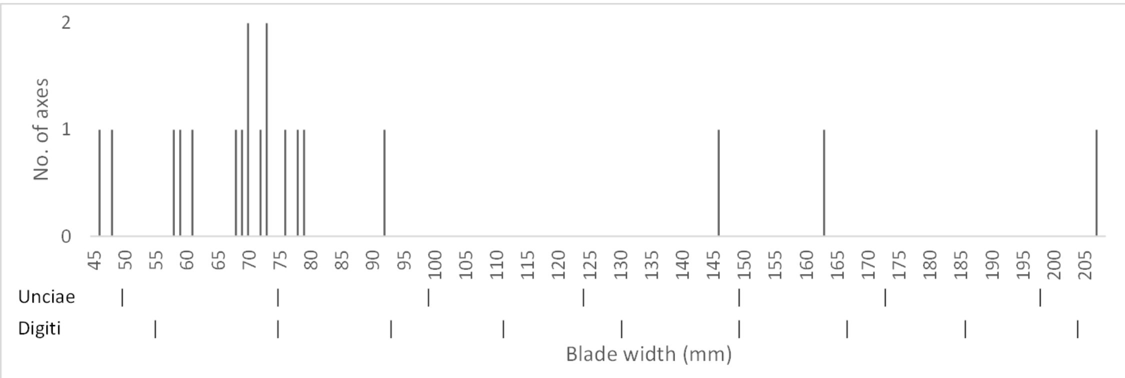


Figure 222 Blade widths of the complete Roman axes from London (total = 18).

Dating

Few of the axes from London have secure stratigraphic dating, and as such they have been phased based on their forms. Whilst most Roman axe forms are clearly recognisable when compared to the axes of other periods, others are not so clearly differentiated.

Shaft hole axes are known in the British Iron Age (Darbyshire, 1995, pp. 325–46), although socketed axes are more common. The majority of Iron Age forms are clearly differentiated from those of the Roman period by their expanded eyes and narrow polls (ibid). One axe with a typically Roman profile, from the Dinorben hillfort (Gardner and Savory, 1964, p. 155) was considered to be late Iron Age, but is perhaps more likely to have been early Roman, or an early import (Manning, 1966, p. 13). However, Darbyshire's (1995, p. 328) Late Iron Age Form 2 has the rectangular poll and triangular longitudinal section of Roman axes. One axe from the Museum of London, AXE05, was originally catalogued as Roman, and is categorised here as a Type 2A, but resembles Darbyshire's Form 2a. It may therefore be Late Iron Age.

Some chronological distinctions are visible within the Roman period. Lugs are common on axes in Britain in the 1st and 2nd centuries, with unlugged axes appearing in the 3rd and 4th (Manning, 1966, fig. 13, 1972b, p. 164; Pietsch, 1983, p. 13). However, it is probable that this apparent distinction is caused by the contexts in which tools survive, i.e. hoards. Since lugged axes seem to have developed on provincial military sites (Hanemann, 2014, p. 345), this chronological trend may reflect the fact that most early hoards in Britain come from military sites, whilst the later ones are from civilian sites (Manning, 1966, p. 13). Finds from Pompeii and Herculaneum demonstrate that unlugged 'civilian' axes were present on the Continent in the 1st century (Manning, 1966, fig. 13; Pietsch, 1983, p. 13).

Pietsch (1983, p. 46) suggests that rectangular lugs become shorter and wider over the course of the Roman period (Figure 223), although Hanemann (2014, p. 345) found that they had gone out of use on most common axe types by the 4th century. Triangular lugs are a feature of Late- and post-Roman tools (Hanemann, 2014, p. 345).These different shapes can be seen amongst the lugged tools from London, although there are issues with supposing that these minor developments occurred concurrently across the Empire.

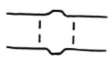
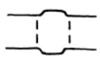
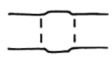
	Frühe Kaiserzeit 1. Jh.	Mittlere Kaiserzeit 100 – 260	Späte Kaiserzeit 260 – ca. 400
Schaftlochlappen			

Figure 223 The development of Roman lug shapes (Pietsch 1983, Abb. 26).

Five axes came from recent excavations, although AXE06 does not have any associated dating evidence. AXE24 supports the 3rd century dating attached to the triangular-lugged Type 5B. AXE22 has wide, low lugs, and comes from a 3rd or 4th century context, supporting the patterns identified by Pietsch (1983, Abb. 26). AXE14 and 21 are unfortunately too badly corroded to tell the shape of their lugs.

Bench Knives

Technology

Bench knives (referred to by Manning (1985a, p. 19) as pivoted knives, also commonly referred to as cloggers' knives) are bladed woodworking tools, modern examples of which resemble a cleaver with a hook at one end and a long handle at the other. The hooks of these tools are attached to a staple in a wooden bench, allowing the knife to pivot (Salaman, 1975, p. 249). These tools are used to shave and carve wooden objects; the wooden object is held in one hand, with the other hand using the blade like a lever to shave off the wood (Figure 224). Today, these tools are used to make rake tines, tent pegs and spoons, and are particularly strongly associated with clog making (Salaman, 1975, pp. 249–50).

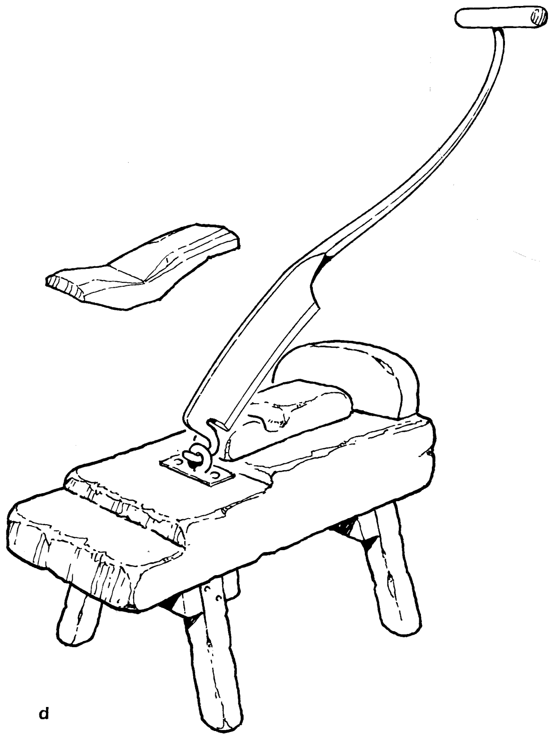


Figure 224 A modern Clogger's knife and stool (Salaman 1975, fig. 399).

Numbers

Two possible bench knives come from London, one from the Museum of London and one from the British Museum, although neither is identified with certainty.

Typology

BEN01 is a small socketed knife with a long, looped bar projecting from the tip of the blade. Knives with this feature are common on Continental Europe in the Late Iron Age (Jacobi, 1974, pp. 45–7, Taf. 24, 402-4), and continue to be used on some early Roman sites in Northern Europe (Table 36). Coming from London, it is likely that BEN01 is later in date than the majority of the Continental examples. The majority of known examples from Europe have a flat handle or tang with a looped butt, and BEN01 is therefore unusual in being socketed.

Site	Site Type	Context	Date	Reference
Augsberg-Oberhausen	Military/ Urban	-	27 BC - 16 AD	(Deschler-Erb, 2014, Abb. 4, O/1114)
Haltern	Military	-	1 BC - 9 AD	(Harnecker, 1997, Taf. 33, 367)
Magdalensberg (x2)	Urban	-	15 BC - 50 AD	(Pohanka, 1986, Taf. 40, 169, 170)

Table 36 Comparanda for BEN01.

Jacobi (1974, pp. 45–7) has discussed the Iron Age examples of this type, suggesting that they should be seen as small bench knives. Their interpretation as woodworking tools is supported by their appearance in graves and hoards alongside other woodworking tools (Jacobi, 1974, p. 46). However, these objects have also been interpreted as pruning knives (Jacobi, 1974, pp. 45–6; Mossler, 1974, p. 79; Pohanka, 1986, Taf. 40, 169-70; Hanemann, 2014, pp. 207–8). This is potentially given support by the existence of Iron Age examples with serrated blades (Jacobi, 1974, p. 46), and the fact that most Continental examples have a loop at the butt, presumably for suspension. This would be an unusual feature on tools which would have been attached to a bench. The split socket on BEN01 would also be unusual on a woodworking tool, but split sockets are common on agricultural tools. As such, there is a question mark over the function of these objects. If they did function as bench knives, their small blades would be suitable only for making small objects, such as pegs or spoons.

BEN02 was identified by Manning as a bench knife, although there is no surviving loop. It may be a bench knife or drawknife, although it’s very narrow blade would be unusual on either tool. BEN02’s identification must therefore be considered uncertain.

Billhooks

Technology

Billhooks are curved bladed tools used in harvesting, forestry and crafts. They are larger and more robust than sickles and reaping hooks (see p.575), although there is overlap between some types of Roman reaping hook and billhook (Manning, 1985a, p. 55). The billhooks from London are considerably larger than the reaping hooks, so there is no confusion between the two here.

Billhooks can be used to cut brush and branches as well as leaves and plant stems. As well as curved cutting edges, Roman billhooks can have short projections at the tip, which may have been used to hook branches down for cutting (Rees, 1979, pp. 467, 469). Some also have 'talons'; small supplementary blades projecting from the back edge of the blade (Hanemann, 2014, Abb. 178, 180-2), although these are not present on any of the London tools. Some billhooks, especially Type 4, are very robust and could have functioned as light axes (Rees, 1979, p. 470), although an example from Hill Farm had not been hardened in the same way as an axe from the same site, limitng its use as a craft tool (Manning, 1985b, p. 48). All of the tools from London have blades which are flat on one side and bevelled on the other, similar to the set seen on modern 'side axes' (Figure 214). As such it is possible that they were used as woodworking tools, although the presence of curved edges and tip projections makes this unlikely.

Numbers

Nine billhooks have been found in the London collections, all but one of them at the Museum of London. Many of them were catalogued as medieval, but their form is well paralleled amongst Roman objects (below). One further object comes from excavations by MOLA.

BIL01 and BIL04-07 have no recorded provenance, although they appear to derive from the Layton collection. It could be cautiously suggested that these objects may have been found in Greater London, as the majority of the provenanced tools from Layton's collection were found in the Thames in the Brentford area. However, Layton collected widely, and there is no guarantee that these objects were even found within London. Although they are numbered sequentially in the Museum of London (as O2092a-e), this should not be taken as an indication that they were found together. Their numbering reflects the fact that they were catalogued on entry to the London Museum as part of the Layton collection, which had previously not been catalogued (Glynn Davis pers. comm.).

Typology

Rees (1979, pp. 467–71) provides a five-part typology of billhooks, which neatly covers the material from London. Manning's (1985a, fig. 14) two billhook types are the same as Rees' types 1 and 2.

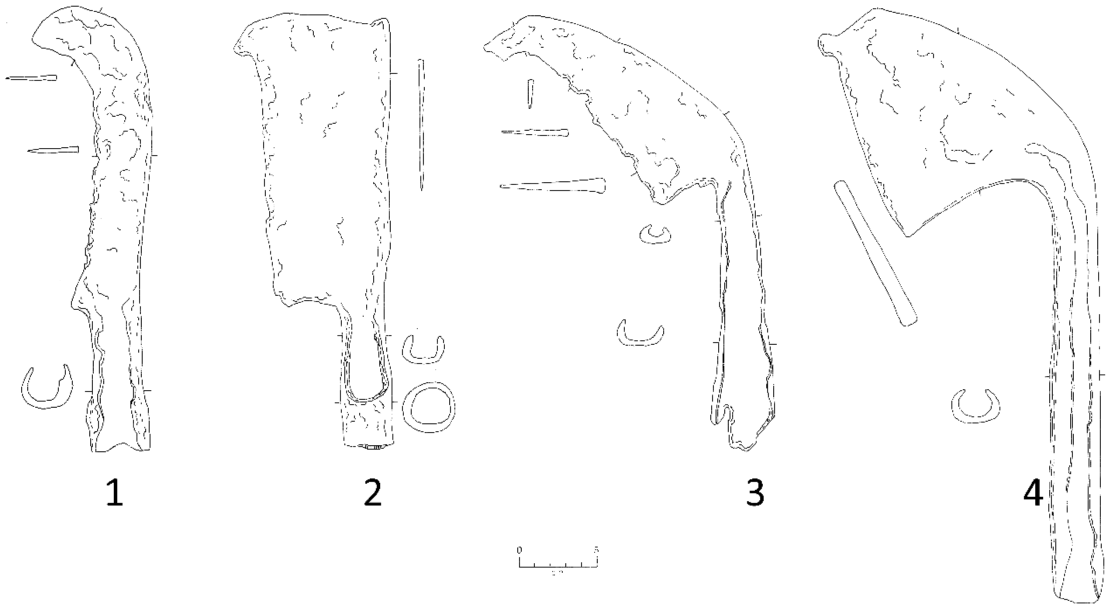


Figure 225 Rees' billhook typology (Rees 1979, figs 217a, 221b, 227b, 230, 232b).

Type 1 billhooks have a blade which continues the line of the handle, before curving forward to form a hooked tip. They very closely resemble Type 4 reaping hooked blades (see p.576), and there is a degree of overlap between the larger reaping hooks and smaller billhooks (Manning, 1985a, p. 58). However, both objects of this type from London, BIL01 and BIL02 are so large that they must have functioned as billhooks. Rees (1979, p. 468) found this type to be extremely common, especially on native sites in the Iron Age and early Roman periods. However, only two come from London. Both tools are also unusual.

BIL01 is unique among the British tools of this type for having a raised protrusion at the end of the beak. The shoulder between the blade and the socket is also much wider than it is on any of the Type 1 billhooks figured by Rees (1979, figs 215-20). These features are much more common on the comparatively rare Type 3 and 4 billhooks which otherwise dominate the London assemblage, although a similar tool comes from Lullingstone villa (Meates, 1987, fig. 44, 255).

BIL02 is unusual in being tanged. All of the other billhooks from London are socketed, as are the majority of the tools from Britain (Rees, 1979, pp. 467–8). Where tangs exist on billhooks, they are usually short, but the tang of BIL02 is exceptionally long. It would originally have passed all the way through the handle, in the manner of a Type B sickle tang, and is peened over a square washer at the butt, in a similar way to the reaping hook SIC09. The only comparable object known to the author is a corroded hook from Milbourne St. Andrew (Rees, 1979, fig. 213), but this is still considerably smaller than the London tool. Whilst the Type 1 billhooks discussed by Rees are mostly Late Iron Age or Early Roman, BIL02 is from a Late Roman context.

Type 2 billhooks have a wide blade with a straight edge in line with the handle, sometimes with a small projecting beak at the far end or a talon on the back edge. Although again being found in the Iron Age, this type perhaps survives later than Type 1, and has a wider distribution, although again slanted towards native sites (Rees, 1979, pp. 468–9). No examples of this type come from London.

Type 3 billhooks have long sockets with straight or slightly curved blades projecting from them, bent at an angle of around 20 degrees. This type often has a curved projection at one end. Although rare nationally, with only eight examples known to Rees (1979, pp. 469–70), this is the most common type of billhook from London. Five examples are known, BIL03-07, three of which have projections. The larger proportion of stray finds means that the chronology of these tools is not well understood, but they appear to span the 1st to 3rd/4th centuries in Britain, and are found on both military and civilian sites (Rees, 1979, p. 470).

Type 4 billhooks also have long sockets, but end in smaller axe-like blades. This type also often has a small projection at the top of the blade. Despite its long socket, depictions in sculpture show this tool with a short handle (Tisserand, 2015). Type 4 billhooks from France and Germany have been studied by Tisserand (2015), who breaks them into three types, here used as subtypes:

Type 4.1 has a heavily curved back edge, which curves to be downward pointing at the cutting edge, and straight lower edge, giving the blade a quarter-oval shape.

Type 4.2 has a less heavily curved back edge and an angled lower edge, giving the blade a triangular shape. Both objects from London, BIL08 and BIL09 are of this type.

Type 4.3 has the less heavily curved top edge of Type 4.2, and the straight lower edge of Type 4.1.

Although Tisserand (2015) discusses these tools as a phenomenon local to a small area of southern France, Rees knew of 11 examples from Britain, to which another example from Asthall (Mould, 1997, fig. 4.5, 16) can be added. Both Type 4 objects potentially came from rivers. BIL08 is recorded as coming from the River Thames at an unrecorded location. BIL09 is recorded as coming from the 'site of crannog' on the River Lea. This potentially refers to the pile dwellings found in the construction of the Maynard reservoir in 1869, or at the nearby Banbury reservoir at an unknown date (Museum of London, 2000, p. 117, WF2, WF4).

Type 5 billhooks have heavily curved blades with blunt tips, at the ends of long rectangular-sectioned tangs. Only two examples of this type are known, and Rees (1979, p. 471) expresses considerable doubt that they could have functioned as billhooks. No examples come from London.

Boring Tools

Technology

Modern drills are almost universally power drills, so it is useful to briefly review the types of boring tools available to Roman craftspeople.

Bradawls and Birdcage Awls

The simplest boring tools are bradawls and birdcage awls. These are discussed elsewhere alongside awls and bodkins (see p.377).

Augers and Gimlets

Augers and gimlets consist of a cutting head at the end of a metal shaft, the other end of which is fitted with a T-shaped cross handle (Figure 226). For Salaman (1975, p. 31) an auger was necessarily a large tool and had to be at least 12 inches (30.5cm) long, whilst a gimlet was smaller, for making holes between 1/8-1/2 inches (3-13 mm) in diameter (Salaman, 1975, p. 208). Here, the term 'auger' will be used to refer to all boring tools powered by a cross-bar, regardless of size.

Figure 226 Reconstructed auger (BOR40).

Augers cut in only one direction (Ulrich, 2007, p. 19). Lengthening the handles allows greater force to be applied (Ulrich, 2007, p. 21), and as such augers are often used to drill holes too wide or deep for conventional drills, for example in shipbuilding (Salaman, 1975, p. 31). No auger handles survive from the Roman period, but their use has been conjectured based on the forms of the surviving iron parts (see below). *Contra* Ulrich (2007, p. 21), an auger is potentially depicted on a tombstone from Aquileia (Gaitzsch, 1980, Taf. 42, 197).

Braces

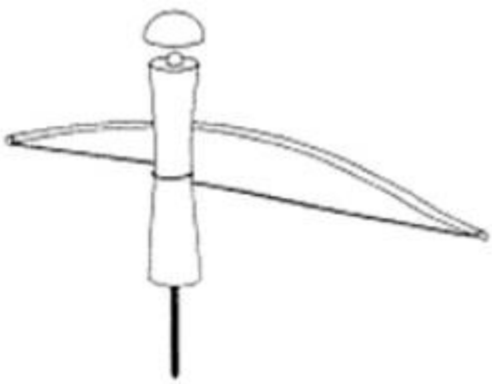
A brace consists of a double-cranked handle with a rotating head at one end and a chuck for taking a drill bit at the other (Salaman, 1975, p. 90). Some objects in the Museum of London's collections were referred to as brace bits, but despite its apparent simplicity the brace is not known in Europe before the early 15th century (Goodman, 1964, p. 175; Salaman, 1975, p. 92).

Drills

Two types of powered drill are shown in use in Roman art; the bow drill and the strap drill. Both operate on the same principle. They consist of a wooden stock, with an iron drill bit at one end and a rotating wooden head at the other. The head of the drill is held, whilst straps wrapped around the stock are pulled, causing the drill to rotate. Complete drill stocks of this type, with iron bits still in place, come from Roman-period Hawara, Egypt (Ulrich, 2007, fig. 3.19), and from a Roman ship in De Meern, the Netherlands (Jansma and Morel, 2007, Afb. 8.49-50).

Figure 227 Photograph (top) and MRI scan (below) of a wooden drill stock from De Meern, showing the composite construction of the head, and the Type C drill bit still in place (Jansma and Morel, 2007, Afb. 8.49-50).

In the case of a strap drill these straps are pulled by an assistant, whilst the person holding the drill stock directs the cutting. A strap drill is depicted in use by a pair of sarcophagus carvers on a mid 4th century sarcophagus from Rome (Ulrich, 2007, fig. 3.24). In the case of the bow drill, the strap is attached at both ends to a flexible wooden bow, allowing it to be operated by just one person (Figure 228). This same arrangement can also be used with the drill stock mounted horizontally, stabilising the drill for use in precision tasks, such as cutting and polishing gemstones, or drilling beads (Goodman, 1964, p. 163; Ogden, 1992, p. 54).



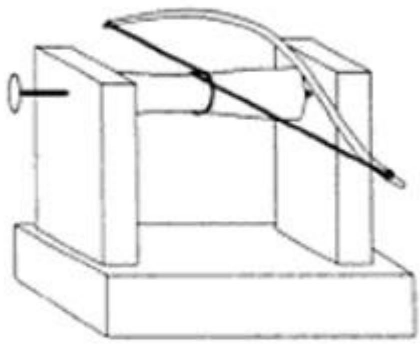


Figure 228 Bow-powered drills, held vertically (left) or mounted horizontally (right) (Ogden, 1992, fig. 39).

Augers or Drills?

Only the iron portions of boring tools survive from Roman London, and it is not always obvious how they would have been mounted and powered. For the sake of simplicity, all objects will be termed ‘drill bits’. Manning (1985a, p. 27) suggests that boring tools with simple straight tangs (Type A) would have been mounted in T-shaped auger handles, whilst those with lanceolate (Type B) and pyramidal tangs (Type C) would have been mounted in rotating drill shafts. However, others (Salaman, 1975, p. 31; Ulrich, 2007, p. 21) interpret pyramidal- and lanceolate-tanged objects as augers.

A Roman-period drill stock from Egypt retains an iron bit in place (Ulrich, 2007, fig. 3.19). This appears to be a narrow Type A tang, although this is not clear from published photographs, and the tool requires examination in person. Lanceolate tangs (Type B) can be seen on modern auger bits (Salaman, 1975, fig. 29), indicating that these were not used as drill bits.

Recently, a rotating wooden drill stock was found at De Merrn, with Type C drill bit still in place (Jansma and Morel, 2007, Afb. 8.49-50) (Figure 227), confirming their use in drills. Pyramidal tangs can also be seen on some modern drill bits illustrated by Salaman (1975, fig. 191), and Manning’s (1985a, p. 27) argument that pyramidal tangs ensured a better, longer-lasting grip within a drill stock is probably correct. However, three objects with Type C pyramidal tangs (BOR27, BOR25 and BOR39) have burred butts (Figure 229). This indicates that the ends of the pyramids were projecting through their handle, and implies that they had been deliberately burred to hold them in place. This is impossible with a drill shaft, implying that they were mounted in T-shaped auger handles.

Figure 229 Type C-1.2 drill bit (BOR25) with a burred butt (Courtesy of the Museum of London).

Facets and Direction of Cutting

Modern drill bits and augers are typically designed to cut in a clockwise direction; the direction in which right-handed people can most easily twist. Nine Type 2 drill bits from London have heads which were sufficiently well preserved to see facets on their edges. When pointing down, these facets were on the right-hand side only in all but one case. Only BOR50 has facets on the left hand side. This object is unstratified, and as only a fragment of the shaft and the cutting head survive, it is not possible to confirm that this object is in fact Roman.

Pietsch (1983, Abb. 27) interprets tools with a cutting bevel on the right hand side of the blade as anti-clockwise cutting. However, Goodman (1964, p. 166) reports a study of Russian augers (Kolchin, 1953) as saying that the spiral bits studied 'have the cutting edge on the right-hand side of the spiral, i.e., the workman turned the auger clockwise (as at the present time)'. The sole Type 5 spiral bit from London, BOR50, also has a facet on the right-hand edge of the blade, but the direction of the spiral suggests that it was used with a clockwise rotation. This implies that, contra Pietsch, a facet on the right-hand side indicates a clockwise-turning tool, and that the vast majority of the Roman Type 2 drill bits from London were designed to rotate with a clockwise motion, as they have continued to be to the present day.

Faceted heads may indicate that a tool was designed to cut in only one direction, and therefore mounted as an auger. It is therefore interesting that facets are seen on both Type A and Type C tools in London, which are likely to have been mounted as drills. This implies that facets were added to drill bits despite them turning in both directions.

Numbers

56 drill bits and auger bits are discussed here (Table 37). The majority (36) come from the Museum of London. Ten come from recent excavations by MOLA, three from the LAARC. Five come from British Museum, and one each comes from the Bank of England Museum and Salisbury Museum. Five more drill bits are recorded on the Museum of London's MIMSY database, but could not be located.

		Tang Type							
		A	B	C	D	E	F	Unk	Auger?
Blade Type	1.1			BOR22-24					
	1.2			BOR25-26					
	1.3			BOR27					
	2			BOR35-37		BOR48			
	2.1	BOR01-03		BOR28-32				BOR50-51	
	2.2	BOR04							BOR53
	2.3			BOR33-4					
	3		BOR15-18					BOR52	
	3.1								
	3.2		BOR07-12						
	3.3								
	3.4		BOR13-14				BOR49		
	3.5			BOR38-42					
	4		BOR19-20						
	5			BOR43					
	Unk	BOR05-07	BOR21	BOR44-47			BOR56		BOR54-55

Table 37 Typological breakdown of the boring tools from London.

Typology

Several authors have previously created typologies of drill bits. Gaitzsch (1980, pp. 19–37) distinguishes between four types of tools; straight drill bits (*Spitzbohrer*), spoon bits (*Löffelbohrer*), spiral bits (*Spiralbohrer*) and trepans (*Treapane*). Pietsch (1983, pp. 42–5) distinguishes between spoon bits (*Löffelbohrer*) and other drill bits (*Spitzbohrer*), and also subdivides spoon bits based on shape of the tang. Manning (1985a, pp. 25–8) defines three boring tool types based on the form of the tip, and also distinguishes between three types of tang (simple tapering tangs, lanceolate tangs and expanded pyramidal tangs). Type 1 comes to a simple point, Type 2 to a diamond-shaped head, and Type 3 to a spoon head. Hanemann (2014, pp. 385–91) provides the most detailed typology of spoon bits, distinguishing between those with lanceolate (Typ1) and pyramidal (Typ2) tangs, and subdividing Typ 1 into six subtypes (Typ 1 A-F).

There is therefore a need to combine these disparate typologies into a single system for classifying and studying Roman drill bits. The following typology is in two parts, following previous authors in distinguishing between tang type and blade type. In contrast to other two-part typologies in this thesis, where blade form has been given precedence, tang form (represented by a letter) will be given first, followed by blade form (represented by a number). This is because tang form has been seen as most indicative of the method of powering a drill.

Tang form

Three main forms of handle attachment are seen on Roman boring tools.

Type A is a simple square-sectioned tang which tapers to a point. In most complete examples from London the tang is clearly distinct from the round-sectioned stem of the blade. This is the simplest form of tang, but also the least efficient for boring tools, as the blade would become loose in the handle after only a small amount of wear (Goodall, 1980, p. 27).

Type B is a flat diamond-shaped or triangular lanceolate tang. This form was also common from the middle ages (Goodall, 1980, p. 27) up to the 19th century (Salaman, 1975, fig. 29), and there are several tools with this form of tang in the Museum of London's medieval collection. However, as there is no way of distinguishing between Roman and medieval tools with this tang form, the catalogue only includes those tools which were originally catalogued as Roman. All examples of this tang type from London are Type 3 spoon bits.

Type C is an expanded square-sectioned pyramidal tang. Similar tangs are seen on more recent drill bits (Salaman, 1975, fig. 285, b), although I am unaware of examples from the post-Roman or medieval periods.

In addition to these common types, three further tang forms can be seen on Roman boring tools.

Type D is a loop or eye at the butt through which a cross-bar can be inserted. No tools of this form were found in London, but an auger eye of this type is reported from Newstead (Curle, 1911, Pl. LIX, 6). This form of attachment continues to be used today for large augers (Salaman, 1975, fig. 30f).

Type E resembles the pyramidal Type C, but differs in having heavily scalloped or concave sides, giving an X-shaped cross-section resembling a modern lemon squeezer. One object of this form, BOR48, was found in London. The only other example known to the author is a spoon bit found at Fishbourne (Cunliffe, 1971, figs 63, 76).

Type F is a flat rectangular-sectioned tang which tapers towards the blade. Two objects from London, BOR49 and BOR56, have this form, BOR56 ends in a chisel-tip. It is possibly a very simple boring tool, but the only indication of this is the fact that it shares a tang shape with the spoon bit BOR49. A somewhat similar tang can be seen on an object from Caerleon identified as a 'scoop' (Scott, 2000, figs 97, 33), which may be a Type 4 tapering shell bit. This type of tang would be suited for slotting into a cross-handle for use as an auger.

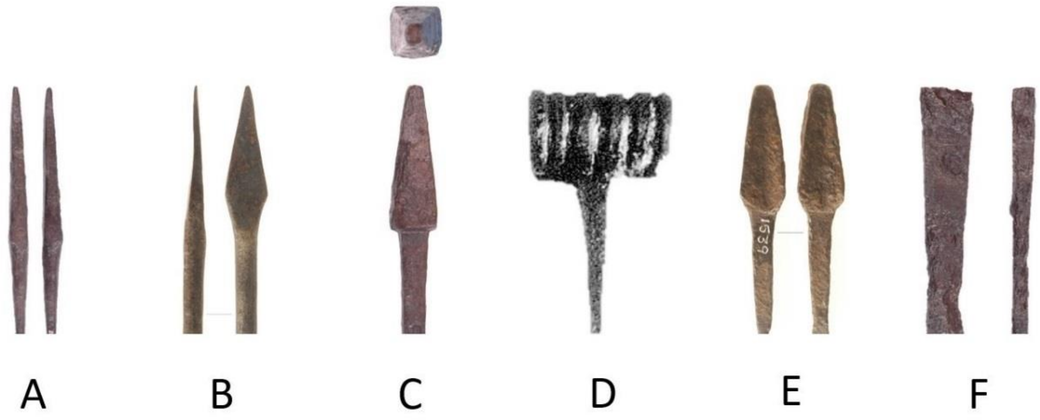


Figure 230 Roman boring tool tang types (Type A, BOR01; Type B, BOR15; Type C, BOR35; Type D, Newstead (Curle 1911, Pl.LIX, 6); Type E, BOR48; Type F, BOR49). Not to scale.

Type G is a solid octagonal-sectioned handle. Various solid-handled bradawls are discussed elsewhere (see p.377), but one object from London, BOR53, has a solid octagonal-sectioned handle with a lanceolate (Type 2.2) blade similar to that seen on other drill bits (below). Two further objects, BOR54 and BOR55, have the same handle but are missing their tips. A comparable object, also without a tip, comes from Haltern (Harnecker, 1997, Taf. 18, 168).

Tip form

The following typology of drill bit tips (Figure 231) is based on the three-part tip typology proposed by Manning (Manning, 1985a, fig. 5). The excellent preservation of fine details on some of the London objects allows this typology to be expanded with subtypes, whilst the Type 3 spoon-bit subtypes are adapted from Hanemann (2014, Abb. 329) (Table 38).

Type	Manning (1985)	Hanemann (2014)
1.1 1.2 1.3	Type 1	
2.1 2.2 2.3	Type 2 Type 2 Type 2	
3.1 3.2 3.3 3.4 3.5	Type 3 Type 3 Type 3 Type 3 Type 3	Typ 1A Typ 1B Typ 1C Typ 1D Typ 2
4		Typ 1F
5		

Table 38 Correspondence between drill bit typologies.

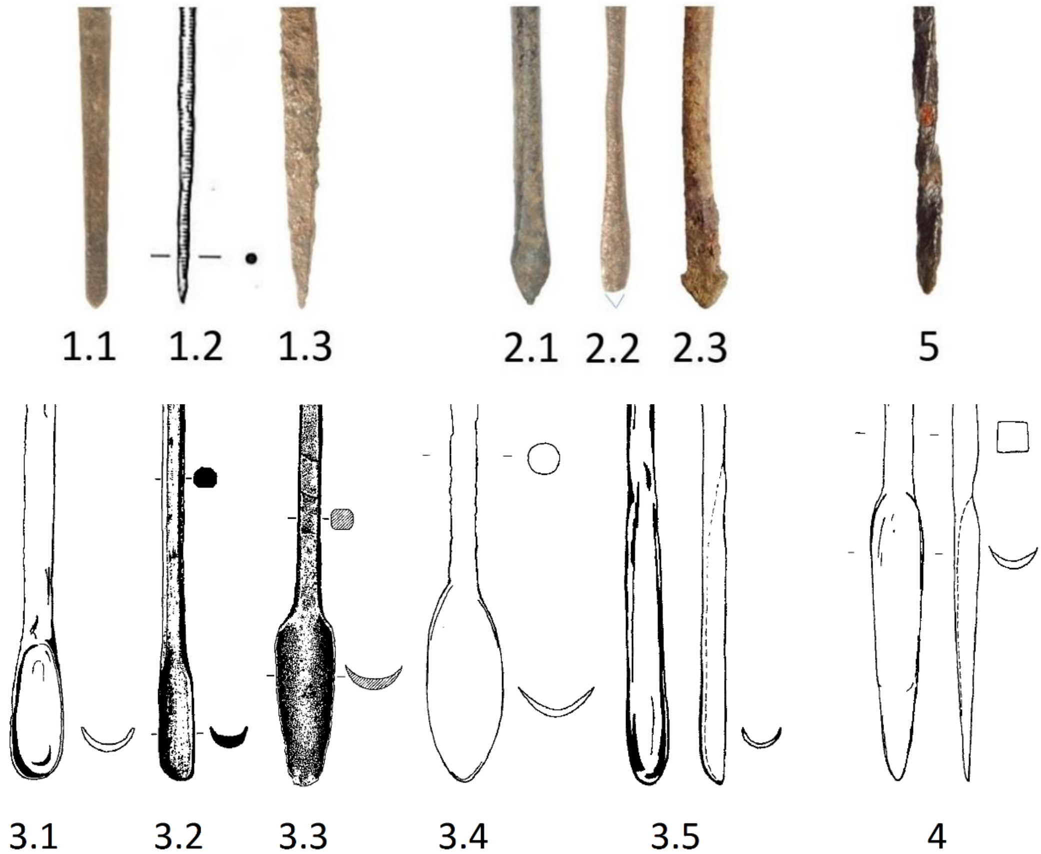


Figure 231 Boring tool tip types (Type1.1, BOR23; Type 1.2, BOR 25 (Manning, 1985a, E9); Type 1.3, BOR27; Type 2.1, BOR01; Type 2.2, BOR53; Type 2.3, BOR33; Types 3.1-4, (Hanemann, 2014, Abb. 329); Type 5, BOR43). Not to scale.

Type 1 bits come to a point that is the same width as, or narrower than, the shaft of the drill. Unlike the other types, these tools were limited in how far they could bore by the fact that the hole they created was narrower than the shaft they were made of (Manning, 1985a, p. 26). **Type**

1.1 is a flat tip with a simple V-shaped tip, which may be faceted. **Type 1.2** ends in a sharp point. Manning (1985a, p. 40) considered these objects to be Type 4a awls, but their similarity to Type C drill bits must make us consider whether they could have functioned as boring tools. **Type 1.3** is square in section, tapering continually to a point. Type A objects with this shape of blade will have been catalogued as birdcage awls or reamers in the awls chapter (see p.377). Only one object from London, BOR27, has this blade form as well as a Type C tang. It has no provenance, nor are any comparable objects known. It is therefore questionable whether this object is in fact a Roman drill bit. Nevertheless, a drill bit of this form would have been functional, operating in the same way as a reamer or birdcage awl. It may have been primarily for enlarging rather than drilling holes.

Type 2 bits have expanded cutting heads that would allow the drill to cut deeper without snagging (Manning, 1985a, p. 26). They can be subdivided into three types, although without good preservation these are indistinguishable. **Type 2.1** expands to a diamond-shaped head with sharp corners. **Type 2.2** expands to an oval-shaped head. These two subtypes are difficult to distinguish between, and it is possible that the much rarer Type 2.2 heads are simply worn Type 2.1 diamond-shaped heads. **Type 2.3** steps out sharply before tapering to a point, creating a triangular head. Manning (1985a, p. 26) considered this type to be rare in Britain, but it is very common in London, with thirteen objects (BOR01-04, 28-37, 48, 55).

Type 3 bits have a dished 'spoon' shaped head, which closely resembles that of a gouge (see p.487) but has a closed tip, like a spoon. Similar modern bits have been praised for drilling a cleaner hole than other bit types, being less likely to split the wood, and being able to drill at any angle (Salaman, 1975, p. 79). This makes them suitable for joinery tasks, such as making holes for dowels or chair legs (Salaman, 1975, p. 85). The following subtypes are adapted from those used by Hanemann (2014, Abb. 329), which are based on the shape of the head. **Type 3.1** is widest near the tip. **Type 3.2** is parallel-sided. **Type 3.3** is widest at the back, tapering towards the tip. **Type 3.4** is oval-shaped head, widest in the centre. Most of the London drill bits are Type 3.2, although some appear to expand slightly. **Type 3.5** is longer than the other types, expanding constantly from the tang to a rounded tip.

Eighteen Type 3 drill bits come from London. All five examples of Type 3.5 have Type C pyramidal tangs, whilst almost all other Type 3 tools have Type B lanceolate tangs. The one exception is BOR51, which has a Type F tang. Most of these tools have corroded tips, but where they are complete they seem to be simple round, spoon-like ends. An exception is BOR18, which has the nose of a modern shell-bit (Salaman, 1975, fig. 44). This modification makes cutting more efficient, but seems to be a 17th century development (Salaman, 1975, p. 39). As BOR18 is in better condition than many of the other drill bits and has no provenance, it is probable that this is a post-medieval object.

Type 4 has a long continually-tapering shell blade with a U-shaped cross section. They strongly resemble modern taper augers, which are primarily used as reamers for expanding holes which have already been started with another tool (Salaman, 1975, pp. 40–2). Two objects of this form come from London, both with Type B lanceolate tangs.

Type 5 has a twisted shaft, and is most similar to a modern drill. The twist allows sawdust to be drawn out of the hole, allowing the drill to be used for longer without the hole becoming clogged. Although apparently a Roman period introduction to Britain, Ulrich (2007, p. 32) discusses the possibility that the Romans adopted the twist bit from Gaul, referring to it as the *terebra gallica*. Twist bits remain rare in the Roman period compared to other drill bit forms, an only one example, BOR45, comes from London.

Metric Analysis

Widths and Lengths of Tangs

Manning (1985a, p. 27) has suggested that pyramidal drill bit tangs allowed the drill bit to sit securely but loosely in a drill stock, making them easy to swap out. One key question to be asked of the tangs of these tools is therefore whether or not they would have been truly interchangeable in the way that modern drill bits are, or whether craftsmen would need a drill stock for every bit they owned. If the drill bits were interchangeable, we would either expect them to cluster around certain standard measurements, or for the width and length to increase at a constant rate, allowing larger tangs to be partially inserted into smaller holes with the same geometry.

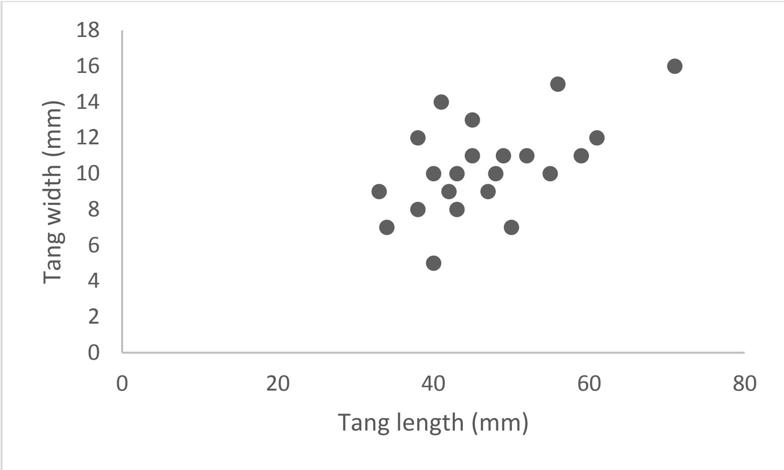


Figure 232 Graph showing the lengths and widths of Type C pyramidal drill bit tangs from London (Total = 22).

However, the Type C drill bit tangs from London do neither of those things (Figure 232). These measurements are not exact, as post-depositional corrosion will have altered the tangs, whilst the fact that some tangs come to points whilst others do not will limit the degree to which this truly represents their geometry. Nevertheless, these measurements indicate that Roman Type C drill bits were not universally interchangeable. It is possible that standard size changed over time, but this cannot be approached with the London data, as it lacks good dating evidence. The idea that tangs were standardised is also contradicted by BOR44 and BOR46, which have rhomboid- or diamond-sectioned tangs.

This throws into question why Type C tangs were manufactured in this way if not to make them interchangeable. It is possible that this was to make them more secure in the drill, or possibly to extend the life of drill stocks, as a greater degree of wear would be necessary before the bit became loose. Alternatively, the situation could have been similar to that seen with interchangeable brace bits in the early 19th century, when different brace models had different chuck attachments. Bits could be changed, but only for other bits within a set (Salaman, 1975, pp. 75–7). It is possible that Roman bits were interchangeable within the sets that they were manufactured and sold in, but this analysis suggests that they were not universally interchangeable.

A more direct relationship is seen with Type B lanceolate tangs (Figure 233), suggesting that these were interchangeable. This is curious, as Type B tangs appear to be from augers rather than drills, and there seems less need for them to be interchangeable.

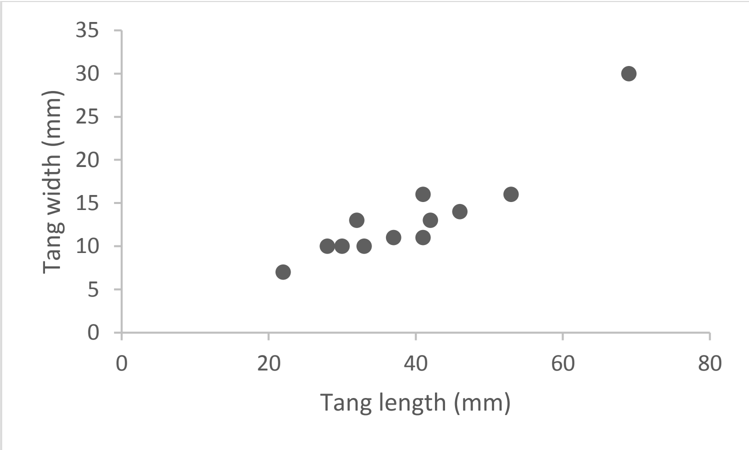


Figure 233 Lengths and widths of the Type B lanceolate boring tool tangs from London (Total = 12).

Widths of Tips

Gaitzsch (1980, pp. 30–2) has studied the widths of 43 spoon bits, and suggested that 29 (67%) conformed to standardised half *digitus* measurements, with the majority being between 0.5 and 1.5 *digiti*. Larger bores of 2-3 *digiti* were seen as a feature of the Late Roman period, whilst smaller bores did not conform closely to the standard measurements. In London, only one Type 3 spoon bit (BOR51), conforms closely to the *digitus* system (Figure 234). At 38mm wide it is close to 2 *digiti* (37 mm), or 1.5 *unciae* (36.9 mm). Other examples show a range of widths with no clear clustering around a standard measurement. Type 2 drill bits are similarly mixed. The majority are narrow, under 0.5 *digiti*, and do not clearly match any standard measurements. Of the remaining three objects, only BOR03 (24 mm) is close to a standardised measuremtn (1 *unciae*, 24.6 mm).

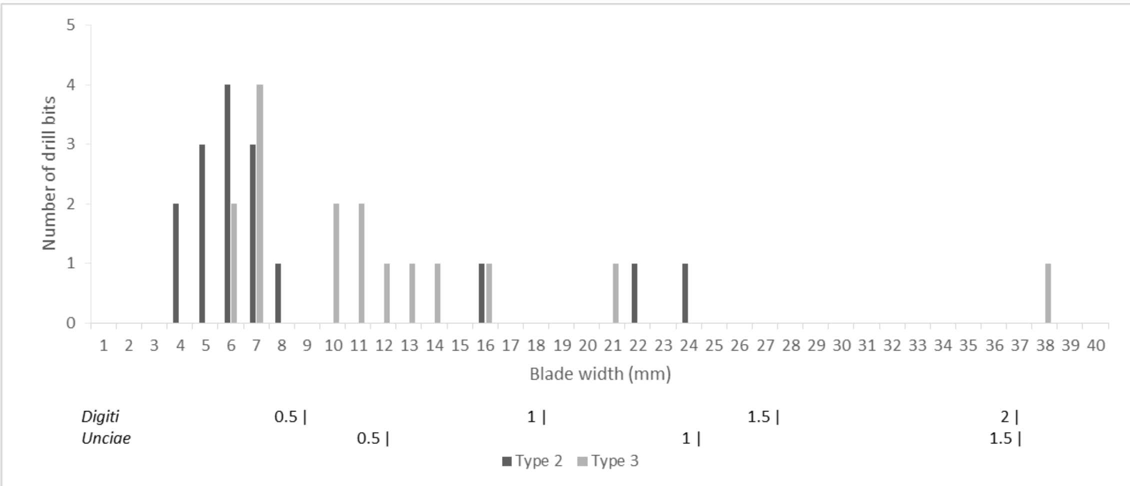


Figure 234 Blade widths of the drill bits from London (Total Type 2 = 16; Total Type 3 = 16).

Small boring tools may not conform standard measurements partially because craftsmen lacked measuring tools accurate enough to make reliable small diameter tools. We should also consider that wear and preservation will have had greater effects on smaller objects. Two of the larger objects from London do seem to follow standardised measurements, but these follow the *unciae* system better than the *digitus* system sought by Gaitzsch, and it is not clear whether these isolated examples coincide with standardised measurements purely by coincidence.

Brush Holders

Technology

The objects discussed here are copper alloy brush holders. Their key feature is a thin copper-alloy socket, which would have been crimped around organic bristles. These bristles could have been made of hair, feathers, plant fibres and moss, pieces of cloth, or sponge (Raux, 2015, p. 681).

The most common type of Roman brush is represented by a simple copper alloy sleeve, which would have held bristles onto a wooden handle (Raux, 2015, p. 685). However, no objects of this type were identified in London. The objects described here are examples of unusual types which appear in the 1st century AD with no obvious precursor forms (Gostenčnik, 2002, pp. 231–2). They may have been the invention of a particular workshop; that of Agathangelus, a bronzeworker operating in Gaul, possibly Lyons, between c.30-79 AD (Gostenčnik, 1997, 2002, pp. 227–9, 248; Raux, 2015, p. 682). Another type of tool produced by Agathangelus, a distinctive form of tweezer (Gostenčnik, 2002, pp. 232–3) is represented by one object from London, MOL A27976, but is not part of this study. A range of different interpretations have been suggested for these objects.

Type 2 knife/brushes have been discussed as leatherworking/currier's knives (Gansser-Burckhardt, 1942, Abb. 8, 42:26; Leguilloux, 2004, p. 66) and woodworking tools (Gostenčnik, 2002, p. 234), but this is unlikely as they do not appear to have had very sharp or robust blades (Gostenčnik, 2002, p. 234). Others have suggested that they were modelling tools for plaster or stucco work (Gostenčnik, 2002, p. 234), and they might make sense as part of a suite of brushes and palette knives for plaster work and fresco painting.

Type 3 double-ended brushes are usually seen as paint brushes (Gostenčnik, 2002, p. 243; Raux, 2015, pp. 684–7), in which context they could have been used on a wide range of materials. They have also been seen as writing equipment (Fünfschilling, 2012, pp. 180–2). Two examples of this type come from bath buildings, and as such they may have had a cosmetic function (Gostenčnik, 2002, p. 243).

The *Agathangelus* objects have been considered as a functional group by Raux (2015, pp. 687–95), who suggested that they may have been a suite of tools for gilding; knives for cutting gold leaf, brushes for applying the leaf and glue, and tweezers for picking up the delicate foil. The slender double-sided Type 3 brush holders are noted for their similarity to modern gilding brushes, whilst Type 2 knives/brush holders, like modern gilding knives, have relatively blunt edges (Salaman, 1986, pp. 7, 10). This is a plausible interpretation, although it is unclear why gilding would suddenly need an entirely new suite of tools in the early Roman period.

Numbers

Seven brush holders are discussed in this section; three from the LAARC, two from the Museum of London, and one each from the British Museum and from recent excavations by MOLA. Three further 'brush fragments' are reported in the Draper's Garden finds assessment (Hawkins, 2009a, p. 241), but are not discussed here.

Typology

Raux (2015) has recently studied all of the known copper-alloy brush holders from Europe, and provides a three part typology (Figure 235).

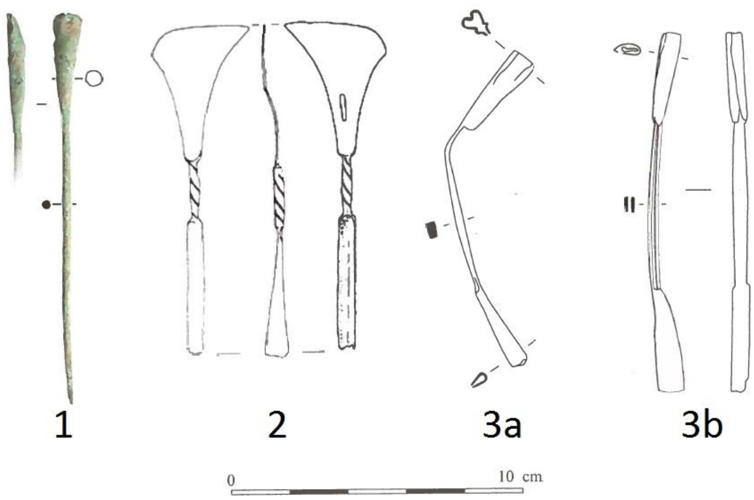


Figure 235 Copper alloy brush holder types (Raux 2015, fig. 1, 2, 3-5).

Type 1 brushes have a solid shaft, with a brush holder at one end and a pointed stylus tip at the other. No objects of this type come from London.

Type 2 brushes have a brush holder at one end, and a wide spatulate blade at the other. Three objects of this type, BRU01-03, come from London. Some examples of this type have V-shaped ends, thought to be for carving, rather than brushes (Gostenčnik, 2002, p. 234), whilst BRU04 from London has a knob terminal at the other end rather than a brush holder. These varied forms potentially suggest a range of functions (ibid), although the spatulate blades are not incredibly different from one another.

Only fourteen other objects of this type are known (Gostenčnik, 2002, pp. 240, 253). They appear to have been manufactured in at least two workshops; those of *Agathangelus* and *Hermes*. Another Type 2 tool from Gorsium, with a fragmentary stamp, may relate to a third workshop (Gostenčnik, 2002, pp. 237, 248). Those from the *Agathangelus* workshop are characterised by stamps and twisted shafts (Gostenčnik, 2002, p. 234), neither of which are seen on the Type 2 tools from London. However, the blade of BRU01 is noticeably similar to that on *Agathangelus* products (Gostenčnik, 2002, p. 240).

The location of the *Hermes* workshop is unknown, but tools with this stamp come from Pompeii (Gostenčnik, 2002, p. 237) and London (BRU03). The names *Hermes/Hermae* are common for slaves/freedmen, but may also relate to the unusual depiction of a temple alongside the name on BRU03's stamp (ibid). This has been seen as a continuation of a Hellenistic/Republican stamp tradition (Gostenčnik, 2002, pp. 246–7), and may indicate an early date for the production of this tool, although it was found in a mid-2nd century context. Another Type 2 brush holder from Caerleon (Gostenčnik, 2002, p. 243), as well as BRU02 from London, also come from mid-2nd century contexts, showing that this type was still in use in the mid-2nd century.

Type 3 brushes have a central ribbon-like rectangular-sectioned handle, with an angled brush holder at either end. Raux (2015, p. 680) identifies two subtypes of this form, based on their construction. **Type 3a** is made of a single piece of copper alloy, flattened and bent into sockets at either end. Two objects of this form, BRU05 and BRU06, come from London. This is the most common subtype, with Raux (2015, fig. 4) identifying 32 examples from outside London. **Type 3b** is made of two pieces, each with a large and small socket, stacked on top of one another with the small socket housed inside the large socket of the other piece. One object of this type, BRU07, comes from London. Raux (2015, p. 680) was aware of only one other example of this type, from an Augustan context at Besançon.

The distribution of this type differs from that of many of the other tools from London (Figure 236), coming mainly from modern day France, and being heavily associated with urban rather than military sites (Raux, 2015, p. 684). Although often poorly dated, most seem to date to the 1st century AD (ibid). Seven of the known objects have the stamp of Agathangelus (Raux, 2015, p. 682), as does BRU07, although other stamps are also seen on these tools (Gostenčnik, 2002, p. 246).

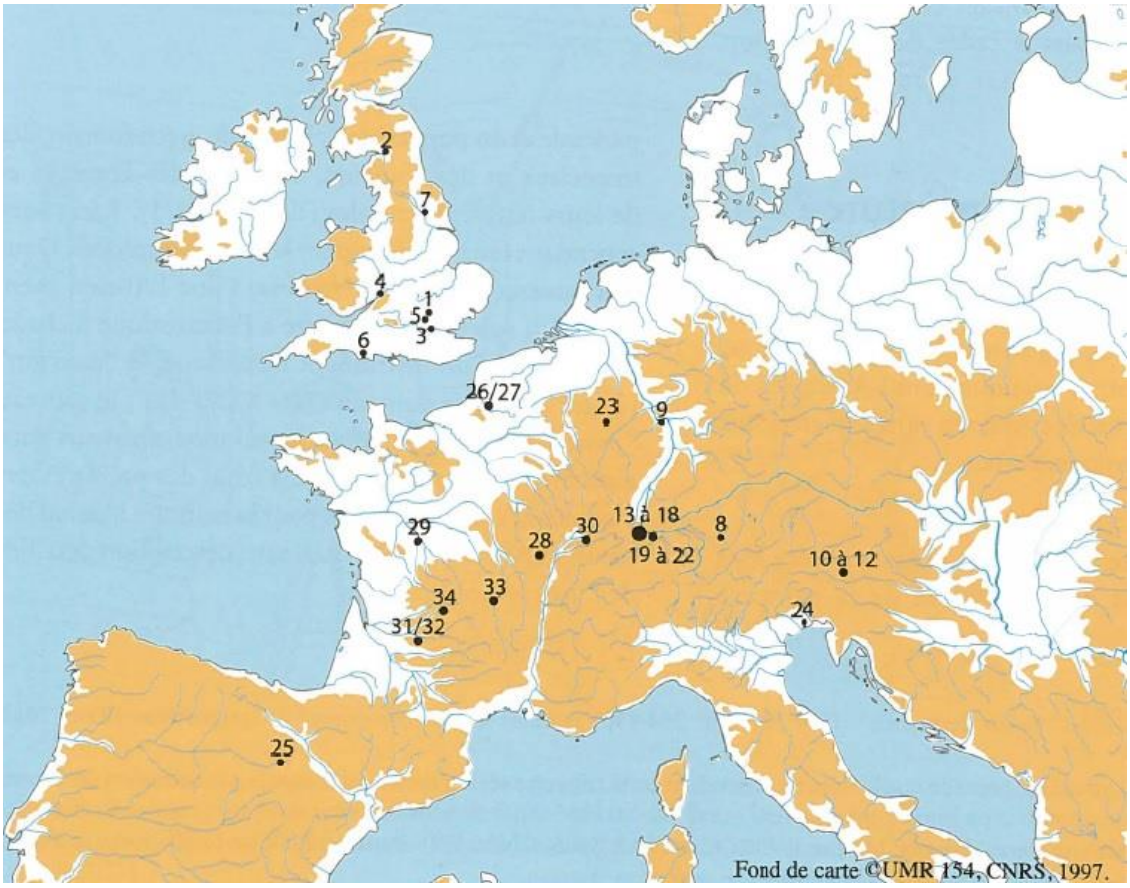


Figure 236 Distribution map of Type 3 brush holders (Raux 2015, fig. 5).

Chalk Line

Chalk lines are used by masons and woodworkers to mark out long, straight lines. Fine string is covered in chalk or soot, held taught in the desired position, and 'snapped' to leave a coloured impression on the surface it was snapped against (Salaman, 1975, pp. 128–9). The string is usually kept on a turned wooden line reel. A line iron can be used to hold the other end of the string. Modern line irons consist of a symmetrical, pointed blade, which would be inserted between a course of bricks, and a stem with an expanded head around which the string could be tied or wound. One object from the Museum of London, CHA01, was recorded as a line iron, and this is a plausible interpretation. I am aware of no directly comparable Roman objects, although a number of 'spear-shaped spatulas' with untwisted handles are similar (see p.596).

Chisels ; Cold Chisels

Technology

Cold chisels are used to shape metal that has not been heated in a forge. As they are used to work harder materials, and because the metal is not hot, cold chisels can be shorter and stockier than hot chisels (Manning, 1985a, p. 8). These tools are extremely difficult to separate from mason's tools, as both require very similar properties. Only tools which bear a strong resemblance to modern stone carving tools have been separated out into a separate section on mason's chisels (see p.444). Other chisel-edged tools are described in the relevant sections as hot chisels (see p.441) and wedges (seep.615).

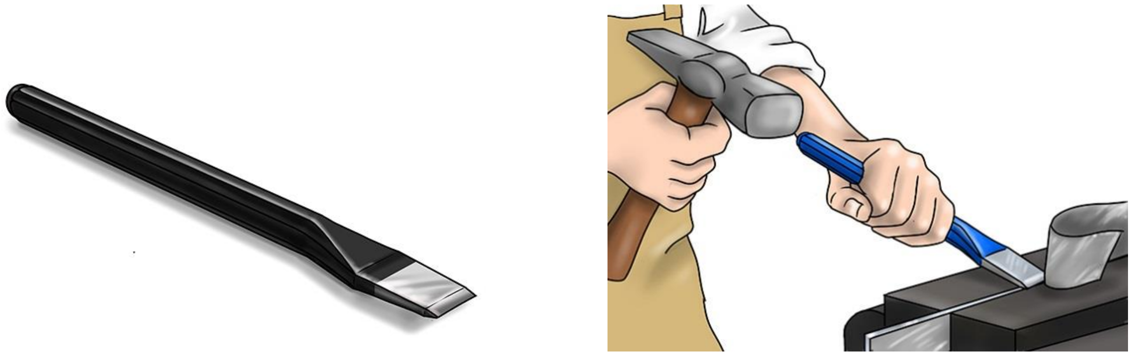


Figure 237 Modern cold chisel (left) and a cold chisel being used to cut sheet metal (right) (https://www.wonkeedonkeetools.co.uk).

Numbers

Eleven tools are described here; eight from the Museum of London, two from the LAARC and one from recent excavations by MOLA.

Typology

The objects in this section can be divided into two main types based on the section shape of the handle.

Type 1 has an octagonal-sectioned body. Modern cold chisels also have an octagonal-sectioned body (Salaman, 1975, p. 138), usually with a tip formed in two stages, first by long forging bevels, and then by short sharpening bevels from both sides of the blade (Figure 237). Six objects of this type come from London, although there remains considerable variation between them.

COL01 has a narrow, blunt tip. This may indicate that it is a chisel-edged hot punch (Manning, 1985a, p. 10) rather than a cold chisel, although the head shows considerably heavier burring than can be seen on the other possible hot punches (see p.547), perhapsindicating its use in cold work. COL03 is very neatly made, and closely resembles modern cold chisels, although it may also have been used as a tracing tool (see p.541). COL02 has a form which sits somewhere between these two, and could have fulfilled either function. COL04 is highly corroded, but the edge may have been pointed rather than chisel-like. COL05 is considerably shorter and stockier than the other chisels in this group. Although originally interpreted as a stonemason's chisel, it could also have functioned as a cold chisel or, if held in tongs, a hot set. Similar objects come from Wanborough and Whitton Farm (Table 39).

COL06 is considerably longer and more robust than the other tools of this type. Like COL3, it strongly resembles modern cold chisels, although its large size would also make it a useable mason's tool. Similar tools come from Avenches (Duvauchelle, 1990, No. 105-6, 111), and it is also comparable to a large chisel or punch found in a bag of woodworking tools with a soldier in Herculaneum (Roberts, 2013, p. 287).

Site	Site Type	Context	Date	Reference
Maryport	Military	Unstratified	-	(Jarrett, 1976, fig. 20, 4)
Newstead	Military	Pit	80-105	(Curle, 1911, Pl. LXIII, 7)
Ribchester	Military	-	-	(Howard-Davis and Whitworth, 2000, fig. 73, 138)
Vindolanda	Military	-	120-40	(Blake, 1999, No. 5272)
Wanborough	Urban	Unstratified	-	(Isaac, 2001, fig. 50, 3)
Whitton farm	Rural	Unstratified	-	(Manning, 1981, fig. 75, 5)
Haltern	Military	-	1 BC - 9 AD	(Harnecker, 1997, Taf. 16, 131)
Saalburg (x8)	Military	-	85-160	(Pietsch, 1983, Taf. 11, 221a, 222a-225, 227-8)
Zugmantel (x2)	Military	-	90-260	(Pietsch, 1983, Taf. 11, 221, 222)

Table 39 Comparanda for Type 1 cold chisels.

Type 2 has a rectangular-sectioned body. Three objects of this type, COL07-09, come from London. Another tool, HOT06, is similar, but has been interpreted as a hot chisel on account of its long blade and sharp edge.

Site	Site Type	Context	Date	Reference
Camerton	Military?	-	100 BC – AD 100?	(Jackson, 1990, Pl. 25, 251-3)
Gadebridge Park	Villa	Unstratified	-	(Manning, 1974, fig. 77, 605)
Hod Hill (x3)	Military	-	48-53	(Manning, 1985a, A23-5)
Feldburg	Military	-	150-260	(Pietsch, 1983, Taf. 11, 233d)
Haltern (x7)	Military	-	1 BC - 9 AD	(Harnecker, 1997, Taf. 16.133, 136, 139, 17.141, 143, 146, 149)
Saalburg (x10)	Military	-	85-260	(Pietsch, 1983, Taf. 11, 230, 230a-c, 231, 231b, 232, 232a, 233b-c)
Zugmantel (x8)	Military	-	90-260	(Pietsch, 1983, Taf. 11, 231a, 232b-c, 233, 233a, 234, 234a, 235)

Table 40 Comparanda for Type 2 cold chisels.

One final object, COL10, has been interpreted as a cold chisel on account of its size, which is most similar to the other objects in this section. However, with its truncated cone head, it is most similar to tools interpreted elsewhere as mason's chisels (see p.444). It is possible that this tool has been recycled out of the handle of a lager mason's tool. Pietsch (1983, Taf.11, 209) figures a similar tool from Zugmantal.

Chisels ; Hot-Cutting Tools

Technology

The tools discussed in this section were used to cut metal which has been heated in a forge. Manning (1985a, pp. 8–9) divides these tools into two groups along modern lines; hot chisels and sets. Hot chisels are held in one hand and struck with a hammer held in the other. They therefore need to have handles long enough to be held without getting too close to the heated metal, and strong enough to withstand striking. As they cut soft hot metal, they can be thinner and sharper than cold chisels (see p.438). Sets are struck with sledgehammers, and are held away from the user with a long handle. As there is no risk of striking or burning the hand, these tools can have much stouter blades than chisels. Distinguishing between these objects is not easy, however. Today, sets can take a variety of forms, from chisel-like tools held in twisted wire handle, to axe-like tools with a wooden haft. With only the iron element surviving, the differences between chisels and sets may not always be obvious.

Numbers

Five objects are identified as possible hot cutting tools, four from the Museum of London and one from the British Museum.

Typology

HOT01-04 all have the same form of a robust rectangular-sectioned iron handle, tapering into a thin, flaring blade. Objects of this type (Table 41) have been interpreted in a number of different ways by different authors, and their true function remains unclear. Gaitzsch (1980, pp. 156–9), Pietsch (1983, p. 35) and Duvauchelle (1990, p. 24) interpret them as wood- or stone-working chisels. Hanemann (2014, pp. 399–401) interprets similar objects as scrapers or spatulas, on the basis that their blades are too thin to have been used as chisels. However, Manning (1985a, pp. 8–9) interprets the majority of these objects as hot sets and hot chisels, on the basis that their thin blades would not withstand use on hard materials, whilst their broad handles suggest that they were struck with heavy tools. This interpretation is not universally applied, however, and near-identical tools from the same context at Verulamium were seen variously as a hot chisel (Manning, 1972b, figs 60, 2) and paring chisel (ibid., fig. 61, 11). HOT04 is considerably more slender than the other objects of this type, and may be a solid-handled paring chisel (Type A-6) rather than a hot chisel. However, the possible burring to the butt of this tool suggests that it was struck, and therefore implies use on a soft material, such as hot metal or perhaps plaster. Another possible explanation for these tools is as caulking irons, which today typically have robust integral handles and thin, flaring blades (Salaman, 1975, figs 116-8).

Site	Site Type	Context	Date	Reference
Brancaster	Military	Pit	-	(Hinchliffe, 1985, fig. 34, 67)
Ickham (x2)	Industrial	-	-	(Riddler and Mould, 2010, fig. 119, 1241-2)
Kingsholm	Military	-	49-69	(Manning, 1985a, A18)
Richborough	Military/ Urban	Unstratified	-	(Henderson, 1949, Pl. LXI, 343)
Verulamium (x2)	Urban	Makeup layer	270-5	(Manning, 1972b, fig. 60.2, 61.11)
Aquileia	Urban	-	-	(Gaitzsch, 1980, Taf. 39, 183)
Avenches	Urban	-	-	(Duvauchelle, 1990, No. 71)
Neupotz (x2)	-	Hoard	275-300	(Künzl, 1993, Taf. 590)
Zugmantel (x3)	Military	-	90-260	(Pietsch, 1983, Taf. 11, 192a-c)

Table 41 Comparanda for hot chisels HOT02-05.

HOT05 has a simpler form, resembling an exceptionally long Type 2 cold chisel (see p.438), consisting of a long rectangular-sectioned bar coming to a sharp tip through long bevels on both sides of the blade. Manning (1985a, p. 9, A22) interprets a similar, although shorter, tool from Hod Hill as a hot chisel. Another comes from Kingscote (Scott, 1998, fig. 60, 10.3). However a similar tool, although identified as a 'punch', was found amongst a number of carpentry tools with a soldier from Herculaneum (Roberts, 2013, p. 287), and HOT05 could therefore be interpreted as a Type B-6 solid-handled woodworking chisel.

Chisels ; Improvised Chisels

In addition to the chisels discussed in other sections, three chisels in the London collection appear to have been improvised from other tools. CIM01 has the form of a small flat file. However, no teeth are present, and the object tapers towards a chisel tip. It is possible that this object was originally made as a file, but was later re-forged into a small chisel, perhaps one which would have been mounted in a small handle, in a similar way to CHI12. CIM02 and CIM03 appear to have been made from Type B wax tablet spatulas. Each has one blademissing, the the broken end heavily burred from striking. As all of these chisels have narrow tips, they may have been used in metalwork as tracing tools (see p.541), rather than as woodworking tools (see p.447), although this cannot be established with certainty.

Chisels ; Mason’s Chisels

Technology

The chisels in this section are those thought to have been used in stone carving. Other chisel types thought to be for woodworking (see p.447), or metalworking (see p.438, 441) are found in their respective sections.

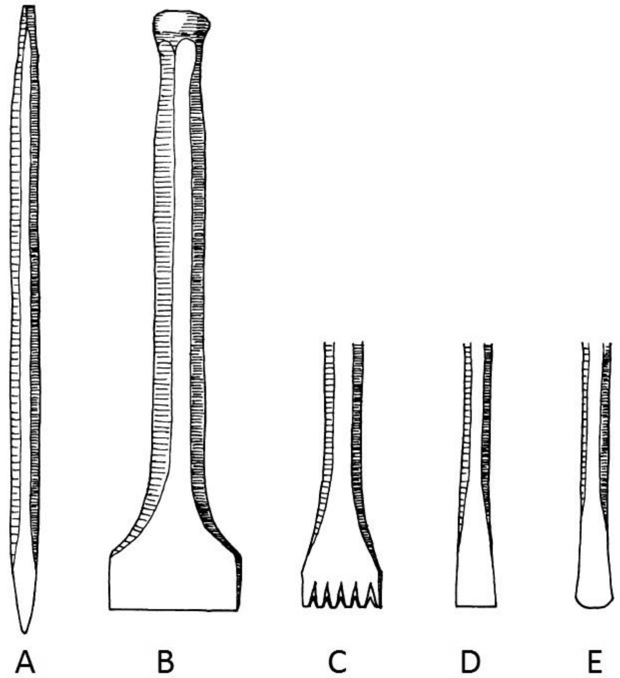


Figure 238 Modern stone carving chisel types (A, point; B, drove/bolster; C, claw/toothed; D, flat; E, bull-nose/roundel) (Blagg, 1976, fig. 1, G-K).

Masons use a number of specialist chisel types (Figure 238). The simplest is the point chisel (Figure 238, A), which comes to a pyramidal tip. This tool can be held at a sharp angle and used to break off large flakes of stone in rough shaping, or at a shallow angle to cut channels and create level surfaces, or to carve stone (Blagg, 1976, pp. 159–60; Wooton, Russell and Rockwell, 2013, p. 3). After rough shaping at the quarry, the majority of stone is today removed with this tool. The length of the point varies depending on the material being worked, with harder stones requiring tools with shorter points (Wooton, Russell and Rockwell, 2013, p. 3).

The toothed or claw chisel (Figure 238, C) can be used for work between roughing out and smoothing; for levelling out a surface created with an axe or adze, before it is finished with a flat chisel. It can also be used for decorative effect, and in the Roman period seems to have been primarily a finishing tool (Blagg, 1976, pp. 162–3; Rockwell, 1990, pp. 210–11; Wooton, Russell and Rockwell, 2013, p. 4). Although Blagg (1976, pp. 162–3) identifies marks from this tool on carved stone from Britain, no chisel of this type has been found. It is possible that other toothed tools were used instead. A toothed hammer or pick comes from Chalon-sur-Saône (Bonnamour, 2000, figs 16, 7), whilst Rockwell (1990, p. 220) suggests that toothed scrapers (see p.566) were also used.

Flat chisels (Figure 238, E) have a normal chisel edge and are used for a variety of tasks, from smoothing to decorating (Wooton, Russell and Rockwell, 2013, p. 5). Flat chisels can have rounded corners, to reduce the chance of causing accidental damage, or sharp corners to enable detailed carving, for example of letters (Wooton, Russell and Rockwell, 2013, pp. 4–5). Wide-bladed examples (Figure 238, B) are sometimes called bolster chisels or droves, and are used to smooth the surface of a stone after rough working (Blagg, 1976, pp. 161–2; Wooton, Russell and Rockwell, 2013, p. 4). Bolster chisels are also used to cut bricks, and for general demolition tasks on construction sites.

Gouges and round-ended bull-nosed chisels (or roundels) (Figure 238, E) are used to carve curves and hollow surfaces (Blagg, 1976, p. 164; Wooton, Russell and Rockwell, 2013, p. 5).

Numbers

Four chisels are discussed in this section, three from the Museum of London and one from recent excavations by MOLA.

Typology

Two groups of chisels can be identified in the London collection based on the forms of the handles.

MAS01 and MAS02, have the shared form of a round-sectioned handle and a truncated cone head. These objects have very similar dimensions, differing in length by only 8 mm. Two other tools from London also have truncated cone heads; the mortice chisel CHI42 (see p.458) and cold chisel COL10 (see p.438). It is possible that these objects were also used as stone carving tools.

MAS01 comes to a square-sectioned point. It could be considered a square-sectioned hot punch (see p.547), but is interpreted here as a mason's point chisel as it is so similar in form to MAS02. Another long pointed tool, PUN10, could also have served as a mason's point chisel.

MAS02 tapers from one side to a narrow chisel edge, and strongly resembles a modern stone mason's flat chisel. The blade has rounded corners, although it is not clear whether this is due to corrosion. Several comparable objects come from Saalburg and Zugmanetel (Pietsch, 1983, Taf. 11, 209-10) and Königsforst (Gaitzsch, 1980, Taf. 54, 273).

MAS03 and MAS04 are both bolster chisels, with the shared form of a round-sectioned integral handle, with a knob terminal at one end, and a wide parallel-sided blade at the other. Beyond this, the two tools are quite different. MAS03 is much larger, with a sloped shoulder and slightly curved blade. A number of comparable tools are known (Table 42), with MAS03 being at the larger end of their size range.

Site	Site Type	Context	Date	Reference
Housesteads (x2)	Military	-	124-410	(Manning, 1976b, fig. 16, 68, 70)
Shepton Mallet	Rural	-	-	(Moscrop, 2001, fig. 70, 5)
Chalon-sur-Saône	Bridge	River	-	(Bonnamour, 2000, fig. 17, 6)
Niederbieber	Military	-	185-260	(Gaitzsch, 1980, Taf. 45, 213)

Table 42 Comparanda for MAS03.

MAS04 is very small, with a sharp shoulder and short blade. An identical object comes from Avenches, where Duvauchelle (1990, No. 82) was unable to assign a function to it. A fragment of a similar blade comes from Vindolanda (SF 16842). The combination of a strong, wide blade and, in the case of the Avenches object, heavy burring to the butt, indicates that it was a tool for working strong materials, such as stone. Its small size and sharp corners indicates its use in delicate work, such as carving or lettering. Other comparable objects include a number of small chisels with knob terminals and flaring blades from Newstead (Curle, 1911, Pl. LIX, 4), Shepton Mallet (Moscrop, 2001, figs 71, 6), Wanbrough (Isaac, 2001, figs 50, 20), and Chalon-sur-Saône (Bonnamour, 2000, figs 17, 7). These may also be small stone-carving chisels, although their blades are considerably less robust.

An alternative interpretation for MAS04 would be as a caulking iron or reaming iron. These tools are used in shipbuilding and ship maintenance to open the joints between planks and drive strands of oakam between them, making them waterproof (Salaman, 1975, pp. 115–6). A square reaming iron figured by Salaman (1975, fig. 187/2) closely resembles MAS04. This interpretation may be supported by the fact that MAS04 was found near the Thames waterfront. Although landlocked, evidence of shipbuilding has been found at Avenches (Duvauchelle, 2005, p. 133), where the nearby Lakes Morat and Neuchâtel would have provided venues for boating. There seems no need for caulking irons at Vindolanda, however.

Chisels ; Thonging Chisels

Thonging chisels are tools used to make regularly spaced slits in leatherwork, through which flat leather thongs can be threaded. They are operated with a hammer, in the same way as a woodworking chisel. An object from the Museum of London, THO01, strongly resembles a socketed version of a modern thonging chisel. Salaman (1986, p. 220) considers this type of tool to be a modern introduction, and since THO01 has no provenance, it is not clear whether this is a Roman object. Blizquez (1994, No. 105) and Künzl (1982, Taf. 28, X1-2) figure somewhat similar implements as cauteries or scrapers.

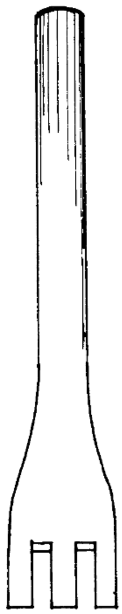


Figure 239 A modern thonging chisel (Salaman, 1986, fig. 8:8).

Chisels ; Woodworking Chisels

Technology

Chisels are tools with a cutting edge perpendicular to the handle, which can be a tang or socket for a wooden handle, or an integral metal handle. Today, woodworking chisels are broken down into three main types; paring, firmer, and mortice chisels (Salaman, 1975, pp. 130–2; Manning, 1985a, p. 21). Gaitzsch (1980, pp. 151–71), Pietsch (1983, pp. 29–37) and Manning (1985a, p. 21) all divide Roman chisels into these modern functional groups.

Paring chisels have light, thin, flexible blades. Today they often have bevelled edges, although these were not a feature of Roman tools. They are not struck with a mallet, and are instead pushed along the surface of the wood during finishing work. Today they are used particularly by joiners and cabinet makers (Salaman, 1975, p. 130; Manning, 1985a, p. 21). **Firmer chisels** are stouter, general purpose tools, which are struck with a mallet. Today they have parallel-sided blades, also often with edge bevels (Salaman, 1975, pp. 130, 139; Manning, 1985a, p. 22). **Mortice chisels** have considerably thicker blades than other types, with an edge formed by a deep bevel on one side only. They are used to cut deep mortice joints, and for other tasks requiring an exceptionally sturdy tool (Salaman, 1975, pp. 132, 141; Manning, 1985a, p. 23). In addition to these types there are numerous forms of **special-purpose chisels**, used for tasks such as carving, lathe turning, etc. (Salaman, 1975, p. 132).

It will therefore be the purpose of this section to examine the formal variation of Roman chisels, to see whether the division of these tools into modern categories is justified, and to see what functions these tools would have had.

Numbers

55 chisels are discussed here. The majority (33) come from the Museum of London. Fourteen come from recent excavations by MOLA, two each from the British Museum, the LAARC, and publications by PCA, and one each from the Bank of England Museum and Pitt Rivers Museum.

Typology

Manning (1985a, fig. 4) provides a six part typology for Roman chisels, which is not sufficient to cover the material from London. Whilst Gaitzsch (1980, pp. 151–71) and Pietsch (1983, pp. 29–37) emphasise the high degree of variability in chisel form, they stop short of providing their own typologies. Hanemann (2014, Abb.326, 366) created separate typologies for mortice chisels and other woodworking chisels. In both cases they are broken down by handle type (socketed, tanged and solid-handled) and subdivided based on the form of the blade. This goes some way toward circumventing the issue of high diversity in chisel form, but this typology is still too restrictive to cover all of the chisels from Roman London.

With a simple typology of chisels seeming impossible, this section will follow Hanemann's lead in describing chisels as a series of elements. The following typology is in two parts. The first part, represented by a letter, describes the form of the blade of the tool, which gives an indication of the sort of work carried out with it. The second part, represented by a number, defines the method of attachment to the handle. This produces a total of 48 possible variations, although it must be recognised that not all combinations will have existed in the Roman period. Table 43, below, shows how the tools from London are accommodated in these types.

		Blade Types							Tang only
		A	B	C	D	E	F	G	
Tangs	1	CHI01-03	CHI17-18						
	2	CHI04-05	CHI19-21	CHI29-31	CHI33-5				CHI52-53
	3	CHI06-07	CHI22-23				CHI45		CHI54
	4	CHI08-13							CHI55
Socket	5	CHI14-15	CHI24-27		CHI32, 36-39	CHI43		CHI46	
Solid handle	6	CHI6	CHI28		CHI40-42	CHI44			
Blade only		CHI47-49	CHI50			CHI51			

Table 43 The blade and handle attachment types of the complete chisels from London.

This typology does not take the width of the blade into account. Whilst modern chisels are almost universally parallel-sided, Roman chisels tend to gain width by flaring towards the tip. As such, chisels which taper continually to the tip and those which flare considerably can be described as being of the same form, although superficially they can look quite different. Chisels with wide, parallel-sided blades are discussed in the mason's chisels section (see p.444).

Handle-Attachment Form

Roman chisels have three types of handle attachment; tangs, sockets, and solid iron handles.

Tang Forms

Four types of tanged chisel can be seen in the London collection (Figure 240). Chisels with simple Type 1 tangs were used in both the Iron Age and Roman periods (Darbyshire, 1995, pp. 495–7), but Types 2-4 seem to be Roman period introductions (Darbyshire, 1995, p. 487).

Figure 240 Chisel tang types (Type 1, CH17; Type 2, CHI21; Type 3, CHI22, CHI07; Type 4, CHI08). Not to scale.

Type 1 is a simple tapering tang that is continuous with the blade. Five chisels of this form come from London (Table 43). There is variation within this form; CHI03 and CHI17-18 have short tangs, separated from the blade by a shoulder. CHI01 and CHI02 have very long tangs which merge seamlessly with the blade. CHI01 is unique in being clenched at one end, indicating that it would have projected from the end of the handle.

Type 2 is a short tang above a wide rectangular shoulder. A complete hafted example of this form from Aquileia (Figure 241) shows that these shoulders would have rested on a metal ferrule, which would effectively give this type the stability of both a tang and a socket. Because of this, tangs of this type are found on chisels with most blade types (Table 43). Thirteen examples of this type come from London, making it the most common form of handle attachment, along with sockets.

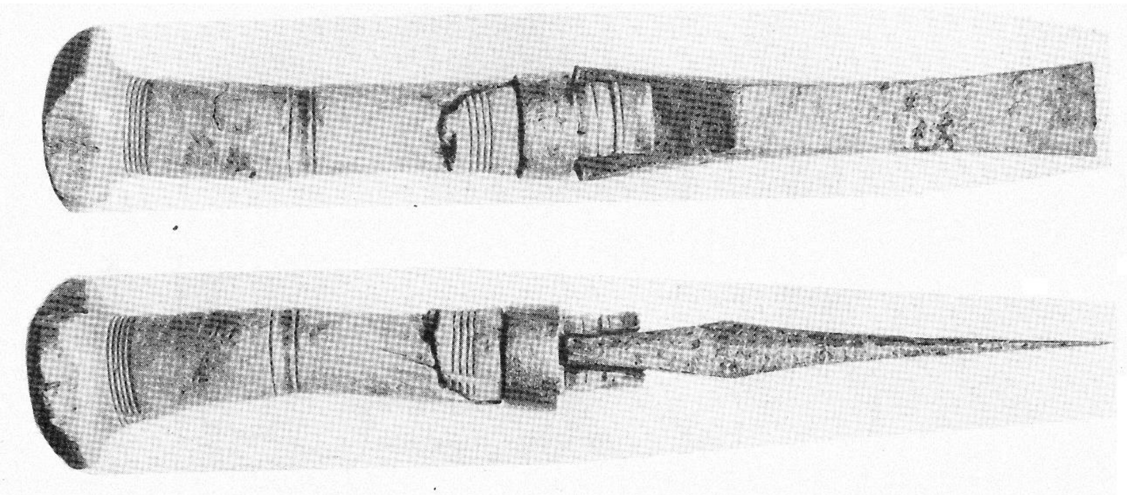


Figure 241 Type 2 tanged chisel from Aquileia, with complete handle (Gaitzsch 1980, Taf. 38, 181).

Type 3 also has a short tapering tang, this time stepping out to an octagonal shoulder. The majority of the objects of this type taper continuously from the shoulder to the blade, but CHI07 continues as a parallel-sided octagonal-sectioned shaft before tapering towards the blade. This type of tang is rare, and only a handful of other examples are known to the author (Table 49), all of them from the Continent. Six objects of this type come from London (Table 43).

Type 4 also steps out from a short tang to an octagonal shoulder, but instead of tapering immediately, this type swells into a wide 'diamond shaped' handle, before tapering towards the blade. For this reason, fragmentary Type 4 chisels are sometimes confused with Type 1.2 awls/bradawls (see p.384). However, these two object types can easily be distinguished since chisels always have heavily bevelled edges, whilst the awls/bradawls always have a square cross-section in the centre (although the front or rear edges may be bevelled). Six objects of this form come from London, all of which have Type A paring chisel blades (Table 43). This type is rare, but examples are known from elsewhere in Britain and the Continent (Table 46).

Like Type 1 awls/bradawls, non-tanged variants on this form also exist. These include examples with a flat butt (Manning, 1985a, p. 22; Künzl, 1993, Taf. 591) or a knob head at the butt (Manning, 1985b, figs 20, 163), and the tanged version may be an earlier type (Pietsch, 1983, p. 35, Abb. 15). The knobbed examples may indicate that Type 4 was furnished with a wooden mushroom cap on the tang (Manning, 1985a, p. 22), and it is in this way that the type has been reconstructed in the Museum of London (Figure 242). No examples of these variant forms are found in London.

Figure 242 CHI10, with reconstructed wooden handle.

Another variant on this type (**Type 4S**) has a much smaller expanded section at the butt, with a small burred head rather than a tang. One object of this type, CHI13, comes from London. This type of butt can also be seen on the moulding plane iron PLA02, which may have been made from a modified chisel of this type. Other chisels with this form of butt come from Shakenoak farm (Brodribb, Hands and Walker, 2005, fig. 1.34, 12) and Saalburg (Pietsch, 1983, Taf. 10, 178).

Socket Forms

Only one socket type, described here as **Type 5**, is seen on the Roman chisels from London. This is a round, fully enclosed socket, with no nail holes, which tapers towards the blade. Thirteen socketed chisels come from London (Table 43), making this the most common form of handle attachment, along with Type 2 tangs. Sockets can be seen on chisels with almost every blade type.

Round sockets are a feature of pre-Roman chisels in Britain (Darbyshire, 1995, pp. 484–6), although the seams of these tools are usually butted, whereas most from London have sockets which are welded shut. Roman chisels never have slender rectangular sockets of the sort seen on Type C spatulas/modelling tools (see p.594). Three tools (MOL 1508, PRM 1884.140.621, and HGA02[646]<426>), originally catalogued as a Roman 'spud' and Roman chisels respectively, have hexagonal-sectioned sockets. However, it is clear from the shape of the blades of these tools that they are 17th century firmer chisels (Salaman, 1975, fig. 195). Another (MOL 79.115/2), has an octagonal-sectioned socket. This object has a narrow mortice blade, which is not paralleled on any other Roman chisels known to the author, and has no provenance associated with it. It is therefore unlikely to be Roman, and is not included in the catalogue.

Solid Handle Forms

Six possible woodworking chisels from London have integral iron handles, described here as **Type 6** (Table 43). A number of other solid-handled chisels are discussed elsewhere as hot cutting tools (see p.441), cold chisels (see p.438), tracing tools (see p.541), and mason's chisels (see p.444), although it is possible that some of these were in fact used in woodwork. With a larger sample size, this type could be broken down into numerous subtypes. Roman solid-handled chisels can be octagonal, oval, rectangular, or round in section. They can have flat, burred, faceted, or flared butts, or have pyramidal, truncated-cone, discoidal, rectangular or spherical heads at the butts. Solid handles can be seen on chisels with most blade types, and do not necessarily indicate that heavy work was being carried out.

Blade Form

Common Blade Forms

Four common blade types can be distinguished amongst the Roman chisels from London (Figure 243).

Figure 243 Common chisel blade types (Type A, CHI10, CHI12; Type B, CHI22, CHI24; Type C, CHI30; Di, CHI32; Dii, CHI39). Not to scale.

Type A

Type A blades are either thin and ribbon-like, or flatten quickly from the handle/tang, becoming extremely thin for most of their length. They would probably have been flexible, and in this way they correspond to the modern 'paring chisel' category. Unlike modern paring chisels they have no side-bevels, coming instead to straight edges which may have only subtle sharpening bevels. Nineteen objects of this type come from London (Table 43), making this the most common blade type.

Type A chisels show the most diversity in form, and examples can be seen in London with every type of handle attachment. The majority are narrow, and parallel-sided or slightly tapering, although a small number of flaring examples are also present.

CHI01 and CHI02 have Type 1 tangs. With their triangular blades and long tangs, these chisels conform to Darbyshire's (1995, pp. 495–7) Form 6, although both are longer than Darbyshire's examples. This type appears in the Late Iron Age, possibly as a result of contact with the Roman Empire, although most long-stemmed examples appear to have been deposited around the time of the conquest (Table 44). CHI01 is unique in two respects; it has a tang that would have projected from the butt of the handle, and is made of copper alloy rather than iron.

Site	Site Type	Context	Date	Reference
Hod Hill	Military	-	43-51?	(Manning, 1985a, B30)
Skeleton Green	Oppidum	Pit	15-25	(Darbyshire, 1995, fig. 75, O15)
Wookey Hole	Cave	-	Late Iron Age/Roman	(Darbyshire, 1995, fig. 75, O18)
Manching (x4)	Oppidum	-	300-30 BC	(Jacobi, 1974, Taf. 7, 107-111)

Table 44 Comparanda for Type A-1 chisels.

CHI03 could also be interpreted as a Type A-1 chisel, although it is quite different in form to CHI01 and CHI02, having a shorter, stouter tang and curved, parallel-sided blade. These features are common on Roman paring chisels, although as this object is unstratified there must be some doubt about its date.

Both examples of Type A chisels with Type 2 tangs are unusual. CHI04 is the smallest of this type known to the author. It may be a miniature rather than a functioning tool, although the blade seems robust enough to withstand use. Pietsch (1983, Taf. 10, 168-9, 171) figures a number of only slightly larger Type 2 chisels, and CHI04 is comparable in size to CHI17 and CHI30. It may therefore have been mounted in a small organic handle in the same way as these tools.

CHI05 has a very narrow shoulder and flared tang, which may indicate that it was peened over the butt of the handle. These features are not typical of Type 2 tanged tools, and it is therefore possible that this object is not Roman. Several tools with similar continually-flaring blades are known, although not with this tang form (Table 45).

Site	Site Type	Context	Date	Reference
Beadlam	Villa	Rubble layer	-	(Neal, 1996, fig. 41, 113)
Ingleby Barwick	Villa	Hoard	Late Roman?	(Hunter, 2013, fig. 4.23, d)
Milton Keynes	Rural	Unstratified	-	(Manning, Marney and Zeepvat, 1987, fig. 50, 268)
Shepton Mallet	Rural	Unstratified	-	(Moscrop, 2001, fig. 71, 6)
Wanborough	Urban	Unstratified	-	(Isaac, 2001, fig. 50, 20)

Table 45 Comparanda for CHI05.

Two chisels, CHI06-07 have Type 3 tangs. This is a rare type (Table 49), and no other examples are known with delicate Type A blades. Both of these examples have slightly angled blades, although as they are so narrow it is not clear whether these represent skew chisels, or wear or damage to the blades.

Five Type A chisels, CHI08-13 have Type 4 tangs. Type 4 is always paired with a Type A blade, although it is not always tanged (see above). This type is not common, and only a handful of other examples are known to the author (Table 46). Of these, only those from Great Chesterford and Augsburg-Oberhausen are tanged.

Site	Site Type	Context	Date	Reference
Great Chesterford	Urban	-	-	(Manning, 1985a, B26)
Hill Farm	Villa	Ditch (hoard?)	138-400	(Manning, 1985b, fig. 20, 163)
Kingsholm	Military	-	49-69	(Manning, 1985a, B27)
Verulamium	Urban	Rubble layer	400-500	(Manning, 1984a, fig. 37, 3)
Water Newton	Military/ Urban	-	-	(Manning, 1985a, B28)
Augsburg-Oberhausen	Military/ Urban	-	27 BC - AD 16	(Pietsch, 1983, Abb. 15, 1)
Neupotz (x2)	-	Hoard	275-300	(Künzl, 1993, Taf. 591)

Table 46 Comparanda for Type A-4 chisels.

CHI14-15 both have Type 5 sockets, but again are quite different beyond this. CHI14 has a flat blade extending directly from one edge of the soket. This form can be paralleled on a small number of other examples (Table 47). CHI15 expands to a robust square-sectioned shoulder before tapering. No closely comparable objects are known. Whilst CHI14 appears to be the more delicate tool, the burring to the back of the socket may indicate that CHI14 was struck with a mallet.

Site	Site Type	Context	Date	Reference
Dorchester	Urban	-	-	(Manning, 2014a, fig. 141, 37)
Saalburg	Military	-	85-260	(Pietsch, 1983, Taf. 9, 159)
San Giovanni di Ruoti (x2)	Villa	-	-	(Simpson, 1997, fig. 30, 269-70)

Table 47 Comparanda for Type A-5 chisels

CHI16 has a solid, decorated handle. There is no burring to the handle, indicating that it was not struck, and was instead used in the manner of a modern paring chisel. Similar tools with flaring blades and robust integral handles are discussed elsewhere as hot cutting tools (see p.441), but have also been argued to have been paring chisels or scrapers. A similar tool comes from Verulamium (Manning, 1972b, fig. 60, 10).

Type B

Type B is more robust than Type A. Rather than flattening immediately, the blade tapers continuously from the widest part of the handle to the tip. Whilst this could be considered analogous to the modern ‘firmer chisel’ category, this type in fact shows a great degree of variability, depending on how long the blade is and how wide it was when it began to taper. Some examples are only slightly more robust than Type A, and would perhaps only have been suitable for light striking, whilst others are considerably more robust and could have functioned more like modern ‘firmer chisels’. Type B blades should be distinguished from solid-handled chisels with edges formed by relatively short bevels from both sides, which are discussed as cold chisels (see p.438) rather than alongside the woodworking chisels.

Thirteen Type B chisels come from London, making them the second most common type. They are found with a similarly wide range of handle attachments to Type A, although no Type B tools with Type 4 tangs are known.

CHI17-18 both have short Type 1 tangs which taper directly from the blade. These are very small tools, and only CHI17 is certainly a chisel. CHI18 may have an angled blade, although this is not clear as the tool has not been cleaned. Directly comparable objects are difficult to find, although poor preservation would quickly render these small tools indistinguishable from nails. These blades may have been mounted in short handles and pushed with the hand rather than struck (Manning, 1985a, p. 22). A similar object from Whitton has an antler handle (Manning, 1981, figs 75, 11), and another from the Sandy hoard has a solid iron handle imitating one in turned wood (Manning, 1985a, B32).

CHI19-2 have Type 2 tangs. This combination is one of the more common Roman chisel types, and parallels can be cited from numerous sites (Table 48). Wider-bladed examples, such as CHI19-20, often taper before flaring at the tip, giving them a waisted outline.

Site	Site Type	Context	Date	Reference
Camulodunum	Urban	-	-	(Hawkes and Hull, 1947, Pl. CV, 4)
Harlow Temple	Religious	-	-	(Gobel, 1985, fig. 49, 43)
Hill Farm	Villa	Ditch (hoard?)	138-400	(Manning, 1985b, fig. 20, 164)
Strageath	Military	Demolition	142-61	(Grew and Frere, 1989, fig. 85, 146)
Wavendon Gate	Rural	Unstratified	-	(Hylton, 1996, fig. 69, 72)
Avenches	Urban	-	-	(Duvauchelle, 1990, No. 79)
Haltern (x5)	Military	-	1 BC - 9 AD	(Harnecker, 1997, Taf. 6.41, 45, 7.54, 55, 9.69)
Magdalensberg	Urban	-	15 BC - 50 AD	(Mossler, 1974, Abb. 12-13)
Neuss	Military	-	-	(Simpson, 2000, Pl. 41, 13, 14)
Pompeii	Urban	-	Before 79	(Gaitzsch, 1980, Taf. 20, 114)
Saalburg (x5)	Military	-	85-260	(Pietsch, 1983, Taf. 10, 168, 168a-c, 170a)
Zugmantel (x5)	Military	-	90-260	(Pietsch, 1983, Taf. 10, 168d, 169, 169a-b, 170)

Table 48 Comparanda for Type B-2 chisels.

CHI22-3 have Type 3 tangs. The fragmentary chisel CHI55 may also have been of this type. This type of tang is very rare, and can only be paralleled on a few sites outside of London (Table 49).

Site	Site Type	Context	Date	Reference
Alise	Urban	-	-	(Champion, 1916, Pl. 1, 60958)
Magdalensberg	Urban	-	15 BC – AD 50	(Mossler, 1974, Abb. 15)
Saalburg	Military	-	85-260	(Pietsch, 1983, Taf. 10, 172)

Table 49 Comparanda for Type B-3 chisels.

CHI24-27 are socketed. This group shows the most diversity, with CHI24 having a relatively slender blade somewhat similar to Type A, and CHI25 having a very robust blade which would have been more comparable to a Type D in practice.

Site	Site Type	Context	Date	Reference
Lullingstone	Villa	-	150-200	(Meates, 1987, fig. 45, 262)
Avenches	Urban	-	-	(Duvauchelle, 1990, No. 74)
Feldburg	Military	-	150-260	(Pietsch, 1983, Taf. 9, 160)
Magdalensberg	Urban	-	15 BC - 50 AD	(Mossler, 1974, Abb. 16)
Neupotz (x4)	River	Hoard	275-300	(Künzl, 1993, Taf. 584-5)
Saalburg (x8)	Military	-	85-260	(Pietsch, 1983, Taf. 9, 155a, 156a-b, 156d, 160a, 161, 161a, 162)
Zugmantel (x5)	Military	-	90-260	(Pietsch, 1983, Taf. 9, 155, 156, 156c, 157, 161b)

Table 50 Comparanda for Type B-5 chisels.

CHI28 has a solid round-sectioned handle with a burred butt and a slightly flared blade. This tool could have been used for carving stone or cutting metal as well as working wood. Although solid-handled Type B chisels are not rare, close parallels for this tool are hard to find. Pietsch (1983, Taf. 10, 186-90) figures a number of somewhat comparable tools with octagonal-sectioned handles and flared blades.

Type C

Type C is a blade which swells to become diamond-shaped in longitudinal section before tapering to the tip. In London, this type is only seen associated with Type 2 tangs, but socketed examples are known from elsewhere (Pietsch, 1983, Taf. 9, 163). This blade thickening is also seen on the solid-handled Type E chisel CHI44 (below). This type is less common than other blade types, and only three objects of this form come from London (Table 43). I am aware of only one other object with this blade type from Britain, although comparanda is available from elsewhere in the Empire (Table 51). This may be an early Roman type (Pietsch, 1983, Abb. 26), although an example from Feldburg dates to the middle Roman period (Table 51).

Like Type B, this group straddles the divide between firmer and paring chisels. CHI29 is so thin that it must have functioned as a paring chisel, whilst CHI30 is considerably more robust, and could have been used with a mallet. CHI31 is very small, and would have been suitable for delicate work, although it is probably robust enough to have been used with a mallet. However, a complete chisel with this blade type from Aquileia (Gaitzsch, 1980, Taf. 38, 181) has an unburred handle, indicating that it was used as a paring chisel despite being quite robust.

Two objects of this type, CHI29 and CHI30, have maker's marks, both in the same position on the blade. CH29 is also unusual in this group, in that it conforms to the overall shape of a Type C blade, but also develops edge bevels and becomes octagonal-sectioned in the centre, before tapering and becoming rectangular-sectioned again towards the blade.

Site	Site Type	Context	Date	Reference
Elginhaugh	Military	Demolition	-	(Allason-Jones, 2007, fig. 10.37, 137)
Aquileia	Urban	-	-	(Gaitzsch, 1980, Taf. 38, 181)
Avenches (x2)	Urban	-	-	(Duvauchelle, 1990, No. 76, 78)
Feldburg	Military	-	150-260	(Pietsch, 1983, Taf. 10, 166)
Saalburg (x3)	Military	-	90-260	(Pietsch, 1983, Taf. 10, 164, 167, 167a)
Zugmantel	Military	-	90-260	(Pietsch, 1983, Taf. 10, 165)

Table 51 Comparanda for Type C-2 chisels.

Type D

Type D is a robust rectangular-sectioned blade, the edge of which is formed by a deep bevel on one side of the blade only. It is possible to break this group down into two subtypes. **Type Di** has a blade which is considerably wider than it is deep. One tool of this form, CHI32, comes from London. Modern blades of similar form are considered either firmer or mortice chisels depending on their robustness, although Manning (1985a, p. 23) and Darbyshire (1995, pp. 487–8) describe all objects of this type as mortice chisels. **Type Dii** is deeper than it is wide, corresponding to the form of modern mortice chisels. Ten tools of this form come from London (Table 43). Another type of mortice chisel, with a curved blade, is not found in Britain, but is known from a number of Continental sites (Harnecker, 1997, Taf. 9, 68, Taf. 10, 74; Hanemann, 2014, Abb. 326, 1). These tools would all have been used carry out heavy tasks, and would have been struck with a mallet.

CHI33-5 have Type 2 shouldered tangs. With the wide shoulders of these tools resting on a ferrule, there would be little risk of the handle splitting during heavy work. Today, tangs are more common than sockets on mortice chisels, as indicated by the fact that Salaman (1975, p. 141) considered 'Socket Mortice Chisels' to be a separate type. However, Manning (1985a, p. 23) found tanged examples to be 'unusual' in the Roman period, compared to socketed or solid-handled tools. Comparanda is correspondingly less common, but the type can be found across the Northern provinces (Table 52). It is therefore interesting that tanged examples are almost as common in London as the other types. CHI35 is unusual within this group as it is quite crudely made, with pinched shoulder and a shallow bevel on the underside of the blade.

Site	Site Type	Context	Date	Reference
Hod Hill (x2)	Military	-	43-51?	(Manning, 1985a, B41-2)
Augst (x2)	Urban	Hoard	200-300	(Mutz, 1980, Abb. 4, 15-6)
Avenches	Urban	-	-	(Duvauchelle, 1990, No. 69)
Pompeii	Urban	-	Before 79	(Gaitzsch, 1980, Taf. 20, 115)
Saalburg	Military	-	85-260	(Pietsch, 1983, Taf. 8, 141)

Table 52 Comparanda for Type D-2 chisels.

Site	Site Type	Context	Date	Reference
Brampton	Military/ Industrial	Hoard	100-125	(Manning, 1966, No. 8)
Camerton	Military?	-	100 BC – AD 100?	(Jackson, 1990, Pl. 23, 240)
Chichester	Military/ Urban	-	50-75	(Down, 1978, fig. 10.29, 8)
Chilgrove	Villa	Pit	-	(Down, 1979, fig. 46, 10)
Hod Hill (x2)	Military	-	43-51?	(Manning, 1985a, B36-7)
Kingsholm	Military	-	49-69	(Manning, 1985a, B35)
Newstead (x4)	Military	Pits	80-211	(Curle, 1911, Pl. LIX, 7-10)
Silchester (x4)	Urban	Hoard	200-400	(Evans, 1894, fig. 15)
Avenches (x2)	Urban	-	-	(Duvauchelle, 1990, No. 67-8)
Feldburg	Military	Hoard?	150-260	(Pietsch, 1983, Taf. 8, 130a)
Haltern (x10)	Military	-	1 BC - 9 AD	(Harnecker, 1997, Taf. 6, 42, 49, Taf. 7, 52-3, 56, Taf.8, 57, 65-6, Taf. 9, 70-1)
Königsforst	-	-	-	(Gaitzsch, 1980, Taf. 54, 272)
Niederbieber	Military	-	185-260	(Gaitzsch, 1980, Taf. 45, 212)
Saalburg (x8)	Military	-	85-260	(Pietsch, 1983, Taf. 8, 130, 131, 131a, 132, 132a-b, 133, 133a)

Table 53 Comparanda for Type D-5 chisels.

Five Type D chisels are socketed (Table 43), making this the most common type of mortice chisel in London. This conforms with the pattern Manning (1985a, p. 23) found, and comparanda is plentiful across Britain and elsewhere in the Roman period (Table 53). CHI39 is somewhat different from the others in this group as it has and exceptionally deep and narrow blade. Similar tools come from Augst (Mutz, 1968, Abb. 9).

Three Type D chisels have Type 6 solid handles (Table 43), although their handles are all very different. CHI40 is simply a rectangular-sectioned iron bar, burred and one end and bevelled to a tip at the other. No other Roman chisels with this form are known to the author (Table 54), but a somewhat similar tool comes from a mid-13th century context at Dyserth Castle (Goodall, 1980, figs 38, C35). CHI41-42 both have round-sectioned handles, CHI41 with a slightly flared butt and CHI42 with a truncated cone head. Round-sectioned handles are probably the most common form (Manning, 1985a, p. 23). Solid-handled chisels are likely to have been struck with iron hammers rather than wooden mallets (Manning, 1985a, p. 23), and may have been used on metal or stone rather than wood. The truncated cone head of CHI42 is similar to that seen on other chisel types which are likely to have been for stonework (see p.444), and it is possible that CHI42 was a mason's chisel, perhaps a lewising tool. These chisels may have been employed in cutting joints in substantial timbers in hard woods, such as oak (Manning, 1985a, p. 23), and Salaman (1975, p. 146) describes similar chisels used by wheelwrights and for 'rough work in carpentry, military work, railway wagon building, etc.'

Site	Site Type	Context	Date	Handle section	Head shape	Reference
Dorchester	Urban	Hoard	300-450?	Octagonal	Flared	(Frere, 1984, fig. 33, 30)
Elginhaugh	Military	Road surface	-	Round	Flat	(Allason-Jones, 2007, fig. 10.36, 131)
Ingleby Barwick	Villa	Hoard	Late Roman?	Square	Rectangular	(Hunter, 2013, fig. 4.17, i)
Silchester	Urban	Hoard	200-400	Round	Disc	(Evans, 1894, fig. 15)
Wanborough	Urban	-	-	Square	Flared	(Isaac, 2001, fig. 50, 1)
Winchester	Urban	Demolition layer	325+	Square	Flared	(Rees *et al.*, 2008, fig. 78, 645)
Feldburg	Military	Hoard?	150-260	Round	Flared	(Pietsch, 1983, Taf. 8, 136)
Niederbieber	Military	-	185-260	Square	Flat	(Gaitzsch, 1980, Taf. 46, 224)
Saalburg	Military	-	85-260	Square	Burred	(Pietsch, 1983, Taf. 8, 134)
Saalburg	Military	-	85-260	Octagonal	Flared	(Pietsch, 1983, Taf. 8, 135a)
Zugmantel	Military	-	90-260	Octagonal	Flared	(Pietsch, 1983, Taf. 8, 135)

Table 54 Comparanda for Type D-6 chisels.

Rare blade forms

In addition to the common blade forms, three considerably rarer types can be seen in the London assemblage (Figure 244).

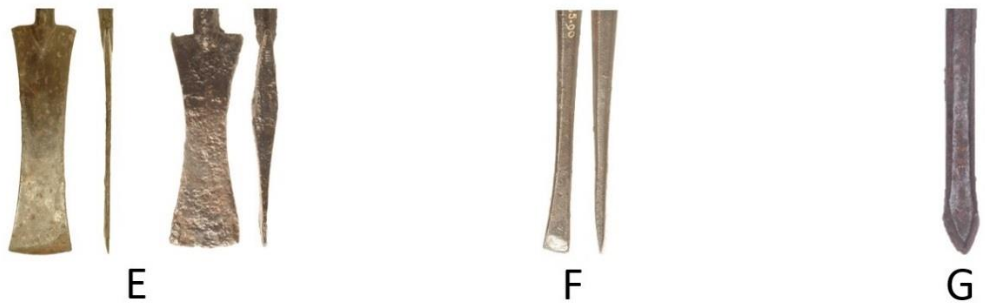


Figure 244 Rare chisel blade types (Type E, CHI43, CHI44; Type F, CHI45; Type G, CHI46). Not to scale.

Type E blades are similar to Type A-C blades, but differ in that they step out considerably from a socket or handle to form a wide shoulder. They resemble Type 2 tanged chisels, with the significant difference that the wide shoulder comes too far down the object to have sat on a ferrule, and therefore serves no obvious purpose. All examples of this type are waisted, giving a distinctive outline. Although categorised here as a separate type, the wide shoulder of this type could be seen simply as a way to strengthen extremely wide examples of Type A and C chisel blades.

The two objects of this type from London both have different blade sections and handle attachments. CHI43 is socketed, with a thin blade comparable to Type A blades. CHI44 has an integral oval-sectioned handle with a robust blade that is diamond-shaped in longitudinal section, resembling a Type C blade. Other socketed tools of this form come from Corbridge (CO91), Pompeii (Gaitzsch, 1980, Taf. 20, 113), Boscoreale (Harvey, 2010, fig. 11), Budapest (Rupnik, 2015, fig. 4, 27), and Avenches (Duvauchelle, 1990, No. 75). CHI51 may be the fragment of a blade similar to CHI43. Despite having blades of very different robustness, all three have wide, rounded cutting edges, indicating that they fulfilled similar functions. Chisel marks of this type have been found within joints on Roman timbers from London (see p.97), and these may have been specialised joint-cutting tools

Type F has an angled tip. Only one object from London, CHI45, has an obviously deliberately angled edge. Other chisels from London with angled edges (CHI05-07) may have been caused by wear or damage, although it is not impossible that these are also skew chisels. Today, angled skew chisels are used either with lathes (Salaman, 1975, p. 144) or in freehand carving (Salaman, 1975, p. 136). CHI45 is sharpened with bevels on both sides, in the same way as modern lathe tools (Salaman, 1975, p. 144). A number of skewed chisels with longer blades and sockets come from the Neupotz hoard (Künzl, 1993, Taf. 586-7).

Type G has a pointed spear-shaped head, with bevels on one side only. Only one tool of this type, CHI46, comes from London. With its bevels on one side only, this tool fits the profile of a modern diamond point scraper; a tool used with a lathe for precision turning of hardwoods (Salaman, 1975, pp. 144–6). An extremely similar object with a bent tip comes from Rachelburg (Pietsch, forthcoming, Abb. 2, 3).

Conclusions

Whilst it is generally accepted that Roman chisels followed the modern tripartite division of chisel form (Salaman, 1975, p. 130; Manning, 1985a, p. 21), this analysis has shown that this is not always a helpful way of examining Roman chisels. Four primary blade types can be seen, of which only one, Type D, can be unambiguously related to a modern blade type, the mortice chisel. Other blade types straddle the divide between paring and firmer chisels. A number of supplementary blade types can be found in London, some of which relate to lathe turning. In addition to these blade types, we can see an incredible diversity of handle attachment type and overall form. These forms do not often associate with only one blade type, although Type 4 was found to be a dedicated paring chisel type.

Metric Analysis

Different chisel types in London are clearly associated with different ranges of widths. Gaitzsch (1980, Abb. 19, 22, 26, 29, 32) has examined the widths of Roman woodworking chisels, and suggests that some were made to standard widths, based on Roman *digitus* measurements (Gaitzsch, 1980, p. 257). However, the chisels from London show a spread of blade widths that cannot obviously be tied to a standardised measuring system (Figure 245). Two chisels stand out, however. CHI44 (38mm) and CHI51 (37mm) conform closely to 2 *digiti* (37mm) or 1 ½ *unciae* (36.9mm). CHI43 has a 49mm wide blade, corresponding closely to 2 *unciae* (49.2mm).

These chisels have highly unusual Type E blades, and their widths suggest that they may have been deliberately manufactured to correspond to the *unciae* measuring system.

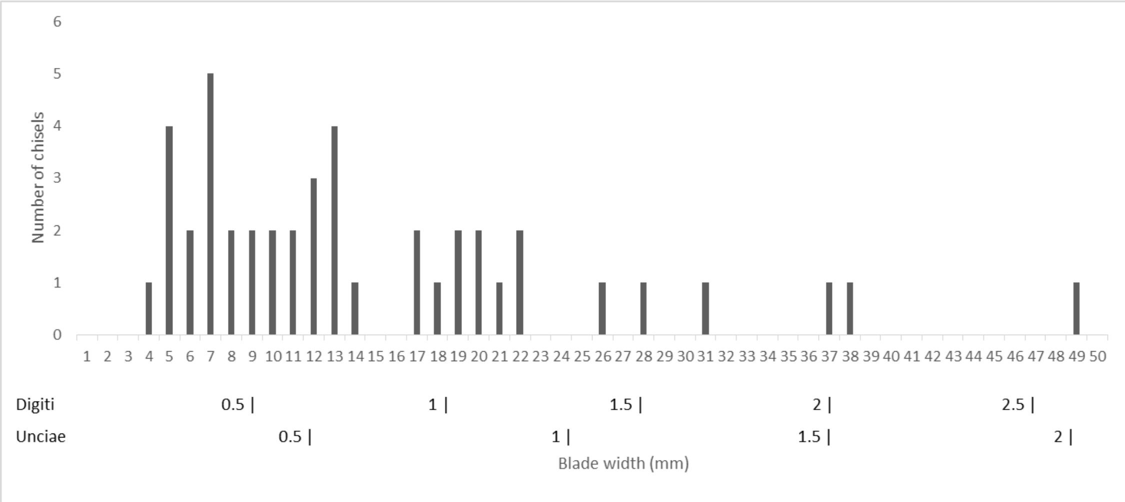


Figure 245 Blade widths of the complete chisels from London (Total = 44).

Creases

A crease is a blunt tool used to imprint a depressed line onto wetted leather (Salaman, 1986, p. 247). Three tools from London may have been used for this purpose, although none can be identified with certainty. The most convincing is CRE01, which has a wide, curved and obviously blunt blade at one end, and a possible smaller angled blade at the other. This tool is not stratified, however, and may not be Roman. CRE02 and CRE03 both have smaller, slightly rounded tips, and may also have functioned as creases. Although originally identified as a bent spatula (Humphreys in Marshall and Wardle, forthcoming), CRE03 may be a crease, as modern tools also have curved stems (Salaman, 1986, fig. 9:32). Another possible creaser is identified at Ickham (Riddler and Mould, 2010, fig. 121, 1276). The fact that none of these objects closely resembles each other may suggest that some or all of them are not in fact creases.

Crowbars and Claw Bars

Technology

This section discusses two closely related tools; crowbars and claw bars. Crowbars (or wrecking bars) are strong iron rods with a chisel edge or spike at one end, which are primarily used as levers to move heavy objects (Salaman, 1975, p. 170). Gaitzsch (1980, pp. 179–80) associates them with quarries and transport, and Manning (1985a, p. 32) with masons, but they would have had a wide variety of uses in any situation in which heavy objects were moved. Claw bars are a type of crowbar distinguished by a split claw at one end, which is adapted for removing nails. Today they are used for opening cases and crates (Salaman, 1975, p. 90), but could also be used by carpenters, builders, farriers etc., especially as claw bars are more common than claw hammers in the Roman world.

Numbers

Two crowbars come from London, one each from the British Museum and Museum of London.

Typology

Crowbars

A number of Roman crowbar types are known, including possible curved examples from Newstead (Curle, 1911, Pl. LVIII, 7-9; Manning, 1985a, p. 32), and examples with wide spatulate ends from Pompeii (Gaitzsch, 1980, Taf. 32, 154-5). The only crowbar from London, CBR01, is of a type with a round handle, flat butt, and a tip like that of a mortising chisel. CBR01 has a neatly formed octagonal-sectioned handle, the workmanship of which Manning (1985a, p. 32) considered to be consistent with first century military ironwork, although a similar object was also found at Pompeii (Table 55). No other tools of this type come from Britain (Manning, 1985a, p. 32), although comparable objects are known from Europe, from the Iron Age onwards (Table 55). An object from Elginhaugh identified as a crowbar (Allason-Jones, 2007, fig. 10.36, 131) is probably a solid-handled mortice chisel (see p.458).

Site	Site Type	Context	Date	Reference
Manching	Oppidum	-	300-30 BC	(Jacobi, 1974, Taf. 7, 82)
Magdalensberg (x3)	Urban	-	15 BC – 50 AD	(Mossler, 1974, Abb. 7-9)
Pompeii	Urban	-	Before 79	(Gaitzsch, 1980, Taf. 32, 153)
Saalburg	Military	Hoard	85-260	(Pietsch, 1983, Taf. 17, 414)
Saalburg	Military	-	85-260	(Pietsch, 1983, Taf. 17, 414b)
Zugmantel	Military	-	990-265	(Pietsch, 1983, Taf. 17, 414a)

Table 55 Comparanda for crowbar CBR01.

Clawbars

Clawbars are much more common than crowbars on Roman sites, with Gaitzsch (1980, p. 176) aware of 46 examples. Gaitzsch (1980, p. 176) distinguishes two size groups, a smaller group under 30cm long, and a larger group between 34 and 85cm long. Longer tools are rarer in the provinces (Gaitzsch, 1980, p. 177), and the claw bar from London, CBR02, is in the short group. It is also possible to break these objects down by their overall form, and three basic types can be proposed.

Type 1 consists of a stout, usually octagonal-sectioned bar, with a flat, often burred, butt at one end, and a forked claw at the other. Most of the objects of this type belong to Gaitzsch's short group. This is the most common type, with examples known from across the Empire, although primarily from military sites. Manning et al. (1995, pp. 250–1) list a number of examples from Museums, to which can be added a number of published examples (Table 56). The only claw bar from London, CBR02, is of this form.

Site	Site Type	Context	Date	Reference
Warrington	Urban/ Industrial	Unstratified	-	(Jackson, 1992, fig. 45, 9)
Vindolanda	Military	-	213+	(Blake, 1999, No. 1000)
Vindolanda	Military	-	160-180	(Blake, 1999, No. 3719)
Vindolanda	Military	-	300+	(Blake, 1999, No. 5617)
Feldburg	Military	-	150-260	(Pietsch, 1983, Taf. 17, 416)
Haltern (x2)	Military	-	1 BC - 9 AD	(Harnecker, 1997, Taf. 23, 281-2)
Novaesium (X2)	Military	-	-	(Gaitzsch, 1980, Taf. 53, 268-9)
Pompeii (x6)	Urban	-	Before 79	(Gaitzsch, 1980, Taf. 29, 146, Taf. 30, 148-52)
Saalburg (x4)	Military	-	85-260	(Pietsch, 1983, Taf. 17, 419a, 420, 421, 421a)
Zugmantel (x3)	Military	-	90-260	(Pietsch, 1983, Taf. 17, 419, 421b, 422)

Table 56 Comparanda for Type 1 claw bars.

Type 2 is a double-ended tool combining a claw bar and a crowbar. It consists of a straight bar with a claw at one end and a wedge-like chisel edge at the other. This type is normally in

Gaitzsch's long group. Examples include those from Vindolanda (Blake, 1999, No. 4102) and Pompeii (Gaitzsch, 1980, Taf. 29, 143).

Type 3 is also double-ended, combining either a claw and chisel-edge, or two claws. The defining feature of this type is that it is bent into a deep curve. Examples include those from Usk (Manning, Price and Webster, 1995, figs 76, 20), Vindolanda (Blake, 1999, No. 3669), Saalburg (Pietsch, 1983, Taf. 17, 423-4), and Avenches (Duvauchelle, 1990 No. 62, 65).

Croze Irons

Technology

Crozes are specialised coopers' tools, which are used to cut a groove (also called a croze (Salaman, 1975, p. 319)) around the inside of a barrel or bucket, in which the base would sit. Although discussed here separately, crozes could also be considered a form of saw or plough plane (Salaman, 1975, p. 319). Crozes consist of three main elements; a semi-circular wooden body (fence), which is held against the rim of the vessel; a vertical post which passes through it, the height of which can be adjusted by a wedge; and a serrated iron cutter, which is inserted into the vertical shaft (Figure 246). No surviving Roman croze body is known, but the iron blades of these tools were identified by Hedges and Wait (1987), and have since been recognised elsewhere (Sagadin, 2015). These objects have also been misidentified as leather stitch-prickers (Pietsch, 1983, p. 60; Manning, 2014a, p. 228) and plaster scrapers (Champion, 1916, Pl. XIV, 15893, 29059).

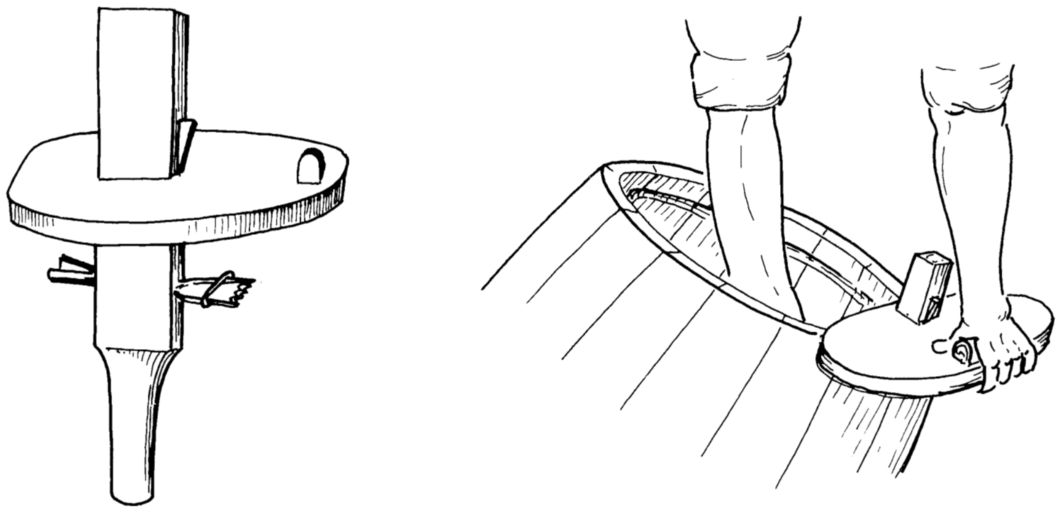


Figure 246 A modern cooper's croze in use (Hedges and Wait 1987, fig. 2).

Numbers

Only one croze iron, CRO01, comes from London.

Typology

Hedges and Wait (1987) identify two types of Roman croze blade.

Type 1 consists of a single semi-circular tanged blade with teeth on the outside edge. CRO01 is of this type. This type would cut a narrower groove than the double-bladed Type 2. Hedges and Wait (1987, p. 259) suggest that the more exaggerated curves of these semi-circular blades indicates that they were used on smaller vessels. However, the curve of the blade does not directly correspond to the curve of the barrel. If it did, the tang of CRO02 would prevent it from entering the barrel. CRO02 has teeth which increase in size from one side to the other, and a set which increases in width as the teeth get wider. Another croze from Roughground farm also has a visible set (Hedges and Wait, 1987, p. 259).

Site	Site Type	Context	Date	Reference
Caernarfon	Military	-	275-350	(Allason-Jones, 1993, fig. 10.13, 290)
Ingleby Barwick (x2)	Villa	Hoard	Late Roman?	(Hunter, 2013, fig. 4.23, f-g)
Roughground Farm	Villa	-	Late Roman	(Allen and Brunner-Ellis, 1993, fig. 99, 64)
Wigginton	Villa	-	-	(Hedges and Wait, 1987, fig. 1.3)
Aquileia	Urban	-	-	(Gaitzsch, 1980, Taf. 3, 176)
Compiègne	-	-	-	(Champion, 1916, Pl. XIV, 15893, 29059)
Zugmantel	Military	-	90-260	(Pietsch, 1983, Taf. 21, 505)

Table 57 Comparanda for Type 1 croze irons.

Type 2 croze irons consist of two blades stacked on top of each other. This is the more modern type (Salaman, 1975, fig. 468, f), and would produce a wider cut than Type 1. Roman examples of this type come from Claydon Pike (Hedges and Wait, 1987, fig. 1.1, 1.2) Dorchester on Thames (Manning, 2014a, figs 143, 70) and Saalburg (Pietsch, 1983, Taf. 21, 503-4).

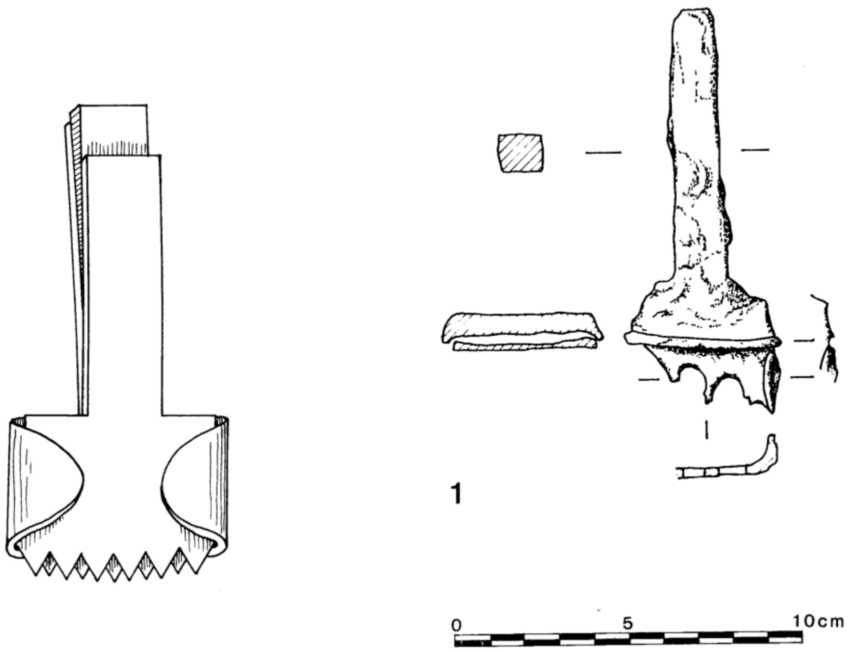


Figure 247 Composite croze irons; modern (left, Hedge and Wait 1987, fig. 3), and Roman, from Claydon Pike (Hedges and Wait 1987, fig. 1.1).

Curry Combs

Technology

Curry combs consist of a serrated iron blade attached to a handle. They are used in animal care to comb animals' coats, removing mud, sweat, hair and skin parasites, in the process massaging the animal's muscles (J Clark, 1995). Until recently, and in the middle ages, they were reserved for use on horses, although some curry combs are referred to in 20th century catalogues as 'cow combs' (J Clark, 1995). Metal curry combs have largely fallen out of use today, as they are unsuitable for use on short-haired animals (J Clark, 1995).

Numbers

Three objects are discussed here, both from recent excavations by MOLA. Another possible curry comb is discussed amongst the scrapers (see p.568). A fifth possible curry comb from London is reported in the Drapers' Gardens finds assessment (Hawkins, 2009a, p. 241), but has yet to be published, and is not discussed here.

Typology

Whilst the medieval curry combs from London are well understood (J Clark, 1995), there is considerable uncertainty about their identification in Roman archaeology. Examples of the most common type of 'Roman' curry comb, consisting of a serrated U-shaped blade riveted to a two- or three-armed handle, are all poorly dated, and many are likely to be Medieval (Humphreys in Marshall and Wardle, forthcoming; J Clark, 1995). Another potential type of Roman curry comb, consisting of a handled rectangular blade with teeth on one side, is found only in Continental Europe. These objects are thought to be weft beaters based on their appearance in graves alongside textiles-working equipment (Pásztókai-Szeőke, 2009).

Recent excavations at Bloomberg London have uncovered two curry combs (CUR01-02), which both have the same form. These objects are the only securely dated, unmistakable Roman curry combs known to the author. Both objects consist of a wide U-shaped blade, toothed along at least one edge, which is attached to a wrap-around wooden handle by nails penetrating the back of the arch. This type is not found in the middle ages, but neither can it be securely paralleled elsewhere in the Roman Empire. The only comparable object known to the author is a toothed U-shaped blade, apparently perforated by a single nail hole, from Saalburg (Pietsch, 1983, Taf. 21, 510).

CUR01's handle is well-preserved, and appears to have been tuned on a lathe, before having a recess cut into one side to accommodate the blade. Wood grain preserved on CUR02 shows that it would have had a wooden handle attached directly to the blade in the same way.

The blades of these objects are not exactly the same. CUR01 is more deeply curved than CUR02, with arms of uneven length, although this may in part be due to corrosion. CUR02's teeth are peculiar, as they are not of uniform size. On one edge, the teeth only extend part of the way along the blade. CUR01s teeth are not well preserved, so it is not possible to tell if this was the normal form.

Another tool from London, CUR03 was originally interpreted as a hoe, but does not resemble any other Roman agricultural implement known to the author. This object is tanged, with the dished profile of the blade possibly indicating that CUR03 is a curry comb, although its edge is not preserved, and it could also be a particularly wide-bladed scraper similar to SCR05 (see p.568).

Dies, Stamps, and Branding Irons

Technology

The objects discussed in this section were used to imprint a design, usually letters, onto another object. The ways in which this could be achieved are discussed in the typology section. Dies in the Roman period could be made of a variety of materials, including metals, clay and stone (Collingwood and Wright, 1991, p. 73), and were used to mark an even wider variety of object types. This section will only consider those dies made of metal. In order to avoid confusion, this section will limit the use of the terms 'die' and 'stamp'. The term 'die' will be used to refer to all marking tools in this section. In Classical archaeology these objects are sometimes referred to with the term *Signacula*. The term 'stamp' will be used only to refer to the impression or mark left by a tool.

Numbers

Five dies come from London, all from the Museum of London.

Typology

Dies can be divided in the first instance into letter dies and shaping dies.

Letter Dies

No general typology of letter dies from the Roman period exists, but several works have collected together catalogues of known examples (Garbsch, 1970; Gaitzsch, 1980, pp. 268–73; Desbat, 1991, fig. 8; Marlière, 2002, fig. 214; Baratta, 2007). From these, four main types of letter dies can be recognised based on the form of the letters.

Type 1

Type 1 dies have small recessed letters incised into the striking face. Dies of this kind would produce stamps with raised letters on a depressed background. One object of this type, DIE01, comes from London. DIE01 has a 'bolster' form similar to that of the Type 2.1 dies, with a rectangular head on a short, burred integral iron handle, indicating that it was struck with a hammer. The short handle would make it unsuitable for heating.

Stamps of this form are common as makers' marks on a wide variety of object types, from pottery and leather to tools (Figure 317). The robust battered stem of DIE01 shows that it was used on harder materials, such as metal. DIE01 has four letters on its striking face; 'MPBR'. An expansion for DIE03 has been suggested as *M(etalla) P(rovinciae) BR(itanniae)*: 'The mines of the province of Britannia' (Wright, 1984). This suggests that the die was an official object, potentially representing the authority of a *procurator metallorum* stationed in London (Wright, 1984, p. 258), and not a private citizen. It may have been used to stamp ingots, possibly of iron, lead or silver (Wright, 1984, below) as they passed through London, although it is also possible that it was used to mark tools used in mining.

Type 2

Type 2 dies have raised letters on the striking surface, normally in retrograde, which would produce an indented, unframed stamp when struck. The letters on the London dies are sharp and wedge-shaped. This type can be broken into three subtypes based on the form of the die.

Type 2.1 dies have the same 'bolster' form as DIE01, consisting of a (usually) rectangular head, with letters on the striking face, and a short integral iron handle. All known examples show signs of battering to the butt, indicating that these stamps were struck with hammers. Type 2.1's short handle would make it unsuitable for heating. Two objects of this form, DIE02 and DIE03, come from London, although DIE03 differs from the usual shape in having a head which expands continually from the shaft, rather than stepping out at the shoulder.

Type 2.2 dies share the rectangular-headed form of Type 2.1 dies, but differ in having a longer iron stem, ending in either a spiked tang or a transverse iron piece, giving a T-shaped butt. This type would probably have had a wooden handle fitted (Deringer, 1965, p. 218; Duvauchelle, 1990, p. 27; Marlière, 2002, p. 102), and this may indicate that the tools were heated before use. However, Deringer (1965, p. 217) has suggested that the Type 2.2 die from Lauriacum is too small to have been used for branding without becoming indistinct. It may therefore have been heated to a lower temperature than that of a glowing branding iron. No objects of this form come from London.

Type 2.3 dies have the form of an axe-hammer with raised letters on the striking face of the poll. No objects of this type come from London. Catalogues of Continental examples are given by Gaitzsch (1980, pp. 268–9) and Hanemann (2014, Abb. 294, Typ 10), to which can be added a probable example from Gorhambury (Wardle, 1990, figs 131, 363). Although Marlière (2002, p. 102) considered these to be dedicated coopers' tools, they may also have been used in forestry, as modern marking hammers are used for adding ownership marks to trees (Salaman, 1975, p. 229).

DIE02 and DIE03 both have three letters on their stamping faces. This is the most common inscription type for both branding irons and dies, and indicates the initials of a *tria nomina;* a personal name and a sign of Roman citizenship (Rhodes, 1987, p. 175; Marlière, 2002, pp. 112–

3; Baratta, 2007, p. 100). Unfortunately it is not possible to expand these names. It is also possible that DIE03's stamp 'CVC' is a numeral for 195. Dies of this type could have been used for marking a range of different materials, including metals, leather and wood.

Stamps on metal: Type 2 Letter stamps are found on ingots of copper (*RIB* 2403.7) and lead (*RIB* 2404.2), although these are generally longer than the London examples. On lead ingots they appear as secondary marks on objects which have usually been cast with a more elaborate inscription already in place. As such they may represent customs marks, ownership marks or marks of quality rather than manufacturer's marks.

Stamps on wood: Type 2 stamps have been found in two situations on wooden objects. Examples from timber offcuts, including examples from London (Hassall and Tomlin, 1996, fig. 8), show that Type 2 dies were used to mark felled timbers. Type 2 stamps are also found on barrel staves (Marlière, 2002, p. 102; Baratta, 2007, pp. 100–2). These can be both inside and outside the barrels, and may variously represent the names of coopers, merchants or the producers of the barrel's contents (Baratta, 2007, p. 102). Tanged Type 2.2 dies would be particularly well-suited to these task as they could be heated and used to burn the letters onto the wood, although it is equally possible that the shorter Type 2.1 dies from London were used cold to impress these marks. Rhodes (1987, p. 176) considered DIE02 to be too large for use on leather, and so it may have been used on barrel staves.

Stamps on leather: Type 2 stamps of this short kind have also been identified on leather, and Rhodes (1987, p. 176) considered DIE03 to be a good match for these stamps. Marks on leather can relate to all periods of use, from tanning, to manufacture and ownership, but Type 2 letter stamps appear to be related to only the first two stages, as well as potentially to the trade in hides and finished objects (Baratta, 2008). In London and elsewhere, letter stamps are often found at the edge of hides, on areas that would be discarded during leatherworking (Rhodes, 1987, p. 173). Rhodes (1987) has demonstrated that some were applied to skins before tanning, suggesting that they were perhaps used to identify bundles of hides in large communal tanneries (Rhodes, 1987, pp. 175–6).

Type 3

Type 3 dies are true branding irons. They consist of flat letters formed of iron, normally attached to individual iron shafts which converge on a single tang. These objects are not suitable for striking, and would have been heated in order to burn the letters onto wood, leather, or livestock. Two British examples, not included in Continental catalogues, include a well-preserved example from Vindolanda (Blake, 1999, No. 4482), and a possible branding iron tang from Dorchester (Manning, 2014a, figs 143, 71).

Type 4

Type 4 dies consist of a flat plate with raised or recessed letters on the stamping face, and a small, normally ring-shaped, handle on the back. One object of this type, DIE04, comes from London. These objects are often referred to as *signacula*, and have been extensively studied (Buonopane, Braito and Girardi, 2014), with a detailed typology recently provided by Baratta (2014). These stamps can be made of bronze (Collingwood and Wright, 1991, RIB 2409.12, 15-16, 29-30, 33, 35-36), lead (Collingwood and Wright, 1991, RIB 2409.4-5, 7-8, 10-11), as well as clay, and would be unsuitable for striking. As such their use would have been limited to soft materials, such as clay or dough. They are therefore unlikely to have been craft tools in the sense of this thesis, and DIE04 will be discussed no further.

Shaping Dies

In addition to the letter dies, a smaller number of dies with abstract and figurative designs are known. These tools would have allowed metal objects with complex repoussé decoration to be mass produced (Brown, 1976, pp. 37–8; Higgins, 1976, p. 55; Johns, 1996, pp. 190–1).

The one example from London, DIE05, has the same ‘bolster’ form as the Type 1 or 2.1 dies discussed above, although DIE05 is considerably larger. It is not clear whether it would have been used alone as a die, or as a swage with a matching lower piece. DIE05 would have produced a curved ‘gadroon’ design. It is possible that this was used to create repeated fluting on the bases of metal vessels (Merrifield, 1983, p. 100).

The author is not aware of any other Roman dies with this form of design, but a number of other Roman shaping dies are known, and would have been used to produce a wide range of artefact types. These include bronze dies for producing military belt fittings from Colchester Sheepen and Oulton (Bishop and Coulston, 2006, fig. 149), a die for producing bracelet terminals in the Ashmolean (Johns, 1996, p. 191), and a die plate with an abstract ‘Celtic’ design from Wroxeter (Brown, 1976, fig. 41). Simple two-part shaping dies consisting of a bronze-headed domed punch and a rounded shaping cup come from Poole’s Cavern (Branigan and Bayley, forthcoming, figs 4, 108-10), and a hinged two-part swage die for making lines of dots comes from Avenches (Duvauchelle, 1990, No. 28). Earlier examples of shaping dies from the Greek and Mediterranean world can be found in Higgins (1961, figs 2, 3, 1976, figs 54, 55), Ogden (1992, figs 26-9), Eluère and Mohen (1993) and Treister (2001).

Drawknives and Tanning Knives

Technology

This section discusses tools which have the shared form of a knife-like blade with handles at either end. Tools of this form are used for a number of purposes by both carpenters and tanners.

Those used by carpenters are known as drawknives (or drawing knives) (Salaman, 1975, p. 175). Sometimes these objects are described as 'spokeshaves' (as all of the objects in this section originally were). This term properly refers to a plane-like device, in which a blade is mounted in a wooden handle (Salaman, 1975, p. 455), which is not known in Roman period (Manning, 1985a, p. 18). Drawknives have a variety of uses in many branches of carpentry, and can have straight, concave, or convex blades, or blades bent into curves, depending on their purpose (Salaman, 1975, pp. 175–83).

Salaman (1986, p. 301) describes a variety of knives of this form which are used in leather processing. Fleshing and unhairing knives are used in the initial stages of tanning to scrape away hair and flesh from a hide. Breaking knives are used to break down and soften the fibres of a hide after soaking, whilst currier's knives are used in the finishing of a tanned hide to shave it down to the desired thickness. Today each of these processes has a specialised knife, although they require many of the same properties and can be used interchangeably (Salaman, 1986, pp. 300–1). Gaitzsch (1980, pp. 66–7) identifies a single type of tool which was presumably used for all these purposes in the Roman period. As such the term 'tanning knife' will be used here to discuss tools of this type, unless a more specific identification is being proposed.

These tools are often confused, and are very difficult to separate from one another. One way of distinguishing between them may be the direction of the handles. Modern drawknives have handles at right angles to the blade, pointing towards the cutting edge. Leather tanning knives have handles which continue the line of the blade. This is because drawknives are pulled towards the body (Salaman, 1975, p. 175), whilst tanning knives are pushed away from the body (Salaman, 1986, p. 300). Whilst these different working methods cannot be presumed to have been standard practise in the Roman period, many curved Roman drawknives have forward-angled tangs (Pietsch, 1983 Taf. 26, 565-6; Manning, 1985a, B16; Hanemann, 2014, Abb. 316), showing clearly that they were pulled towards the body.

A pair of apparent tanning knives from Hod Hill, which have handles pointing away from the blade (Manning, 1985a, E1, E2), and another with backwards-angled handles from Pompeii (Gaitzsch, 1980, Taf. 25, 132), suggest that these were pushed away from the body. However, an otherwise identical object from Aquileia, also identified as a tanning knife by Gaitzsch (1980, Taf. 37, 174), has forward-angled handles. It is unclear if this means that tanning knives were both pushed and pulled in the Roman period, or if the tool from Aquileia has been misidentified. If so, the direction of the handles is the only obvious difference between tanning knives and drawknives.

The direction of pull is not obvious for objects with handles in line with the blade. Whilst these objects are normally tanning knives today, some small modern drawknives also have handles in line with the blade. An object from Ickham (Riddler and Mould, 2010, fig. 120, 1271) with tangs on the same alignment as the blade has the same form as a modern tanning knife, but was thought to have been too small for this, and may have been a drawknife.

Numbers

Four objects, all from the Museum of London, are discussed in this section.

Typology

Drawknives

A typology of drawknives is given by Hanemann (2014, Abb. 316), but this is mainly concerned with curved drawknives of the type used by coopers (Salaman, 1975, pp. 180–1), and does not include any objects that are directly comparable to those from London.

DRW01 and DRW02 have very comparable forms, although they differ considerably in size. Both have a deeply curved convex back, with two forward-angled tangs at either end. Both blades appear to be slightly concave, although in both cases this is so slight that it may be the result of corrosion or wear. Three very similar objects, with both tangs and solid handles, are known from elsewhere (Table 58).

Site	Site Type	Context	Date	Reference
Compiegne	Villa?	-	-	(Champion, 1916, Pl.3, 15883)
Pompeii (x2)	Urban	-	pre 79 AD	(Gaitzsch, 1980, Taf.25, 128, 130)

Table 58 Comparanda for drawknives DRW01 and DRW02.

Gaitzsch (1980, pp. 63–71, Taf. 25, 128, 130), interprets similar tools as general-purpose tanning knives; a single tool type in three sizes (ibid, Abb.8) used to fulfil all of the tasks which Salaman (1986, p. 301) describes. DRW02 would be in the smaller Group C, but DRW01 sits in the gap between Groups B and C. However, the forward-angle of the handles indicates that these tools were pulled towards the body, the way in which modern drawknives are used. This is also implied by the fact that one of DRW01’s tangs has been clenched over the end of the handle.

Modern drawknives usually have handles which point directly forward, but examples with angled handles very similar to those on DRW01 and DRW02 are also sold. Similarly broad, slightly convex-bladed drawknives discussed by Salaman (1975, p. 180) include a cooper's heading knife, used to round the ends of barrel staves, but it is impossible to give a definite use for either of these objects.

Tanning Knives

DRW03 has straight tangs projecting from either end. By analogy to modern tools, it is more likely to have been a leather processing knife than a woodworking draw knife. As the cutting edge is not well preserved, it is not possible to say precisely which operation it was used in. An extremely similar object comes from Saalburg (Pietsch, 1983, Taf. 21, 500), but the only comparable object from Roman Britain known to the author is a small tool from Ickham (Riddler and Mould, 2010, fig. 120, 1271), identified as a drawknife on account of its size.

DRW04 appears to be complete with a tang at one end only, but is otherwise very similar to DRW03. The odd curve to the cutting edge may be the result of wear. An extremely similar, although smaller, object from York, interpreted as a currier's knife, was dated to the medieval period (Ottaway and Rogers, 2002, fig. 1340; Ottaway, 2003, figs 1572, 11537). DRW04 has poor stratigraphic information, and came from a site which also produced medieval material, although DRW04 itself was associated with 1st and 2nd century pottery. There is therefore doubt that this object is Roman.

Engraving Tools

Technology

The objects described here are those used to engrave objects. Tools used to chase and emboss are discussed in a separate section (see p.541). Scribers, which are used to make faint preliminary lines, are discussed alongside awls and bradawls (see p.377).

Tools used to engrave can be generically termed ‘gravers’, although sometimes a distinction is made between gravers, with pointed tips, and scopers, which have chisel-like tips (Lowery, Savage and Wilkins, 1971, pp. 172–3). Both are pushed along the surface of an object to cut away thin shavings of metal, thereby creating a design. Lowery, Savage and Wilkins (1971) provide a basic introduction for archaeologists to these tools and the different marks they are able to create.

Figure 248 A pair of modern gravers (http://portlandjewelry.academy/jewelry-tool-list/grs-gravers/).

Numbers

Two possible engraving tools were found in recent excavations by MOLA at Bloomberg London, although neither can be identified with certainty.

Typology

ENG01 has a tip which could have allowed it to act as a graver (Lowery, Savage and Wilkins, 1971, fig. 1). Several comparable objects, also mostly identified as gravers, can be cited (Table 59), although their distribution across all site types is unusual for such a specialist tool. One of these objects, from Gussage All-Saints was found in a pit containing metalworking tools, and can be accepted as a graver with some certainty. This nevertheless remains an uncertain identification, as the object is very roughly formed. It is also possible that this is a rake tine similar to RAK45-49.

Site	Site Type	Context	Date	Reference
Danebury	Hillfort	Pit	300 BC - 50 AD	(Fell, 1990, fig. A23, 214)
Dorchester	Urban	-	-	(Manning, 2014a, fig. 142, 65)
Gorhambury	Villa	Unstratified	-	(Wardle, 1990, fig. 138, 899)
Gussage All-Saints	Hillfort	Hoard	100 BC - 0	(Fell, 1990, fig. A23, 216)
Shakenoak Farm (x2)	Villa	-	300-400	(Brodribb, Hands and Walker, 2005, fig. IV.58, 393-4)
Wilcote	Rural	-	-	(Hands, 1993, fig. 30, 23)

Table 59 Comparanda for ENG01

ENG02's knife-like form is more reminiscent of modern gravers and scorpers. A small bevel at the tip may indicate that this was also an engraving tool, although it is not closely similar to any of the major modern scorper types. However, ENG02 also strongly resembles a Type 1d knife blade (Manning, 1985a, fig. 28). ENG02's blade is currently rectangular in section, and it cannot have functioned as a knife, but it is not impossible that it represents a partially forged knife blade. No Roman parallels can be cited, but without good preservation ENG02 would be indistinguishable from a knife blade.

Files and Rasps

Technology

Files are abrasive tools with raised teeth on their surface (Salaman, 1975, p. 194) used to work a range of materials types. Fell (1997, p. 85) and Salaman (1975, p. 195) break modern files into three groups, based on how the teeth are formed (Figure 249).

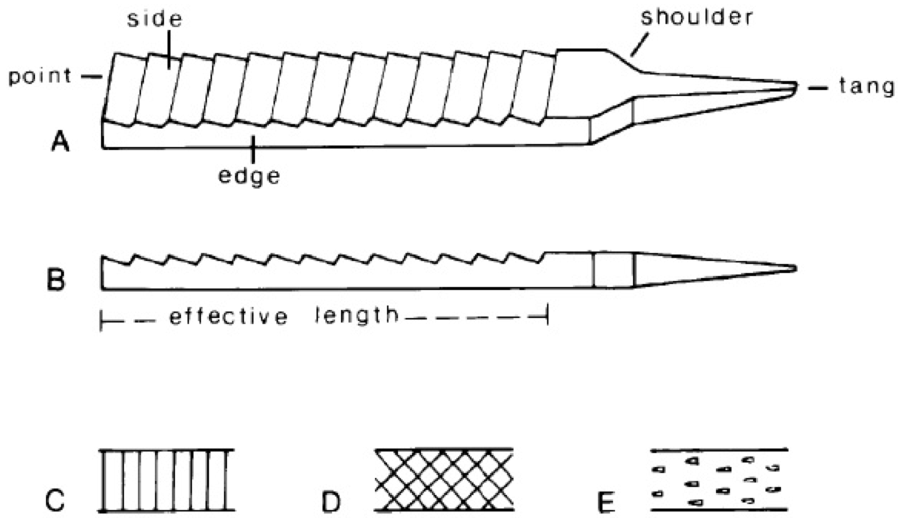


Figure 249 Terminology used to describe files and file tooth type (A-C, single-cut; D, double-cut; E, rasp-cut) (Fell 1997, fig. 1).

Single cut teeth are formed by linear cuts across the surface of the file. These cuts are made at an angle, to leave the teeth sloping in one direction. In modern and Iron Age files this is always towards the tip (Fell, 1997, p. 84). Files with single-cut teeth are known from the Late Bronze Age, and are the most common type in the Iron Age and Roman period (Fell 1997, 82). A variation on this form, **float cut** teeth, are deeper and larger than other single cut teeth. This type is known from the Iron Age and Roman periods.

Double cut teeth are cut in two directions, giving a cross-hatched appearance. This appears to be a Medieval introduction (Fell, 1997, p. 83), and is not seen on any Roman files.

Rasp cut teeth are not formed by linear cuts, but by individual punch marks. These appear to be a Roman introduction to Britain (Fell, 1997, pp. 82–3).

The form of the teeth of a file are a key indicator of function. Manning (1985a, pp. 11, 28) associates wide-spaced teeth, especially float-cut teeth, with soft materials such as wood and horn. These tools may have been used by carpenters or farriers. Narrow teeth are associated with harder materials, particularly metal. This was confirmed for Iron Age files by Fell (1997, 87-9), who showed that finer files were more likely to be quench-hardened (indicating their use on harder materials), often had non-ferrous metal particles preserved in their teeth, and were sometimes associated with metalworking waste. Rasps and files also have a role in stone carving (Blagg, 1976, p. 170; Wooton, Russell and Rockwell, 2013, pp. 8–9).

Numbers

Fourteen files are discussed here. Seven come from the Museum of London, four from recent excavations by MOLA, and one each from the British Museum, Bank of England Museum and the LAARC. A further file, MOL 16372, is recorded on the Museum of London's MIMSY database, but could not be located.

Typology

Files can be classified in two main ways; by the form of the blade, and the form of the teeth.

Teeth

All but one of the files from London have single-cut teeth. The teeth on two well-preserved Roman files from London, FIL05 and FIL09, can be seen to be angled towards the tip (Figure 250), as they are on modern and Iron Age files. On the majority of the well-preserved files (FIL01-03, FIL08-09, FIL13-14) the teeth are applied in multiple, overlapping rows, indicating that the teeth were cut with very narrow chisels. Only FIL11 has rasp-cut teeth.

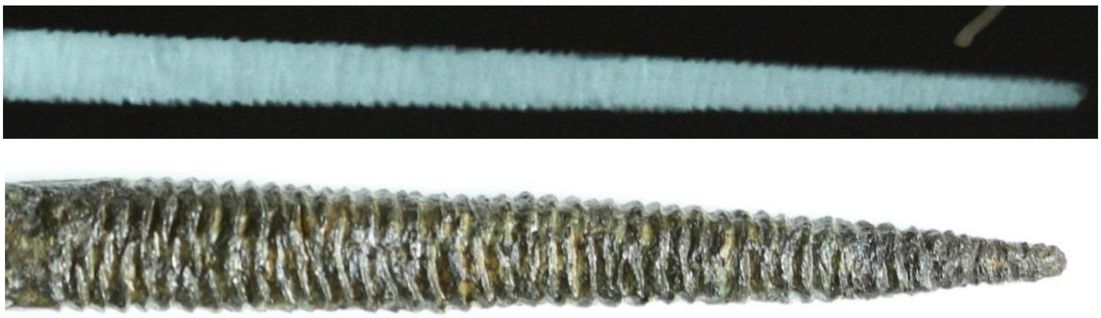


Figure 250 Files with forward-sloping teeth from London (top, FIL05; bottom, FIL09). Not to scale.

Fell (1997, p. 85) classifies files into four groups from 'coarse' to 'very fine' based on the number of teeth per centimetre (Table 60). This is similar to the way in which 19th century tool catalogues divided files from 'smooth' to 'rough' based on the number of teeth per inch (Salaman, 1975, p. 195). Whilst Fell's scheme gives a measure of the roughness of a file, the groups she creates are arbitrary divisions of a continuum of tooth size (Fell, 1997, fig. 9). These groups do not clearly represent defined types among Iron Age files. Only the 'very fine' group is obviously separate from the other files in Fell's dataset.

Category	Teeth/cm
Coarse	<6
Medium	6-9
Fine	9-20
Very fine	>20

Table 60 Fell's categorisation of file teeth (Fell 1997, 85).

When we apply this scheme to the London tools (Figure 251) we can see better-defined groups. No ‘coarse’ files came from London. A clear ‘medium’ group can be seen, but should be extended to include the file with 10 teeth/cm. The ‘fine’ and ‘very fine’ categories represent clear clusters within Fell’s size ranges. This is, however, a very small sample of only ten files, and these clusters may not be visible in a larger dataset.

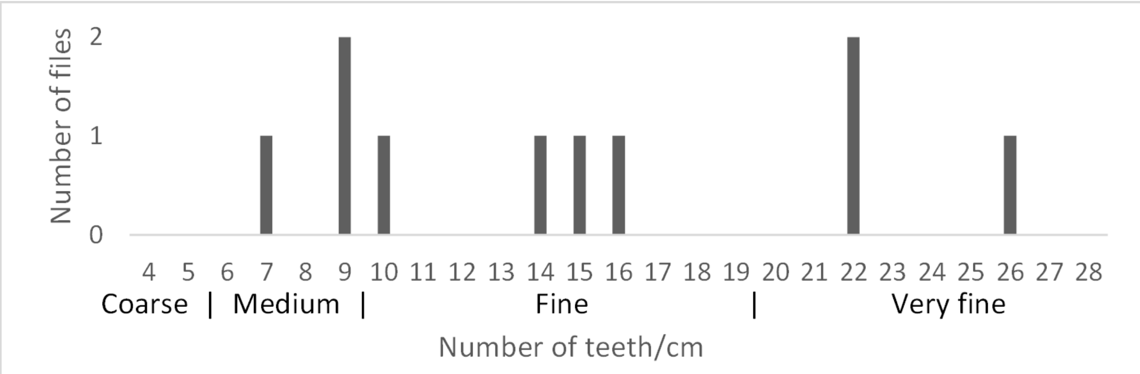


Figure 251 Graph showing the number of teeth on the Roman files from London, broken into the groups defined by Fell (1997, 85).

Blade shape

Most authors (Gaitzsch, 1980, Abb. 6; Pietsch, 1983, p. 50; Duvauchelle, 1990, pp. 12–3; Fell, 1997, Table 1; Hanemann, 2014, Abb. 372) divide files primarily based on the shape of the blade’s section. The blade shapes visible among the London files are shows in Figure 252.

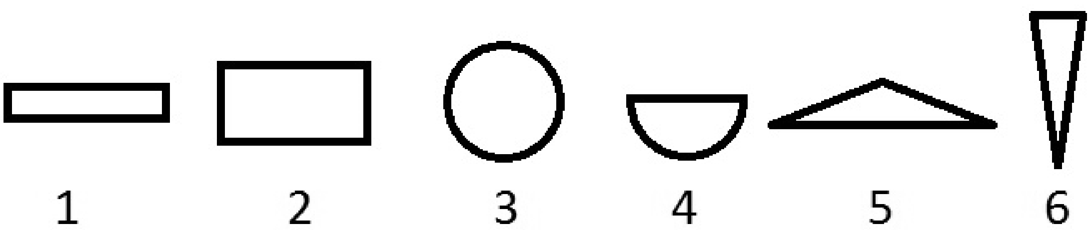


Figure 252 File blade section types. Not to scale.

Type 1 files have flat, parallel-sided or only slightly tapering blades, with flat tips. Two examples, FIL01 and FIL02, come from London, both with single-cut teeth. A third object, CIM01, was potentially a file of this type, but appears to have been reworked into a small chisel (see p.443). As these FIL01 has very fine teeth and FIL02 has fine teeth, they were almost certainly used as metalworking tools.

Site	Site Type	Context	Date	Reference
Caerleon	Military	-	-	(Scott, 2000, fig. 96, 19)
Gatcombe	Villa	Robbing	-	(Branigan, 1977, fig. 25, 450)
Gorhambury	Villa	Ditch	-	(Wardle, 1990, fig. 131, 368)
Usk	Military	Pit	55-69	(Manning, Price and Webster, 1995, fig. 75, 12)
Usk	Military	Pit	200-300	(Manning, Price and Webster, 1995, fig. 75, 13)
Saalburg	Military	-	85-260	(Pietsch, 1983, Taf. 16, 387)
Zugmantel (x3)	Military	-	90-260	(Pietsch, 1983, Taf. 16, 387a, 388, 388a)

Table 61 Comparanda for Type 1 flat files.

Type 2 files have chunkier square- or rectangular-sectioned blades, which taper along their length, sometimes coming to a point. Three examples, FIL03-05, come from London, all with single-cut teeth on all well preserved surfaces. This type varies considerably in size. The largest, FIL04, and smallest, FIL05, files from London are both in this group. FIL04 has medium teeth, and could have been used for woodwork or metalwork. FIL03 has fine teeth, and was probably a metalworking tool. FIL05 has very fine teeth. Due to its extremely slender form, it would have been suitable for very delicate metalwork, such as refining castings, applying decoration, or precision cutting.

Site	Site Type	Context	Date	Reference
Halton Chesters	Military	-	122+	(Manning, 1976b, fig. 14, 53)
Ingleby Barwick	Villa	Hoard	Late Roman?	(Hunter, 2013, fig. 4.25, f)
Vindolanda	Military	-	105-20	(Blake, 1999, No. 5647)
Vindolanda	Military	-	105-40	(Blake, 1999, No. 6504)
Waltham Abbey	-	Hoard	50 BC –AD 50	(Manning, 1985a, A37)
Pompeii	Urban	-	Before 79	(Gaitzsch, 1980, Taf. 12, 53)
Zugmantel (X3)	Military	-	90-260	(Pietsch, 1983, Taf. 16, 389, 389a-b)

Table 62 Comparanda for Type 2 rectangular-sectioned files.

Type 3 files have round-sectioned blades, tapering slightly to flat tips. Today, files of this shape are known as rat-tail files. They are used by wood- and metal-workers to enlarge holes or grooves (Salaman, 1975, p. 195). Three examples, FIL06-07 and FIL15, come from London, all with single-cut teeth running all the way around. FIL06-07 are extremely similar in form, tapering slightly to flat tips, although they differ in size. FIL15 is somewhat unusual; the blade is extremely slender, and terminates in a clenched square-sectioned tip with no visible teeth. It is possible that this tip acted as the tang for a small handle, allowing the tool to be used with two hands, although it appears too delicate for this.

FIL06 has very fine teeth, and was probably a metalworking tool. FIL07 and FIL15 have medium teeth, and may have been woodworking tools. Another file, MOL 16372, is described on the Museum of London's accession register as a 'rat-tail file', but could not be located.

Site	Site Type	Context	Date	Reference
Vindolanda	Military	-	105-20	(Blake, 1999, No. 4060)
Ingleby Barwick	Villa	Hoard	Late Roman?	(Hunter, 2013, fig. 4.25, g)
Saalburg	Military	-	85-260	(Pietsch, 1983, Taf. 16, 395)

Table 63 Comparanda for Type 3 round-sectioned files.

Type 4 files have semi-circular-sectioned blades, which taper to a point. This is the most common type in London, with five potential examples, FIL08-12. This type demonstrates more variety in tooth form than the other file types from London. Most files of this type have teeth on all sides of the blade, but FIL08 has teeth on the convex side only. This is also the coarsest file from London, and may have been a woodworking tool. FIL09 has a semi-circular-sectioned blade at one end, with teeth on all sides, and a short section of finer teeth on one side of what appears to be a tang at the other side. This could be interpreted as a double-sided tool for metalwork. However, the teeth on the 'tang' may have been added to give the tang more purchase inside the handle. FIL11 is the only rasp-cut file from London. Other examples from Haltern and Avenches (Table 64) have been seen primarily as woodworking rather than metalworking tools. FIL12 has no teeth, and is identified as a file purely because of its tapering semi-circular form.

Site	Site Type	Context	Date	Reference
Avenches	Urban	-	-	(Duvauchelle, 1990, No. 95)
Feldburg (x2)	Military	-	150-260	(Pietsch, 1983, Taf. 16, 390, 393)
Haltern (x4)	Military	-	1 BC - 9 AD	(Harnecker, 1997, Taf. 12, 98, Taf. 13, 99-103)
Pompeii	Urban	-	Before 79	(Gaitzsch, 1980, Taf. 12, 54)
Saalburg	Military	-	85-260	(Pietsch, 1983, Taf. 16, 391)
Zugmantel (x3)	Military	-	90-260	(Pietsch, 1983, Taf. 16, 390a, 392, 393a)

Table 64 Comparanda for Type 4 semi-circular-sectioned files.

Type 5 files have triangular cross-sections. FIL13 has a very low triangular section, and an irregular, curving shape. No exact matches for this tool are known to the author. A similar, although considerably shorter, file comes from Catterick (Mould, 2002a, figs 288, 13). Gaitzsch

(1980, Taf. 12, 52) also figures a file from Pompeii with a more equilateral triangular section, although none were found in London.

Type 6 files have knife-like triangular-sectioned blades. The one example from Roman London, FIL14, is only a fragment, with fine single-cut teeth extending most of the way up the long sides. Complete files with this section type (Gaitzsch, 1980, Taf. 12, 56; Pietsch, 1983, Taf. 16, 397-405; Hanemann, 2014, Abb. 372, 7) have a distinctive blade form, often with a notch in the blade near the tang. These are interpreted as saw-setting files (Hanemann, 2014, p. 451); tools used to sharpen saw teeth, with the notch being used to 'set' the teeth by bending them in opposite directions.

Handle attachments

It is also possible to distinguish files based on the form of the handle attachment, although the majority of files from London have simple tapering tangs. Elsewhere, files have been found with cranked tangs, but these are normally coarser than the London files. FIL02 has a long tang or handle, with a flattened terminal, whilst FIL04 has a waisted handle. All of these handle attachments are seen on pre-Roman files in Britain, although cranked handles are rare in the Iron Age (Fell, 1997, p. 90).

Forks ; Pitchforks and Bailing Forks

Technology

This section looks at light iron pitchforks. Two-tined cultivation hoes are discussed in the hoes section (see p.510). Modern pitchforks are mounted on long shafts, with two or more slender tines, usually made of metal. Until the 19th century, wooden forks were more common than metal ones, and the majority of classical references to forks are to wooden objects, although no all-wooden forms survive from Roman period Britain (Rees, 1979, p. 483) (ibid). Pitchforks are primarily used for gathering straw and leaves, although these comparatively robust iron examples could also have been used for light soil cultivation (Rees, 1979, p. 483). In an urban setting, they could have been used for unloading and moving fodder and bedding for animals, or thatch for rooves, and do not necessarily indicate harvesting.

Numbers

18 forks were found in the London collections (Table 65). The majority (13) come from the Museum of London. Five objects came from recently excavated contexts; three from the LAARC and two from MOLA. An object described by Rees (1979, fig. 253a) as Roman is catalogued in the Museum of London as Late Medieval (MOL 24743). Two further objects were retrieved from a search of the Museum's MIMSY database, but could not be located. A trident in the Museum of London is likely to be a gladiatorial weapon or fishing spear, and is not considered a tool.

Type	Number	Catalogue Numbers
Type 1	5	FOR01-05
Type 2	0	-
Type 3	2	FOR06
Type 4	4	FOR08-11
Type 5	5	FOR12-16
Other	3	FOR17-19
Total	18	

Table 65 Type breakdown of the Roman forks from London.

Typology

Rees (1979, pp. 483–4) provides a four-part classification scheme for Roman iron pitchforks (Figure 253, 1-4), to which a fifth type has been added. The first three types are variations on a simple pitchfork, differentiated by the shape of the shoulder.

Figure 253 Roman pitchfork types (Type 1, FOR01; Type 2, (Rees, 1979, fig. 251a)*; Type 3, FOR06; Type 4, FOR08; Type 5, FOR14).*

Type 1 has two straight, usually diamond-sectioned tines. Rees (1979, p. 483) found this to be the most common type in Britain, although only five come from London. FOR01 and FOR02, both from dated contexts, are the most similar in shape to other examples published by Rees (Table 65). Both have corroded and fragmentary tines, and it is possible that FOR02 is actually Type 2. Three others of this type have some unusual features. FOR03 has a differently-shaped shoulder, and an unusual feathered tang. This tool has no detailed provenance, and may not be Roman. FOR04 is unique in having a solid iron shaft, and flat rather than diamond- or round-sectioned tines. It is therefore uncertain whether this object is truly a pitchfork, as it is extremely heavy compared to other objects. This object also has no context, and may therefore not be of Roman date, although it is somewhat similar to an object from Baldock (Table 66). FOR05 has very short tines compared to the other forks of this type. Whilst this object comes from a dated context, it is not obvious that this object acted as a pitchfork. Rees (1979, p. 484) highlights another fork-shaped object, which may be a structural support, and it is possible that FOR05 had a similar function.

Site	Site Type	Context	Date	Reference
Baldock	Rural?	-	-	Rees 1979, fig. 251c
Risingham	Military	-	-	Rees 1979, fig. 252a
Silchester (x2)	Urban	-	-	Rees 1979, fig. 251b, 252b

Table 66 Comparanda for Type 1 Roman pitchforks.

Type 2 has a rounded shoulder, with tines first curving out from the blade, before curving in and flaring outwards again, giving a lyre- or thistle-shaped outline. No clear examples of this form come from London, although it is possible that FOR02 was of this shape. Other examples come from Chesters and Newstead (Rees, 1979, fig. 251, a-b).

Type 3 has a sloped, rounded shoulder, giving a Y-shaped outline to the object. One object of this type, FOR06, comes from London. Only one other object of this type was known to Rees (1979, p. 484); an object from Wetton, Staffordshire, known only from an unscaled sketch. FOR06 is not stratified, and another identified by Rees (1979, fig. 253a) as Roman was catalogued in the Museum of London as medieval. It is therefore not certain that this form is Roman.

Type 4 has a square shoulder, with tapering tines, which are distinguished by having an extra prong, which rises from the tine in the direction of the socket before curving back on itself to point in the same direction as the tines, facing slightly inwards. They are always socketed. It is curious that four examples come from the Bucklersbury House/Bloomberg (BZY10) site, especially as very few parallels can be found for these objects elsewhere. Only one other near-complete example from Britain is known to the author, from Great Chesterford (Table 67). Manning (1985a, p. 60) describes objects of this form as 'bailing forks', used to lift bales of hay and other goods; an interpretation which Rees (1979, fig. 484) agreed with. As such, these do not need to be associated with agriculture; they could be seen as part of a suite of objects associated with trade or transport.

Site	Site Type	Context	Date	Reference
Great Chesterford	Urban	-	-	Manning 1985, F67
Wilcote	Rural	-	-	Hands 2004, fig.24, 183
Rome	Urban	River	-	Manning 1985, 60

Table 67 Comparanda for Type 4 bailing forks

A 5th type of fork is visible amongst the tools from London, but is not accounted for in Rees's scheme. **Type 5** is a very small two-tined fork, with a square shoulder, and tines which vary from slightly inward-pointing to slightly flared. The five objects of this type have all been made in the same way, with two separate pieces of metal, which form the tines, welded together to form the tang. These also appear to be a form of small pitchfork. Another fork of this type comes from Vindolanda (SF 6090).

In addition to these types are a number of miscellaneous forked objects. FOR17 is a three-pronged trident. It is constructed in the same way as the type 5 forks, but has a rounded rather than square shoulder, and an unusual triangular tip at the end of the tang. This object was catalogued as a possible fishing spear, and whilst this is possible, it also strongly resembles a modern three-pronged pitchfork. It is also possible that this object is a candlestick (Eckardt, 2002). As this object is unstratified, its Roman date is in doubt, although square-shouldered tridents with similar construction come from Roughground Farm (Allen & Brunner-Ellis, 1993, fig. 99, 63) and a possible Roman context at Naukratis, Egypt (British Museum No. 1888.06-01.698).

FOR18 is a socketed fork, which branches into U-shaped tips at the ends of the tines. It is the only tool from the Bucklersbury House excavations to be described as 'unstratified' in the original catalogue entry. This could imply that it was from an even less certain context than the majority of the objects from that site, and as such its Roman date is in doubt. The function of this object is unknown. It is perhaps a post-medieval linstock, or an object designed to provide a base for a pivoting object held at the end of the tines.

FOR19 is another odd socketed object that is unlikely to have had a role in agriculture. The closest parallel to this object is a possible post-medieval gun-rest from Chichester (Down, 1981, fig. 8.29, 28), although FOR19 comes from a dated Roman context. Less comparable objects include round-shouldered forks from Saalburg (Pietsch, 1983, Taf. 25, 559) and Dolberg (Ritterling, 1901a, p. 46), and more robust square-shouldered examples from Pompeii (Allison, 2006, fig. 39.4) and Conimbriga (Alarcão *et al.*, 1979, Pl. IX, 111), all thought to have been agricultural tools. Another similar object is a possible bronze soldering iron stand from the Seltz hoard, although this has a solid base rather than a socket (Schaeffer, 1927, p. 8).

Handle Attachments

The majority of these forks have simple tapering tangs, and the same is true for Roman forks in Britain generally (Rees, 1979, p. 483). Rees (ibid) only knew of one socketed fork, from Lydney, although socketed examples are known from Austria (Pohanka, 1986, figs 42, 174, 176). Bailing forks are clearly an exception, as all complete examples have sockets with a single nail hole near the opening. This type of socket is common on agricultural tools, such as sickles (see p.577) and billhooks (see p.416). FOR06 has a tang pierced by a rivet or nail. This feature can also be seen on a Type 2 fork from Newstead (Rees, 1979, fig. 251a). This is also the only potential Roman pitchfork from Britain with a ferrule, although one can be seen on a Type 2 pitchfork from Saalburg (Pietsch, 1983, Taf. 25, 560). FOR03 has a feathered tang. This would ensure a better grip within the wooden shaft. Feathering is also seen on the drill bit BOR28, but is not seen on any other Roman fork.

Gouges

Technology

Gouges are chisels with a hollow (U-shaped or V-shaped) cross-section, used for make curved cuts (Salaman, 1975, p. 211). They should not be confused with spoon-shaped drill bits (see p.426). Gouges are used today in carving hard materials, such as wood (Salaman, 1975, p. 211), stone (Blagg, 1976, p. 164) and possibly metal. Salaman (1975, fig. 204) illustrates a number of gouge cross-sections used in woodworking, with shallower U-shaped blades being used for carving, and deeper U-shapes, described as 'fluters' or 'veiners', being used to carve long parallel-sided channels (Figure 254). It is possible, however, that some of the tools discussed here were also used in leatherwork (see p.492, 545).

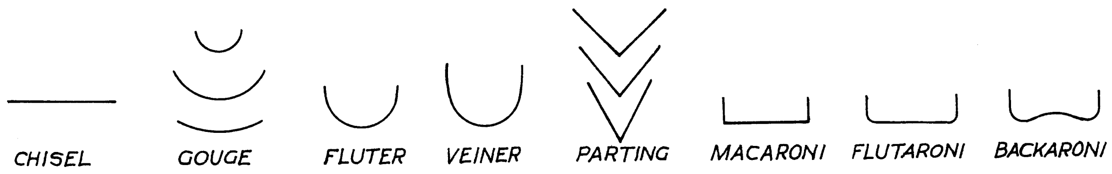


Figure 254 Typical gouge cross-sections (Salaman 1975, fig. 204).

Numbers

Fourteen possible gouges come from London, ten from the Museum of London, three from recent excavations by MOLA, and one from excavations by PCA. Another gouge, MOL 1545, was recorded on the Museum of London's MIMSY database, but could not be located.

Typology

The gouges from London can be most easily divided by the method of handle attachment into socketed, tanged, and solid-handled gouges.

Socketed Gouges

None of the gouges from London are socketed. This is unusual, as socketed gouges are common on other sites. Manning (1985a, pp. 24–5) gives a number of examples from the Iron Age onwards.

Tanged Gouges

Tanged gouges are rare in the Roman period (Gaitzsch, 1980, p. 171; Pietsch, 1983, p. 30; Duvauchelle, 1990, p. 23), and only three possible examples come from London. GOU01 and GOU02 both strongly resemble types of woodworking chisel (see p.447), and can be categorised in the same way as chisels. Without good preservation of the tip, these could easily be mistaken for normal chisels.

GOU01 has the shouldered tang and swelling diamond-sectioned blade of a Type C-2 chisel. As well as having a semi-circular gouge tip, GOU01 is unusual in that the tip is bent at an angle to the tang. Salaman (1975, fig. 205) figures a number of curved gouges as wood carving tools, and GOU01's shallow profile fits that of a carving gouge (Salaman, 1975, fig. 204). It is therefore likely that this is a carving tool, curved to allow the user a greater range of shallow angles. No other Type C-2 gouges are known to the author, although a small number of Type B-2 examples are known, including curved examples from Saalburg (Table 68).

Site	Site Type	Context	Date	Reference
Ickham	Industrial	-	-	(Riddler and Mould, 2010, fig. 120, 1265)
Neuss	Military/Urban	-	-	(Gaitzsch, 1980, Taf. 45, 216)
Saalburg (x2)	Military	-	85-260	(Pietsch, 1983, Taf. 8, 127-8)

Table 68 Comparanda for Type 2.1 tanged gouges.

GOU02 has a simple Type 1 tang and a very shallow cross-section. Its identification as a gouge is uncertain, and only one closely comparable object, a tanged gouge from the Late Iron Age or Early Roman Waltham Abbey hoard (Manning, 1985a, B50), is known. If correctly identified, tools such as this could have been used for carving or lathe work.

Although GOU03 was recorded as a gouge by the excavators (Killock *et al.*, 2015, p. 161) it does not resemble any object known to the author, and is possibly misidentified.

Solid-Handled Gouges

The majority of the gouges from London are small solid-handled objects. Many authors (Gaitzsch, 1980, pp. 171–2; Pietsch, 1983, p. 30; Tisserand, 2001, p. 27) describe these tools as woodworking gouges. However, Manning (1985a, pp. 31, 42) breaks them into two functions. A robust, heavily battered example (Manning, 1985a, p. 31, C4) is interpreted as a mason's tool. Lighter examples, with blades curved over more than a half circle, are interpreted as leatherworking hole punches (Manning, 1985a, p. 42). Gaitzsch (1980, p. 172) also suggests that some of these tools may have been used in leatherwork.

Disentangling the functions of these objects is not easy, but gouges with more than a half-circle blade cannot have been woodworking tools, and were probably therefore used in leatherwork. Unfortunately it is not possible to say with confidence how gouges with U-shaped blades were used, as they could be used to produce C-shaped cuts in leather or to carve wood or stone. Whilst many of the solid-handled gouges from London have deep U-shaped sections, only one, HOL04, obviously curves back over itself to form a 2/3 circle tip. This example is also very different from the types described below, and is therefore discussed alongside the other leather hole punch types (see p.545). Amongst the remaining tools of this type from London, three clear subtypes are visible.

Figure 255 Solid-handled gouge types (Type 1, GOU05; Type 2, GOU07; Type 3, GOU13).

Type 1 has a round or oval-sectioned shaft, with a flat, burred butt, which tapers towards a U-shaped cutting edge. Two examples of this type, GOU04-05, come from London. Both are split for the majority of their length and appear to have had deep 'veiner' sections, although GOU04's tip has been bent closed. A similar object with a fully enclosed tip from Avenches (Duvauchelle, 1990, No.24) must have been a leatherworking tool, although the London tools would have been suitable for use in carving. Close, well-preserved comparanda is hard to find, but somewhat comparable round-sectioned gouges are known (Table 69).

Site	Site Type	Context	Date	Reference
Great Chesterford	Urban	-	-	(Manning, 1985a, C4)
Great Holts Farm	Villa	Ditch	350-410	(Major, 2003, fig. 61, 24)
Verulamium	Urban	Unstratified	-	(Manning, 1984a, fig. 37, 5)

Table 69 Comparanda for Type 1 solid-handled gouges.

Type 2 closely resembles Type 1 in overall configuration, but has a more complicated shape. These tools have a short, burred, rectangular-sectioned head, stepping in to a diamond-sectioned shaft. The side corners of the shaft are sometimes flattened, as is the top edge, sometimes giving a hexagonal section. The shaft tapers and is split for most of its length, ending in a U-shaped cutting edge. GOU06 is a somewhat irregular example as it does not have a rectangular-sectioned head. Four objects of this type, GOU06-09, come from London, but comparable objects are hard to find. A possibly highly corroded example comes from Corbridge (CO132).

GOU07 and GOU08 both have semi-circular 'gouge' or 'fluter' sections, and appear to have been carving tools. GOU06 and GOU09 may curve back over themselves, possibly indicating a leatherworking function, although this is not certain as in both cases this may be the result of damage.

Type 3 has a long rectangular-sectioned shaft, burred at one end, joining a U-sectioned gouge blade at the other. Unlike the other types, the blade does not always taper continuously, and sometimes swells before tapering to the tip. Four objects of this type, GOU10-13, come from London, and numerous examples can be cited from elsewhere in Europe, going back to the Iron Age (Table 70). This type has the widest variety of tip form, with all examples being suitable for carving. GOU10 has a shallow U-shaped 'gouge' tip. GOU12 may be of a similar shape, although the tip is damaged. GOU11 has a deep, narrow V-shaped 'parting' section. GOU13 has a broad 'flutaroni' section. Tools of this type are used for clearing recesses with rounded edges, as well as for decorative carving (Salaman, 1975, p. 136).

Site	Site Type	Context	Date	Reference
Cowbridge	Military	-	-	(Scott, 1996, fig. 63, 6)
Dorchester	Urban	-	-	(Manning, 2014a, fig. 142, 41)
Hod Hill	Military?	-	25-75	(Darbyshire, 1995, N16)
Meare West	Rural	Clay mound	300 BC-AD 50	(Darbyshire, 1995, N15)
Ribchester	Military	-	-	(Howard-Davis and Whitworth, 2000, fig. 73, 131)
Shakenoak Farm	Villa	Paved surface	-	(Brodribb, Hands and Walker, 2005, fig. IV.58, 408)
Water Newton	Military/Urban	-	-	(Manning, 1985a, E33)
Aquileia	Urban	-	-	(Gaitzsch, 1980, Taf. 39, 184)
Feldburg	Military	-	150-260	(Pietsch, 1983, Taf. 8, 123)
Neuss	Military/Urban	-	-	(Simpson, 2000, Pl. 41, 12)
Niederbieber (x2)	Military	-	-	(Gaitzsch, 1980, Taf. 45, 216-7)
Saalburg (x3)	Military	-	85-260	(Pietsch, 1983, Taf. 8, 124, 124c, 126)
Vertault	Urban	-	-	(Tisserand, 2010, Pl.3, 33, Pl.6, 62)
Zugmantel (x4)	Military	-	90-260	(Pietsch, 1983, Taf. 8, 124a-b, 125, 126a)

Table 70 Comparanda for Type 3 solid-handled gouges.

Hammers

Technology

Hammers are blunt, hafted striking tools. They fulfil one of the most basic tool needs, and as such have a role in a wide variety of craft and other activities. In the Roman period, a large number of different hammer forms are known, and as such this section will seek to find which hammers can be tied to specific functions, and which were likely to have been general purpose tools. Combination adze-hammers are discussed in the adzes section (see p.371). A further object with a hammer face is discussed amongst the picks (see p.524), whilst a combined hammer/tongs is discussed amongst the tongs (see p.601).

Figure 256 Terminology used to describe hammers.

Numbers

Thirteen hammers are discussed here. Only five objects came from the Museum of London, with a further five coming from recent excavations by MOLA and one each from the LAARC and British Museum. A fourteenth hammer from the Beddington Sewage Farm site, BSF[09500]<524>, was destroyed in a fire before being drawn or described.

Typology

Manning (1985a, pp. 5–6) divides the hammers from the British Museum, on the basis of size and function, between large sledge hammers and smaller hand-hammers, but these objects have been examined in more detail in continental studies. Hammers are examined in considerable detail by Gaitzsch (1980, pp. 72–102), who breaks them down into a vast number of elements including the overall shape (Gaitzsch, 1980, Abb. 9), shape of the eye, shaft hole, shaft hole casing, and the shapes of the striking surface and cross-pein (Gaitzsch, 1980, Abb. 10). Hanemann (2014, Abb. 362) is the only author to provide a numbered typology of hammers

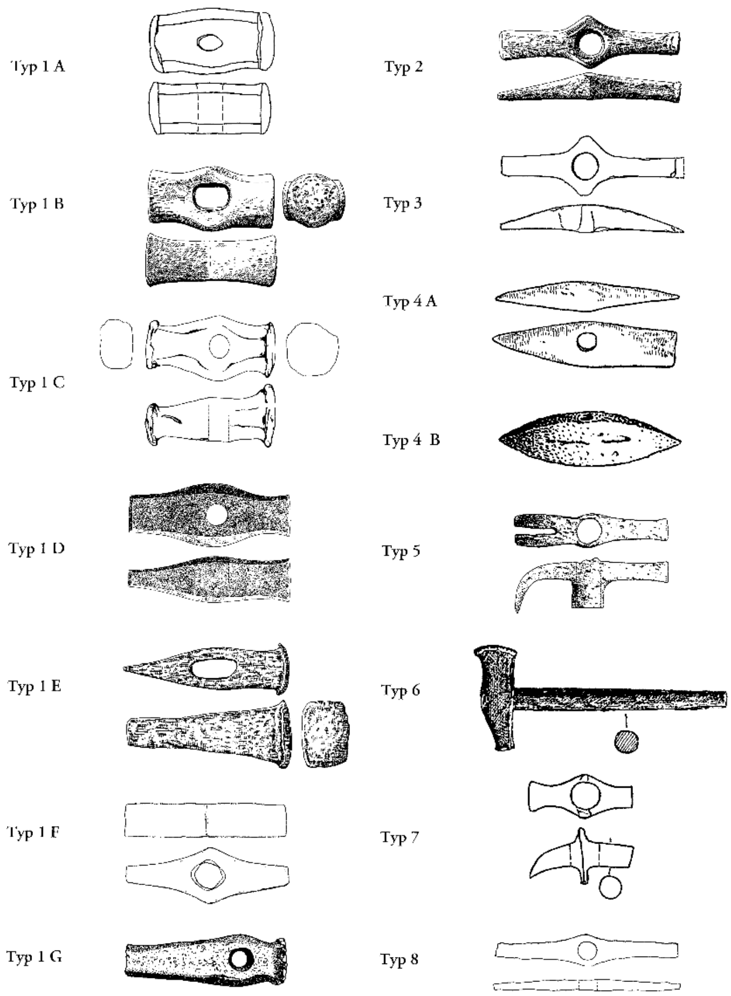


Figure 257 Hanemann's (2014, Abb. 362) typology of Roman hammers.

(Figure 257). As the London tools are limited to a small number of shapes, most of which appear in Hanemann's typology, this scheme will be used here. Only the types which are found in London will be discussed.

Type 2 is a cross-pein hammer, consisting of a central round shaft hole in an expanded diamond-shaped casing, with a hammer head projecting from one end and a blunt cross-pein from the other. This is the most common hammer type in London, with five examples, HAM01-05. Two more hammerheads, HAM06 and HAM07, have the same cross-pein configuration, but do not have an expanded diamond-shaped eye. These will be labelled **Type2b**.

This type varies considerably in size. The largest example from London, HAM01, is 226mm long, whilst the smallest, HAM10, is only 47mm long (Figure 258). This range of sizes is consistent with other examples of the type (Table 71), suggesting that this form was employed for a range of purposes depending on the size of the tool in question.

Site	Site Type	Context	Date	Reference	Length (mm)
Avenches	Urban	-	-	(Duvauchelle, 1990, No.5)	64
Saalburg	Military	-	85-260	(Pietsch, 1983, Taf. 6, 97)	79
Wanborough	Urban	-	-	(Isaac, 2001, fig. 50, 11)	80
Aquileia	Urban	-	-	(Gaitzsch, 1980, Taf. 37, 172)	90
Saalburg	Military	-	85-260	(Pietsch, 1983, Taf. 6, 100)	93
Vindolanda	Military	-	-	(Blake, 1999, No. 1763)	108
Saalburg	Military	-	85-260	(Pietsch, 1983, Taf. 6, 92)	117
Zugmantel	Military	-	90-260	(Pietsch, 1983, Taf. 6, 104)	118
Zugmantel	Military	-	90-260	(Pietsch, 1983, Taf. 6, 96)	121
Dorchester	Urban	Pit	300-400	(Manning, 2014a, fig. 141, 25)	135
Vindolanda	Military	-	105-20	(Blake, 1999, No. 5329)	135
Bar Hill	Military	-	-	(Keppie, 1975, fig. 33, 22)	135
Saalburg	Military	-	85-260	(Pietsch, 1983, Taf. 6, 91)	142
Silchester	Urban	Hoard	200-400	(Evans, 1894, p. 145)	152
Gt. Chesterford (x3)	Urban	Hoard	200-400	(Neville, 1856, p. 6)	152
Aquileia	Urban	-	-	(Gaitzsch, 1980, Taf. 37, 170)	160
Saalburg	Military	-	85-260	(Pietsch, 1983, Taf. 6, 93)	162
Zugmantel	Military	-	90-260	(Pietsch, 1983, Taf. 6, 94)	164
Silchester	Urban	Hoard	200-400	(Evans, 1894, p. 145)	165
Silchester	Urban	Hoard	200-400	(Evans, 1894, p. 145)	177
Gt. Chesterford (x2)	Urban	Hoard	200-400	(Neville, 1856, p. 6)	177
Zugmantel	Military	-	90-260	(Pietsch, 1983, Taf. 6, 95)	179
Eckford	-	Hoard	70-200	(Piggott, 1952, fig. 6, E13)	185
Zugmantel	Military	-	90-260	(Pietsch, 1983, Taf. 6, 89)	193
Zugmantel	Military	-	90-260	(Pietsch, 1983, Taf. 6, 90)	213

Table 71 Comparanda for Type 2 hammer heads, arranged by length.

The smallest Type 2b hammer, HAM07, may have had a votive function, although the author has argued elsewhere that it should be considered a functional tool (Humphreys in Marshall and Wardle, forthcoming). Its domed face is similar to that seen on embossing hammers (Figure 261), and it is possible that the tool was used in this way in fine metalworking.

The larger examples, HAM03-6, are difficult to interpret. Although all could have been used as smith's tools, they also would have been suitable for lighter general tasks, such as hammering nails. HAM01 and HAM02, meanwhile, are quite large and heavy. These would have been ideal smith's tools, but could also have been used in masonry, or in heavy woodworking industries, such as by builders or wheelwrights.

Figure 258 Type 2 and 2b hammer heads from London (from left to right: HAM01, HAM02, HAM03, HAM04, HAM06, HAM07).

Type 7 consists of a round shaft hole surrounded by pointed triangular lugs, with a squat, round-faced hammer head on one side and a downward-curving cross-pein at the other. Hanemann (2014, p. 430) tentatively identifies these as leatherworker's hammers. Objects with a comparable layout are figured by Salaman (1986, fig. 2:40, 3000-4, 2:42, 3032, 2:43, 3036-8). These were used by shoemakers to hammer in large nails and to hammer sole and heel leather, for the purpose of consolidating and stiffening it (Salaman, 1986, pp. 124, 144). The cross-pein was used in 'peening'; a process used to weld sole repairs to the original shoe (Salaman, 1986, pp. 125–6). The same form of hammer was also used by saddlers in shaping leather and "levelling off" stitched seams (Salaman, 1986, pp. 255–6). Alternatively, this layout can be seen in some modern planishing hammers (tools used to smooth out dents in metalwork), although these more commonly have a ball pein at the back. A fragmentary object from London, HAM08, is almost certainly from a hammer head of this type. I am not aware of any other objects of this form from Britain, and the type is rare, with Hanemann (2014, p. 430) giving only a few examples.

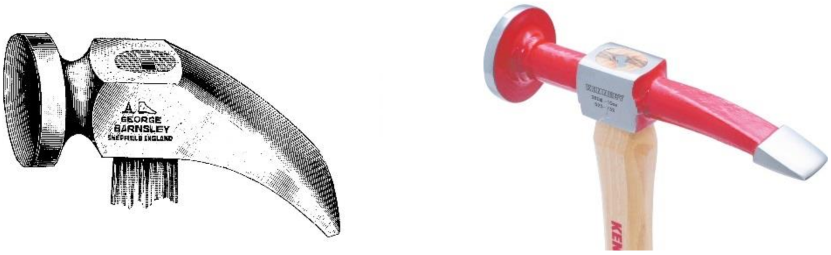


Figure 259 Shoe maker's hammer from a 1927 catalogue (left, Salaman, 1986, fig. 2:40, 3000) and a modern planishing hammer (right, https://www.cromwell.co.uk/shop/automotive/panel-beating-dollies-hammers-and-sets/planishing-hammer-curved-pein-finishing-pick/p/KEN5257320K).

Type 8 has a flat body, with a central shaft hole, coming to rectangular cross-pein-like heads at each end. Beyond this the form is quite variable (Hanemann, 2014, p. 430). Two objects of this type, HAM09 and HAM10, come from London. The double cross-peins of these objects give them a strong resemblance to two different types of modern hammers; raising hammers and saw-setting hammers. Raising hammers are tools are used with a stake anvil to raise metal from a flat sheet to something that is dished or round, for example in the production of bowls, cups or helmets. Saw-setting hammers are used to 'set' the teeth of a saw, by bending them outwards in alternate directions (Salaman, 1975, p. 437). The Type 8 hammers from London most closely resemble saw-setting hammers, but could have functioned in either capacity.

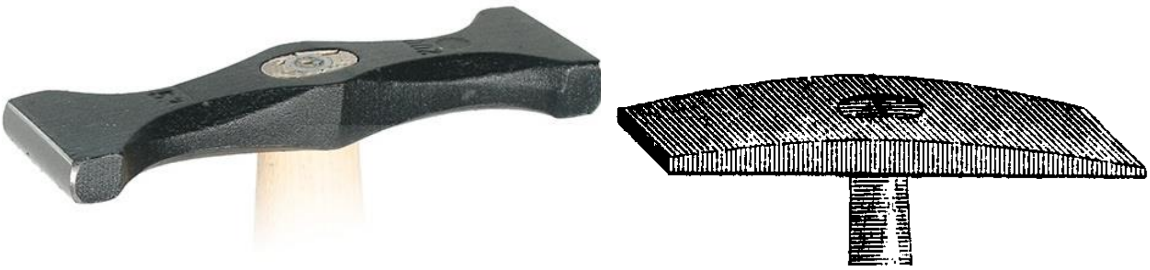


Figure 260 A modern raising hammer (left, https://contenti.com/media/catalog/product/cache/1/image/525x525/9df78eab33525d08d6e5fb8d27136e95/2/6/261-218.jpg) and saw-setting hammer (right, Salaman 1975, fig. 647, a).

Site	Site Type	Context	Date	Reference
Catterick	Urban	-	150-80	(Mould, 2002a, fig. 288, 8)
Wilderspool	Urban/Industrial	-	-	(Thompson, 1965, fig. 22, 4)
Königsforst	-	-	-	(Gaitzsch, 1980, Taf. 56, 281)
Niederbieber (x2)	Military	-	185-260	(Gaitzsch, 1980, Taf. 44, 200, 203)
Zugmantel	Military	-	90-260	(Pietsch, 1983, Taf. 6, 99)

Table 72 Comparanda for Type 8 hammers.

Other Hammer Types

In addition to those which can be accommodated within Hanemann's types, three further hammers come from the London collections.

HAM11 is extremely small, with two long, round-sectioned, dome-faced arms. This type is not in Hanemann's typology, but a similar object comes from Saalburg, which Pietsch (1983, Taf. 6, 101) interprets as an embossing hammer. Modern embossing hammers have a comparable shape, with two domed, round-faced hammer heads of different sizes, and are available in very small sizes (Figure 261). As such, this seems the most plausible interpretation on the London tool.

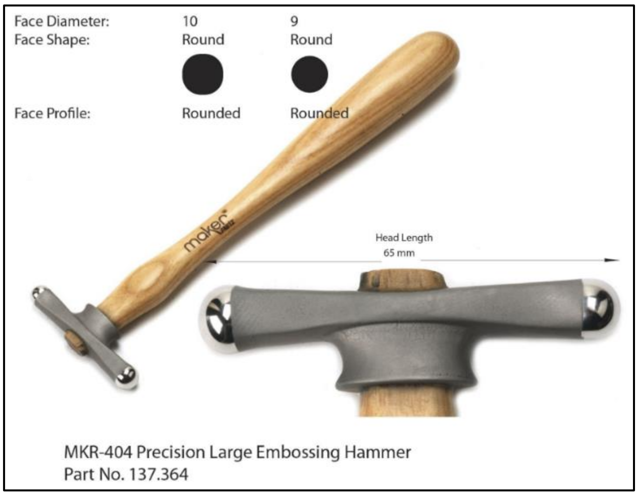


Figure 261 A modern embossing hammer (www.ottofrei.com).

HAM12 is an unusual tool, with a large irregularly-shaped eye, squat head and short rear pein. No close parallels are known to the author, although the fact that this tool was found with Roman pottery (Painter, 1961, p. 116) gives it a better provenance than most from London. The shape of the pein is similar to those on an double-peined hammers from Packenham, Suffolk (Manning, 1985a, A5), Eckford (Piggott, 1952, figs 6, E15), and it may have been a smith's tool.

HAM13 may originally have had a claw at the back, and could be categorised as a Type 12 claw-hammer. However, it is unlikely that this is indeed a Roman tool. HAM13 has a rectangular shaft hole; a shape which is seen in the Iron Age (Fell, 1990, p. 113), Anglo-Saxon period (Ottaway, 1995, fig. 1, g, j, k) and middle ages (Goodall, 1980, figs 26, 28-33), but is rare in the Roman period. Although claw hammers are known in the Roman period, they are rare, whilst they are unknown in the Iron Age. With these two rare features combined, it is perhaps more likely that this hammer is medieval than Roman.

Hearth Management Tools

Technology

This section discusses the tools used to maintain fires in the hearth; fire shovels and pokers. Both are used to move fuel around the hearth, to maintain an adequate supply and create openings for air, as well as to remove slag (Fell, 1990, p. 86) and to clear a hearth after use. As tools for maintaining a fire, these objects would have been used in household practice, cooking, and religious settings, as well as industry. Another key tool used in this process, the bellows, is not represented among the surviving tools from the Roman world.

Numbers

Eight hearth tools are discussed here, only two of which come from the Museum of London. Two more come from the LAARC, and four come from recent excavations by MOLA.

Typology

Barley-Twist Hearth Tools

The most recognisable hearth tools in the Roman period have a flattened rectangular-sectioned handle, with a loop at the butt, joining a barley-twist shaft at the other. This type of handle is usually found on fire shovels, although similar handles can also be found on flesh hooks (Manning, 1985a, P35) and bakers' peels (Mould, 2002b, figs 274, 108), which are not part of this project. Five objects from London, HEA01-05, have this form.

HEA01 has a heavily corroded flat panel riveted to one end. This was probably originally a fire shovel head, although riveted construction is not usual for objects of this type, and this may be a repair. An Iron Age poker from Meare Village has a head welded over the shaft in a similar manner (Fell, 1990, figs A2, 24). HEA02 flattens into a leaf-shaped head, although it is unclear to what extent this was shaped by corrosion. It resembles the 'spatulate ended' pokers of the Iron Age, which probably acted as something between a fire shovel and a poker (Fell, 1990, pp. 86–8). HEA03-5 are fragmentary, and could have belonged to a number of hearth tools. Objects of this type are found throughout the Roman period on all site types in Britain (Table 73), and most are presumed to be fire shovels.

Site	Site Type	Context	Date	Reference
Carrawburgh	Military/Religious	-	122-400	(Manning, 1976b, fig. 23, 149)
Lakenheath	-	Hoard	-	(Manning, 1985a, A42)
Newstead	Military	Well	80-211	(Curle, 1913, Pl. 2, 5)
Shakenoak farm	Villa	Pond	350-500	(Brodribb, Hands and Walker, 2005, fig. IV.65, 514)
Verulamium	Urban	Building	155-60	(Manning, 1972b, fig. 60, 6)
Wilcote	Rural	-	300-400	(Hands, 1993, fig. 29, 1)

Table 73 Comparanda for barley-twist hearth tools.

In addition to these barley-twist objects, a number of other hearth tools can be seen in London.

Other Pokers

Although catalogued as a Roman object, HEA06 has the form of an Iron Age spatulate-ended poker with a 'plain' handle (Fell, 1990, fig. 3:1). Fell (1990, figs A1, 2-8, A2, 9-18) figures a large number of similar objects, ranging in date from the 5th century BC to the decades immediately after the Roman conquest. Unfortunately HEA06 has no provenance associated with it.

HEA07 has a knob terminal and a slightly expanded square-sectioned tip. It was probably a poker, and a similar object with a spatulate tip comes from Neupotz (Künzl, 1993, Taf. 639). A somewhat similar object with a simple tapering tip from Whitton was also seen as a poker (Manning, 1981, figs 75, 4).

HEA08 was originally interpreted as a simple poker, but an identical object from Manching (Jacobi, 1974, Taf. 31, 551) was interpreted as a spit. It is therefore possible that this was a cooking implement rather than a hearth management tool. Another object, MOL 79.115/4, was catalogued as a poker, but is unusual in being socketed. It is probably therefore a form of spearhead.

Other Fire Shovels

HEA09 and HEA10 are both small shovels. The only comparable object known to the author, a small shovel from the Neupotz hoard (Künzl, 1993, Taf. 638), was interpreted as a fire shovel. HEA10 is not very similar to these objects, and may not be Roman in date.

These objects were both originally interpreted as plasterer's tools; presumably thought to have functioned as a form of angle or corner trowel. However, this cannot have been the case. The cranked handle to HEA09 would prevent the indside of the scoop being used to smooth plaster, whilst the reinforcing strip on the underside would present the outside being used in this way.

Hoes

Technology

Hoes are hafted agricultural tools used to break apart and drag soil. Their potential range of functions is wide; they can be used in place of a plough to till entire fields, or used to tend to small plots and gardens. The majority are characterised by a horizontally-mounted blade, putting them in contrast with axes (which have a vertical blade), although tools with heavy pointed tines are also discussed here. Very similar tools used for woodworking are described in the adzes section (see p.369). Hoes balanced by an axe blade are termed mattocks, and are discussed elsewhere (see p.516).

Numbers

Twelve objects are discussed here, nine from the Museum of London, two from the LAARC and one from a recent excavation by MOLA. HOE01 may be the same object as the missing 'adze' 214, as the vague description given for 214 matches that of HOE01. An old number on HOE01 appears to read '211', but as this is the number of an iron knife it seems likely that this number is in fact a faded '214'.

Typology

White (1967, pp. 36–68) discusses nine types of hoe based on the different terms used by Roman writers. However, very seldom do these writings contain accurate descriptions of the tools in question. Rees (1979, p. 306) breaks archaeological finds of hoes into four principle groups; entrenching tools, adze-like hoes, '*ascia rastrum*' hoes, and 'b*idens*' hoes. However, this does not cover the full range of material found in London. Although both of these writers use Latin terms to describe archaeological objects, this is fraught with uncertainly, and these terms will not be used in this section.

Another typology of hoes is provided by Pohanka (1986, pp. 57–109). This typology covers only a small number of types, but in a considerable amount of detail. A recent typology by Hanneman (2014, Abb.160, below) defines five types of hoe, broken down into ten subtypes. This begins to adequately deal with the London material and, with the addition of supplementary types (below), this is the scheme that will be followed here (Table 74).

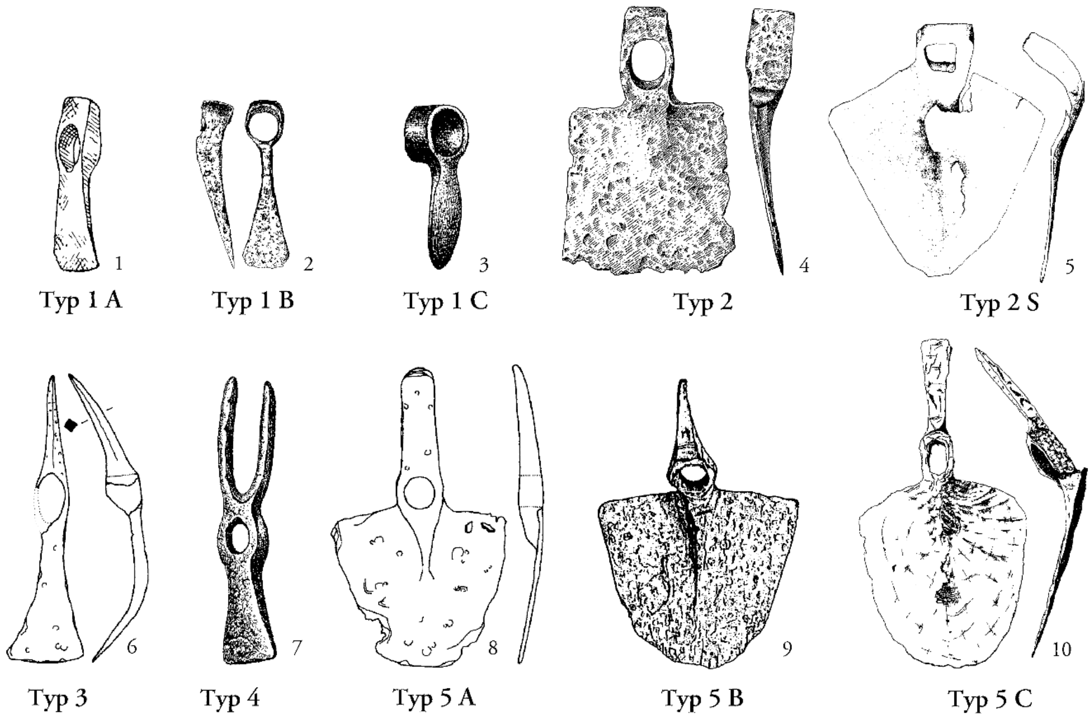


Figure 262 Hanemann's typology of hoes (Hanemann 2014, Abb.160).

Type	Number	Catalogue No.
Type 1	1	HOE01
Type 2	1	HOE02
Type 2S	0	-
Type 3	1	HOE04
Type 4	2	HOE05-06
Type 5A	1	HOE07
Type 5B	0	-
Type 5C	0	-
Type 6A	0	-
Type 6B	0	-
Type 6C	4	HOE08-12
Type 7A	1	HOE13
Type 7B	0	-

Table 74 Type classification of the hoes from London.

Type 1 – Adze-Like Hoes

Hanemann (2014, p. 177, Abb 160, 1-3) defines three types of adze-like hoe, all of which consist of a round eye with a single adze blade projecting from one side. Three objects conforming to this form have been found in London, but two, ADZ01 and ADZ02, appear to be Iron Age woodworking adzes, and have been categorised according to the typology developed by Darbyshire (1995) in the adzes section (see p.370).

HOE01 has a similar form, but does not clearly fit into Darbyshire's typology. It most strongly resembles Darbyshire's (1995, pp. 367–8) Form 2c; an early Romano-British fusion form which is potentially linked to the military. However, HOE01 is considerably larger than these tools; in fact it is larger than any of the objects in Darbyshire's typology. Objects of similar size do come from the Roman period military sites at Brampton (Manning, 1966, fig. 2; Rees, 1979, fig. 83) and Camelon (Anderson, 1901, fig. 45; Rees, 1979, p. 403), but these have much wider, more robust blades. The manner in which the blade joins the top of the shaft hole eye is most closely paralleled in Hanemann's (2014, p. 177) Typ 1C hoes (Figure 262). This is a rare Continental form, unknown in Britain, and has a much narrower leaf-shaped blade. It is nevertheless possible that HOE01 is a variant on this form, and it is possibly a Roman-period object, although its provenance is uncertain.

HOE01 is difficult to assign a function to. Manning (1970a, p. 19, 1985a, p. 16) suggests that wider, curved tools are hoes, whilst narrower, straight-bladed and more robust ones are adzes. HOE01 is narrow and robust, but curved. It is similar to a tool from Hod Hill, which Manning (1985a, p. 17, B10) considered to be a Roman-period adze, although HOE01 has a less sharply-angled blade. The round front edge, which is slightly burred with wear, and the wide bevel on the top edge suggest that this is an agricultural hoe. Modern adzes featured by Salaman (1975, pp. 23–30), and the complete adze-hammer from London (ADZ03), have a narrow bevel on the underside of the blade. Although Hanemann (2014, p. 177) considered tools of this type to have been used for weeding, the large size and narrow blade of this tool would make it suitable for heavier digging. Manning (1970a, p. 19) reports similar tools in Eastern Europe being used for digging, in the manner of a pickaxe.

Type 2 – Broad-Bladed Hoes

Type 2 hoes are characterised by an oval shaft hole, often with a rectangular butt, with a wide spade-like blade projecting from one side. The blades can be rectangular, trapezoidal, triangular or U-shaped, and often have a triangular reinforcing ridge on the underside (Hanemann, 2014, p. 178). In this way they strongly resemble the military 'entrenching tool' (Type 5, below), which appears to have developed from the Type 2 hoe (Manning, 1970a, p. 19; Rees, 1979, p. 309). Hanemann (2014, pp. 177–8) defines two subtypes. **Type 2** has a blade at slightly under 90 degrees to the haft, whilst **Type 2S** is angled sharply downwards. Two objects of this form, HOE02 and HOE03, come from London. Both conform to the more common Type 2, although they vary slightly in size, with HOE03 being the larger.

These tools are common on the Continent, and are found in the Northern provinces (Rees, 1979, p. 309; Duvauchelle, 1990, No. 166-7) and Italy (Allison, 2006, No. 76, 762, 750; Harvey, 2010, figs 2-3), being described by Manning (1970a, p. 19) as a 'Mediterranean' type. Unlike Type 5 entrenching tools, which have similarly wide blades, this type is not strongly associated with the military. This type is incredibly rare in Britain. Manning (1970a, p. 19) considered there to be no British examples, but cites objects from Broxtowe and Lydney (ibid, note 3), which may be considered to conform to this type. Another object, from the Ingleby Barwick hoard (Hunter, 1997, fig. 4.23, b) was plausibly interpreted as a discoidal woodworking adze, but an entrenching tool from Saalburg (Pietsch, 1983, Taf.6, 84) with a similarly round blade, balanced by a narrow adze blade, potentially indicating that this was a digging tool. As the Ingleby Barwick find lacks a secondary blade, it could be considered a variant of a Type 2 hoe.

Large numbers of these hoes have been found stored in villas in the Vesuvian region. Harvey (2010, p. 709) interprets this as evidence that they were stored away at the time of the eruption in late Summer. This fits well with evidence from Classical sources and mosaics for their use in spring, as small-plot cultivation tools to loosen and aerate soil and remove weeds from around vegetables or vines. Their broad blades would also have been suitable for digging drainage ditches (White, 1967, p. 47; Harvey, 2010, pp. 699–701). Their rarity in Britain could be due to the comparative heaviness of the soil, for which these tools are not suited (Harvey, 2010, pp. 699–700). However, it has also been suggested that similar tools were used in construction to mix mortar and plaster (Adam, 1994, p. 75).

Type 3 – Hoe/Picks

Type 3 objects are mattock-like tools, consisting of a central oval shaft hole, with a flaring adze blade on one side and a pick on the other. The pick blades can be either thicker than they are wide, or wider than they are thick. Objects of this form are very similar to the picks in section (see p.523), although these are considerably more robust, with much narrower blades.

The only object of this type from London, HOE04, is unusual in having a narrow adze blade at the back rather than a pick. The shape of the blade is very similar to that seen on woodworking adze- hammers (see p.371), although the blade is thinner and less sharply angled. Due to its similarity to tools with pick blades on the reverse, it is interpreted here as a digging tool. The author is not aware of any tools that exactly match the form of HOE04, nor have any objects of the more common form, with an adze balanced by a pick, been found in Britain. It is therefore possible that this object was a one-off creation, influenced by the Type 3 form but not adhering to it strictly.

Site	Site Type	Context	Date	Reference
Avenches	Urban	-	-	(Duvauchelle, 1990, No. 171)
Feldburg	Military	-	150-260	(Pietsch, 1983, Taf. 4, 67a)
Pompeii	Urban	-	Before 79	(Allison, 2006, No. 23.2)
Saalburg (x3)	Military	-	85-260	(Pietsch, 1983, Taf. 4, 63, 64, 66)
Zugmantel (x3)	Military	-	90-260	(Pietsch, 1983, Taf. 4, 64a, 65, 67)

Table 75 Comparanda for Type 3 hoes.

Type 4 – Hoes/Forks

Type 4 hoes are small tools (typically c.20cm long) consisting of a central oval shaft hole, on one side of which is a hoe blade and on the other a pair of tines. Blade shape varies; most are triangular, as are both examples from London, but they can also be parallel-sided or continually expanding, and often have a reinforcing ridge on the underside (Rees, 1979, p. 310).

There is some evidence of size variations in these tools. Manning (1970a, p. 20) found them to be wider in western Britain than they were in the east, although they are too poorly dated to state whether this is a regional or temporal change. Manning's (1976b, fig. 7) division of these tools into two types on these lines is not followed here, however, as the London tools show high degrees of wear, and it is not therefore possible to make definitive statements regarding their original dimensions. Rees (1979, p. 310) found that that the length of the tines of the London objects was less than the 1/3 of the total length of the object seen elsewhere, but this may also be due to the fact that the London tools show a high degree of wear. Manning (1995, p. 239) has also noted that those in Germany tend to be straight-sided or flaring, in contrast to those in Britain, which are more often tapering, although there are British examples of the flaring type (e.g. from Warrington, Table 76).

These tools are found on Continental sites (Rees, 1979, p. 310), and only appear in Britain during the Roman period. Rees (1979, p. 309) cites their appearance in London as evidence for an early introduction, but they continue to be found into the 4th century. Within Britain, they are found on highly 'Romanised' sites, such as towns and military establishments, but are absent from villa sites (Rees, 1979, p. 310).

These tools are often identified (Rees, 1979, p. 309), following White (1967, pp. 66–8), as the *ascia rastrum* of Classical texts. They are described by Classical writers as being for weeding, aerating soil and delicately tending to plants (Rees, 1979, p. 310), and their small size would make them useful for this. However, finds from Lydney and Thealby Mine (Table 76) may indicate that these were used for hard digging and mining as well. Similar tools are sold today as gardening implements, but are also used by archaeologists for digging.

Site	Site Type	Context	Date	Reference
Caerwent (x2)	Urban	-	-	(Rees, 1979, p. 407)
Cirencester	Urban	-	-	(Rees, 1979, p. 407)
Housesteads	Military	-	124-410	(Manning, 1976b, fig. 407; Rees, 1979, p. 52, 82)
Lydney	Industrial/ Religious?	-	-	(Rees, 1979, p. 408)
Richborough	Military/ Urban	Topsoil	-	(Henderson, 1949, Pl. LXI, 338; Rees, 1979, p. 408)
Rough Castle Central	Military	-	-	(Rees, 1979, p. 408)
Silchester	Urban	-	-	(Rees, 1979, p. 408)
South Harting	-	-	-	(Rees, 1979, p. 408)
Thealby Mine	Industrial	-	-	(Rees, 1979, p. 409)
Usk	Military	Ditch	55-200	(Manning, Price and Webster, 1995, fig. 72, 3)
Warrington	Urban/ Industrial	-	-	(Jackson, 1992, fig. 46, 12)
Wroxeter (x2)	Urban	-	-	(Rees, 1979, p. 409)
Avenches	Urban	-	-	(Duvauchelle, 1990, No. 170)
Saalburg (x15)	Military	-	85-260	(Pietsch, 1983, Taf. 5, 68-70, 71a-77)
Zugmantel (x4)	Military	-	90-260	(Pietsch, 1983, Taf. 5, 70a, 71, 76, 77a)

Table 76 Comparanda for Type 4 hoes.

Type 5 – Entrenching Tools

Type 5 objects consist of a central oval eye, with a wide spade-like hoe blade on one side, similar to that of a Type 2 hoe, balanced on the other by a narrow adze blade (**Type 5a**) or pick (**Type 5b**). The blade is normally slightly angled from the haft, and only occasionally sharply angled (**Type 5c**) (Hanemann, 2014, pp. 179–80). One object of this form, HOE07, comes from London.

The blades are typically around 17x15cm (Rees, 1979, p. 307), and vary in shape, but always have a thick triangular reinforcing ridge on the underside (Rees, 1979, p. 307). In Europe, the most common are trapezoidal or rectangular, but they can also be round or triangular (Hanemann, 2014, p. 179). In Britain, however, the pattern is reversed and the majority of objects have triangular blades, leading Pietsch (1983, p. 21) to dub this the '*englische Variante*' (English variant). Rees (1979, p. 307) relates this to site type, with those with triangular blades coming from military sites, and the small number of tools with rectangular blades, including HOE07, coming from sites with more civilian occupation. HOE07 is, however, unique among known examples for having a heavily dished blade (Rees, 1979, p. 307).

Type	Site	Site Type	Context	Date	Reference
5	Broxtowe	Military	-	50-75?	(Manning, 1976b, p. 28)
	Cadder	Military	-	142-97	(Manning, 1976b, p. 28)
	Camelon	Military	-	142-97	(Manning, 1976b, p. 28; Rees, 1979, p. 401)
	Chedworth	Villa?	-	-	(Rees, 1979, p. 401)
	Chesters	Military	-	-	(Rees, 1979, p. 401)
	Loudoun Hill	Military	-	125-75	(Manning, 1970a, p. 19; Rees, 1979, p. 402)
5a	Aldborough	Military/ Urban	-	-	(Rees, 1979, p. 401; Bishop, 1996, fig. 40, 461)
	Caerleon	Military/ Urban	-	-	(Scott, 2000, fig. 95, 14)
	Carlisle	Military/ Urban	-	-	(Rees, 1979, p. 401)
	Corbridge	Military	-	-	(Rees, 1979, p. 402)
	Wilderspool	Urban/ Industrial	-	100-200?	(Manning, 1970a, p. 19; Rees, 1979, p. 402)
	Saalburg (x10)	Military	-	85-260	(Pietsch, 1983, Taf. 5, 81-81e, 82, 82a, Taf. 6, 84, 86)
	Zugmantel (x2)	Military	-	90-260	(Pietsch, 1983, Taf. 5, 81f, 83)
	Feldburg	Military	-	150-260	(Pietsch, 1983, Taf. 6, 85)
5b	Risingham	Military	-	-	(Rees, 1979, p. 402)

Table 77 Comparanda for Type 5 entrenching tools.

These objects come almost exclusively from military sites in Britain (Manning, 1970a, p. 19; Rees, 1979, p. 307), and on the Continent (Rees, 1979, p. 308; Pietsch, 1983, p. 21), where they are more common in Legionary than Auxiliary sites (Pietsch, 1983, p. 21). For this reason they are thought to have been military-issue tools for erecting fortifications, rather than agricultural tools (Rees, 1979, p. 308). However, Rees (1979, p. 307) considers it not impossible that some objects from civilian sites, including that from London, were used in general earth moving tasks. Few of these objects are well dated, but they are known from 1st to 4th centuries (Rees, 1979, p. 307).

Additional Types

In addition to the five types discussed by Hanemann (2014, pp. 176–81), we can see three other hoe types amongst the tools from London.

Type 6 – Two-Tined Hoes

Type 6 hoes are characterised by a head consisting of two robust tapering tines. The tines are usually slightly inward-angled, and can be at 90 degrees to the haft, or more often angled down as far as 60 degrees (Rees, 1979, p. 311). Four objects of this form, HOE08-11, come from London. Rees (1979, pp. 311–2) and Manning (1970a, p. 12, 1985a, figs 20-1) identify three subtypes based on the method of attachment to the haft (Figure 263).

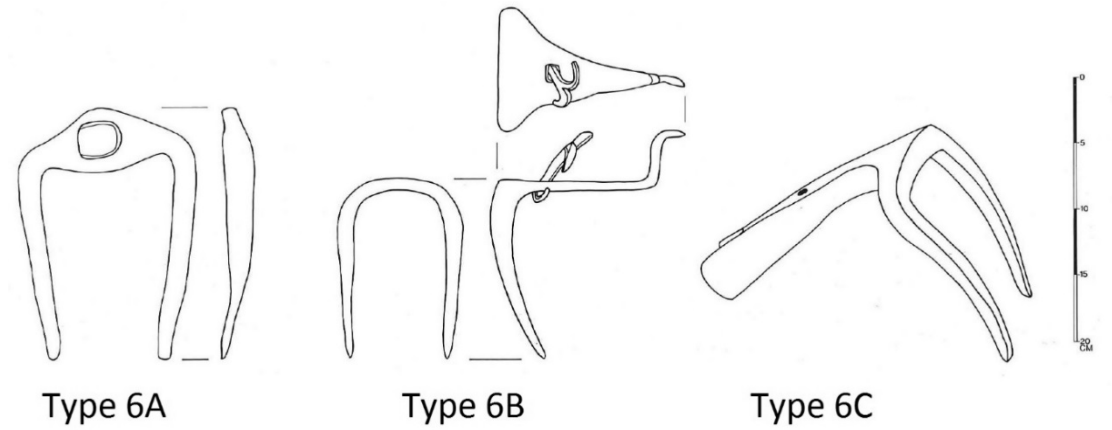


Figure 263 Two-tined hoe types (Manning, 1985a, fig. 12).

Type 6a is a shaft-hole tool, consisting of a U-shaped bar with sharp tapering points, either pierced with a central shaft hole (Rees, 1979, fig. 88a), or with a separate eye attached to the centre (Pohanka, 1986, Taf.17, 70). A number of similar tools made of antler are also known (Rees, 1979, pp. 314–8, below). No objects of this form come from London.

Type 6b is tanged. Only one example is known from Britain, from Rushall Down, Wiltshire (Rees, 1979, pp. 311–2; Manning, 1985a, p. 47). This object has an unusual form, with the tines being attached to the top of a tapering bar, which would run down the front of the haft, before bending 90 degrees to form a clenched tang which would go through the haft. The plate has also secured to the haft by a rivet. Manning (1985a, p. 47) considered this unusual object to be the result of 'misplaced ingenuity' by 'a smith of some eccentricity', but it is more likely to be the result of a tool maker being asked to produce something from outside their normal range of products, as the tang is similar in form to that seen on some scythes (Pietsch, 1983, Taf.24, 538-9) and reaping hooks (Rees, 1979, fig. 178a, 185a).

Type 6c is socketed, although beyond this the form shows considerable diversity. All four objects from London are of this type. Three of them, HOE08, 10 and 11, taper from the socket to a square-sectioned bar with bevelled corners before splitting to form the head. These bars vary considerably in length, whilst another, HOE09, has the tines attached directly to the top of the socket. Most have closed sockets, held in place with nails. Other examples from Britain come from Dunstable (Rees, 1979, p. 409), and possibly from Caerleon (Scott, 2000, figs 97, 23).

This type has been identified as the *bidens*, which was described by Classical writers for use in breaking up and aerating soil (White, 1967, pp. 47–52; Rees, 1979, p. 311; Manning, 1985a, p. 47). Mosaics appear to show them being used for this task, being swung in an overhead manner (White, 1967, p. 51, Pl. 3). However, these tools are identical to modern 'muck drags' or 'dung forks', used to move and spread manure (Museum of English Rural Life, 2017a; Chris Green pers comm), and it is not impossible that the London tools were used this way, particularly in an urban setting.

The objects from London are used to support an early introduction of this type to Britain (Rees, 1979, p. 311), and HOE11 was found with pottery suggesting a late 1st century date. However, it is not certain that all of these are Roman, as this type was also used in the Middle Ages in London (Hinton, 1988, fig. 183, 76). The large amount of iron used in these tools means that the majority were probably recycled (Rees, 1979, p. 311), but they nevertheless survive from a range of site types, including small towns and indigenous rural settlements (ibid). Curiously, they are not found on military settlements (ibid).

Type 7 – Antler Hoes

Although antler objects are not generally included in this thesis, HOE12 deserves discussion on account of its unique form, and the incorporation of iron nails. Antler two-tined hoes are relatively common in Britain, with Rees (1979, p. 314) identifying 23 examples. These objects seem to be a Roman introduction, found mainly on 'highly Romanised' rather than 'native' sites (Rees, 1979, pp. 315, 318), and can be broken down into groups of more robust (Type I) and slender (Type II) tools (Rees, 1979, p. 315). Although previously thought of as a two-tined hoe, HOE12 should instead be considered a form of three-tined hoe. The nails in the sides of the tines, and the joint cut between the surviving tines, suggests that a third tine was fitted between them at some stage. I am aware of no other antler objects with this form.

Continental sites have produced a range of three- and four-tined iron implements, which are thought to have been an innovation of the Northern provinces, created to better cope with tilling the heavier soils (Rees, 1979, p. 482). The absence of these objects from Britain is therefore surprising. However, it seems unlikely that HOE12 could have been used in this way. Rees (1979, pp. 317–8) is sceptical about the suitability of these tools for heavy digging, suggesting instead that they were used as drag hoes. These may have been used to make channels for seeds, and they also would have been suitable for use as muck drags.

Leatherworking Knives

Technology

The objects discussed in this section are knives thought to have been designed specifically for the craft of leatherwork. Leatherwork employs a wide variety of bladed tools at different times. Knives used in tanning and currying are discussed elsewhere (see p.476, 512). The knives discussed here are primarily those used for the initial cutting out of leather objects, although knives will also have been used to shave down edges (skiving), bevel edges for comfort, and cut decorative patterns. Many of these tasks do not require specially designed tools, but whilst a wide variety of knives existed in the Roman period, only those which can be tied specifically to leatherwork are included here.

Numbers

Eight knives are discussed here. Five come from the Museum of London, two from recent excavations by MOLA, and one from the collections held at the LAARC.

Typology

The knives from London which may have been used in leatherwork can be divided into three groups; half-moon knives, angled (bridle) knives, and small knives. Other types of leatherworking knife used in the Roman world, such as large triangular types often identified as 'razors' (see Swift, 2017, fig. 2.35), were not found in London.

Half-Moon Knives

Half-moon knives are the most recognisable leatherworking tools, and appear to have been used for leatherwork since at least c.1400 BC, where they are depicted being used by shoemakers on a tomb wall in Thebes (Salaman, 1986, fig. 2:1). Half-moon knives are also be depicted on several Greek red- and black-figure vases (Museum of Fine Arts Boston, No. 01.8035). That they were used for leatherwork in the Roman period is demonstrated by their depiction on the gravestones of shoemakers (van Driel-Murray, 2011, p. 79).

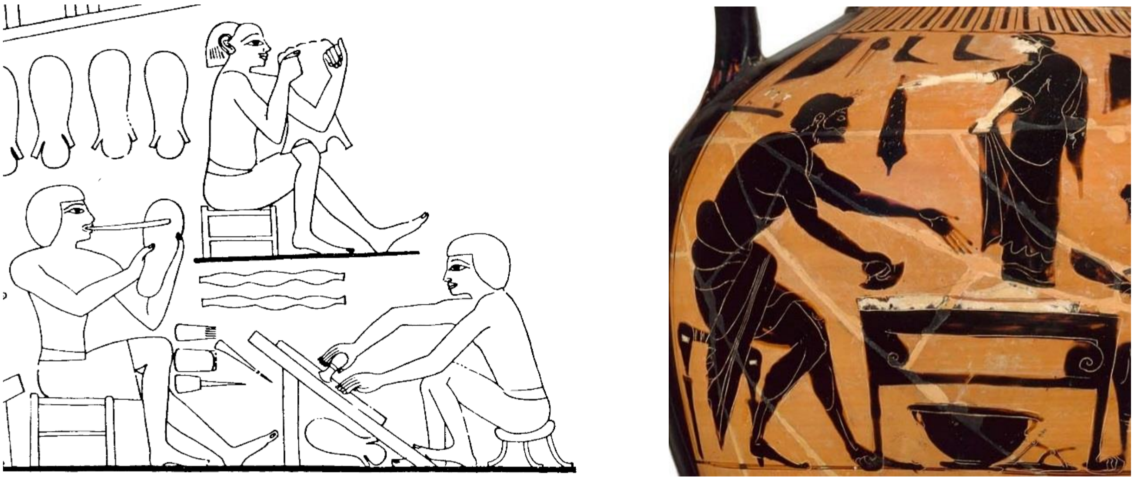


Figure 264 Half-moon knives being used by shoemakers on a tomb from Thebes (left, Salaman 1986, fig. 2:1) and a Greek black-figure vase (right, Museum of Fine Arts Boston, http://www.mfa.org/collections/object/two-handled-jar-amphora-153407).

Modern half-moon knives are used for a wide range of tasks. They are mainly employed for cutting out leather pieces, especially from thick leather, and can be used to cut straight 'without a straight edge of wood or metal such as is sometimes employed along with a small knife' (Salaman, 1986, p. 138). They can also be used for skiving (thinning the edges of a piece of leather by shaving) (ibid). Parchment knives, which are used to scrape skins for parchment making (Salaman, 1986, p. 331), are also very similar in form.

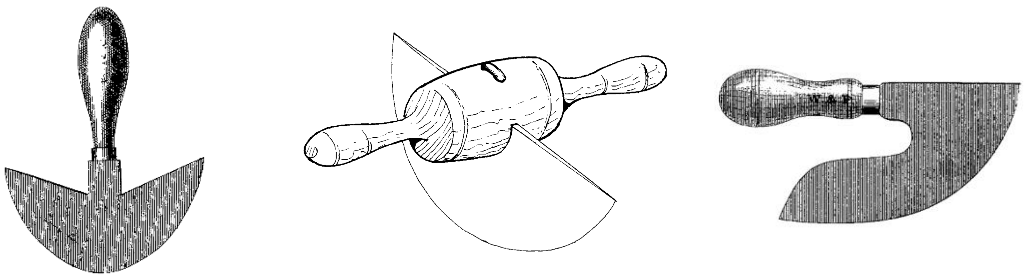


Figure 265 Modern half-moon knife (left, Salaman 1986, fig. 9:5), parchment knife (centre, Salaman 1986, fig. 13:17), and bridle knife (right, Salaman 1986, fig. 9:5). Not to scale.

Roman examples of half-moon knives have been discussed by Gaitzsch (1980, pp. 122–5), but this discussion includes many objects which are probably turf cutters (see p.613) and croze irons (see p.468), and the number of definite leatherworking knives amongst these is low. Two examples from Pompeii were found in association with possible leatherworking structures (Gaitzsch, 1980, p. 124); a socketed example (Gaitzsch, 1980, Taf. 24, 126) from the workshop of Schuster Vesbinus and Menecrates was found with other leather processing tools, now lost, whilst a solid-handled example (Gaitzsch, 1980, Taf. 24, 125) was found in association with tanning knives, and could have been used in either leatherwork or tanning. Half-moon knives are notably absent from Vindonissa, despite large amounts of evidence for leatherworking at the site (Gaitzsch, 1980, p. 124).

Three possible half-moon knives, LEA01-03, come from London, although only LEA01 is certainly not a turf cutter. LEA01 can be paralleled in a small number of finds from elsewhere, including a very close example found recently on the East Kent Access Road (Scott, 2017, fig. 14.1, 4) and others from Pomepii (Gaitzsch, 1980, Taf. 23, 123) and Ickham (Riddler and Mould, 2010, fig. 121, 1274).

LEA02 has a much less heavily curved blade than LEA01, and may therefore be a turf cutter. This seems unlikely, however, on account of its short tang, which better suits a knife than a gardening tool. LEA02's blade is slightly asymmetrical, which may indicate that it has been heavily worn by re-sharpening. A close parallel, thought to be a turf cutter, comes from South Shields (Rees, 1979, fig. 135).

LEA03 could not be located, and was recorded from a published outline image only. It is perhaps a leatherworking knife rather than a turf cutter as its small blade is not as heavily curved as that of narrow Type 1 turf cutters. The short open socket would nevertheless be expected on an agricultural tool rather than a craft knife, and is paralleled on a find from Woodyates (Pitt Rivers, 1892, Pl. CLXXXIV, 9), which may be a turf cutter.

Angled Knives

Two knives from London, LEA04-05, have curved blades which are set at an angle to the tang. Beyond this they are not very similar; LEA04 is much smaller and is made from a single piece of metal. LEA05 is larger, with a separate tang welded to the blade. No comparable Roman objects are known to the author, although another object in the Museum of London, MOL A657, has a tang attachment similar to that of LEA05. This object was interpreted as a 13^{th} century battleaxe, although this is surely incorrect. It is unlikely to be Roman, however, as MOL A657 was found in Westminster. LEA05 was originally interpreted as a 'flaying knife' (Reader, 1903, p. 198), although no similar skinning knives are known to the author. Both knives bear some resemblance to modern 'bridle knives', which are used by saddlers for the same range of tasks as half-moon knives, and they may therefore be leatherworking knives.

Small Knives

Two further knives from London may have been used in leatherwork. LEA06 is a small 'bellied' blade attached to the stub of a handle or tang. It may have been suitable for use in leatherwork, although it is also similar to blades used in surgery (Wheeler, 1930, Pl. XXXVIII; Künzl, 1982, Pl.

11, 7; Blizquez, 1994, p. 121, No. 52). LEA07 is a curious double-ended object, with a blade at each end similar to that of LEA06. LEA08 also appears to be a double-ended knife. Other double-ended knives known to the author include an object with a quarter-circle half-moon blade and small scalpel-like blade from Vindonissa, interpreted as a leatherworking tool (Gansser-Burckhardt, 1942, Abb. 8, 23:760; Hoffman, 1985, Pl. XLIII, 24), and a number of double-ended knives with half-moons at one end from Egypt (Flinders Petrie, 1917,Pl. LXII-LXIII; Salaman, 1986, fig. 2:118b). It is therefore possible that these objects represent a rare form of double-ended leatherworking knife. LEA07 was found in a pit containing leatherworking waste, which also suggests that this was a leatherworking tool.

Mattocks / *Dolabrae*

Technology

A mattock is a tool with a vertical axe blade at one end, and a horizontal adze blade at the other (Rees, 1979, p. 306). In British (and German) archaeology, mattocks are sometimes referred to as *dolabrae* (Manning, 1970a, p. 19; Rees, 1979, p. 312; Pietsch, 1983, pp. 88–9; Hanemann, 2014, p. 419), although this is usually reserved for a type of pickaxe (a tool combining an axe and a pick) with a curved diamond- or round-sectioned pick, thought to have been used by the military (Manning, 1970a, p. 19, 1976b, p. 28). In classical texts there is no clear distinction between the terms *dolabra*, *securis*, and *ascia-securis*, which appear to be used for tools with various combinations of axe and adze blades (Rees, 1979, p. 312), and as such the word 'mattock' will be used here. Tools which combine an adze blade with a pick are described as Type 3 hoes (see p.506).

Tools such as this are suitable for a range of tasks. The adze blade would be useful for breaking up ground in digging (Rees, 1979, p. 312), and it is not impossible that MAT02, found in a brickearth quarry pit, was used in this way prior to being discarded. The axe blade could be used to cut away vegetation, and they may have been used in forestry (Rees, 1979, p. 312), but it is worth noting that the axe blades of these tools are considerably thinner than those on the axes from London (see p.400). Nevertheless, 100mm wide axe marks from a thin-bladed tool on structural timbers from 1 Poultry suggest that these tools could also have been used in heavy structural carpentry (Goodburn, 2000, p. 7), and similar tools are even used in stonework (Kings College London, 2017). The thin blades may also have made these tools useable as weapons.

Numbers

Two mattocks come from London; one from the Museum of London and another from the LAARC.

Typology

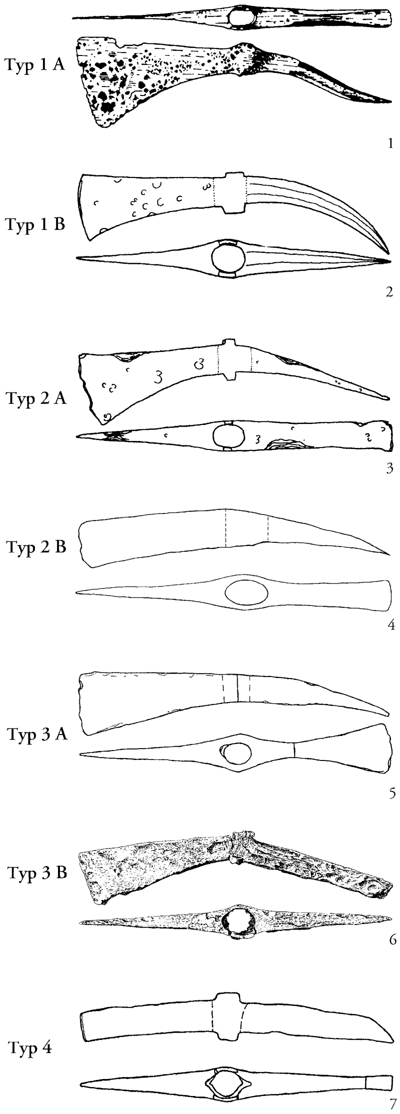


Figure 266 Hanemann's typology of pickaxes and mattocks (dolabrae) (Hanemann 2014, Abb. 357).

Hanemann (2014, Abb. 357) provides a three-party typology of all tools conventionally labelled *dolabrae,* with true mattocks making up **Type 2** (Figure 266). This type is further divided into two subtypes, which are analogous to Manning's (1970a, p. 19, 1976b, p. 28) 'military' (**Type 2a**) and 'civilian' (**Type 2b**) mattock types. 'Civilian' mattocks usually have much narrower axe blades and wider adze blades than the 'military' type, and are usually shorter. Both of the London examples therefore appear to be of the 'military' type, although only one, MAT01, has the lugs which Manning (1976b, p. 28) also considered to be indicative of the type.

Both are likely to have been of early date. MAT02 comes from a pre-Boudiccan quarry pit, whilst the narrow lugs on MAT01 may be indicative of a date in the first century (Pietsch, 1983, Abb. 26). Although Manning identifies these tools as of a military type, and many come from military sites (Table 78), neither was obviously associated with the military in London (Rees, 1979, p. 312). Both come from the middle Walbrook valley, although MAT01 is effectively unstratified. A ditch near to the pit in which MAT02 was found had an 'ankle-breaker' profile, which is sometimes seen as evidence of military fortification. However, this was dismissed by Wallace (2013) in a recent review of the pre-Boudican archaeology of London, who found that such ditches are more likely to have been involved in drainage. It is also worth noting that the narrower 'civilian' type is also found on Continental military sites (Pietsch, 1983, Taf. 3, 46-8).

Site	Site Type	Context	Date	Reference
Carrawburgh	Military	-	122-400	(Manning, 1976b, fig. 18, 77)
Housesteads	Military	-	124-410	(Manning, 1976b, fig. 17, 76)
Richborough	Military/Urban	-	-	(Manning, 1970a, fig. 1, b)
Carnuntum (x2)	Military/Urban	-	-	(Pohanka, 1986, Taf. 22, 81, Taf. 20, 82)
Magdalensberg	Urban	-	14-37	(Pohanka, 1986, Taf. 19, 77)
Mauer an der Url (x2)	Military	Hoard	200-250	(Pohanka, 1986, Taf. 22, 79, Taf. 18, 80)
Pompeii	Urban	-	Before 79	(Gaitzsch, 1980, Taf. 7, 31)
Saalburg	Military	-	85-260	(Pietsch, 1983, Taf. 3, 45)
Wels	Urban	-	-	(Pohanka, 1986, Taf. 19, 85)
Zeiselmauer	Military	-	Late Roman?	(Pohanka, 1986, Taf. 18, 78)
Zugmantel (x3)	Military	-	90-260	(Pietsch, 1983, Taf. 3, 43, 44, 46)

Table 78 Comparanda for the Type 2a mattocks from London.

Ox Goads

Technology

The objects discussed in this section are small loops or sockets of iron, with a spike projecting from one end. Following Pitt Rivers (1892), Rees (1979, p. 75) considered these objects to be the tips of ox goads; long sticks used to prod and direct cattle in ploughing operations, the use of which is described in Roman sources. As the majority of these objects are simply made of iron, they could certainly fulfil the requirements of a simple, replaceable agricultural tool. However, positive evidence for this interpretation is hard to find. A sharpened stick would be just as effective (Rees, 1979, p. 75), although the *Greek Anthology* (6.95) specifically records the dedication to Demeter of an 'ox-turning iron-tipped, threatening goad'.

Other objects identified as ox goads would be unsuitable for this kind of work. Rees (1979, pp. 77–9) highlights a number of decorated bone examples from the late Iron Age, but these are not an exact match for the iron objects, and may have had a different function. A copper alloy object from Bucklersbury House, OXG32, has been described as a Type 2 ox goad. However, this object is much less substantial than the iron goads, with the tip being made of a folded piece of metal only half a millimetre thick. Its construction is also unusual, as the spike comes from the centre of the bent panel, rather than the edge. Another bronze goad of the same form comes from Kettering Museum (Rees, 1979, p. 78). It is possible that these also had a separate function, but an iron Type 2 goad from London, OXG33, has very similar dimensions, albeit with a marginally more robust tip coming from the edge of the panel.

The most developed alternative interpretation of these objects is as pens. This was first suggested when a Type 2 example was excavated at Vindolanda with a wooden shaft intact. This shaft appeared to have a 2mm hole bored through the centre, argued to have worked as an ink reservoir, and ink staining around the tip (Blake, 2013a). Replicas of this form of object have apparently proven effective as pens (ibid), and thre are references to iron pens in Pliny

(*The Natural History*, 34.39, although this may refer to styli). However, several arguments can be made against the idea that ox goads functioned as pens.

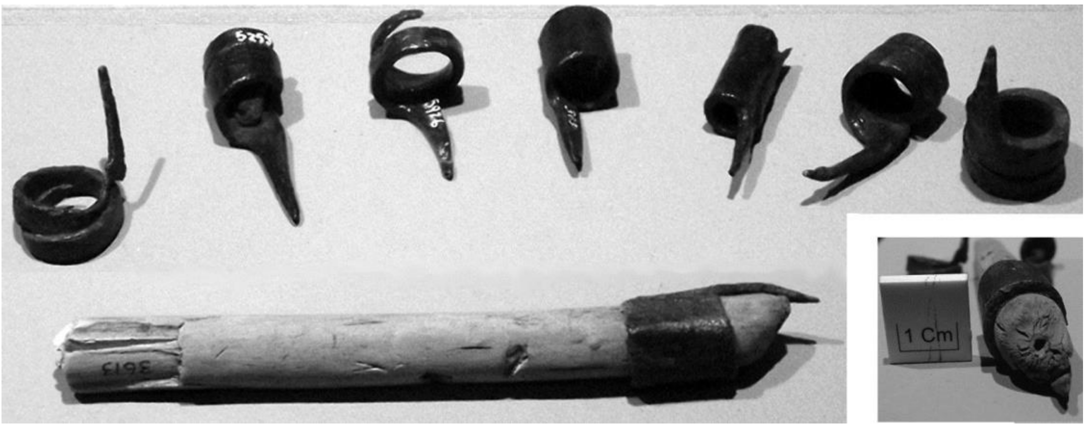


Figure 267 The Vindolanda 'pen' (Blake 2013, fig. 10).

In possessing a central hollow, the Vindolanda object is unique. Several objects from London retain the impression of wood within them, but only OXG10 and OXG19 retain well preserved wood. In both cases this is a solid piece of wood, with no evidence of a central channel. Ox goads from Vechten (Fünfschilling, 2012, p. 179) and Dalton Parlours (Scott, 1990, figs 120, 79) also retains part of apparently solid wooden handles. It therefore seems unlikely that the channel in the middle of the Vindolanda object was normal. Given the narrowness of this channel, it is possible that it is a natural result of decay of the central pith (Marshall and Wardle, forthcoming).

Eckardt (pers comm.) reports that Roman metal inkwells typically have an opening of between 9 and 17mm. If we look at the external diameters of the ox goads from London (Figure 268) we can see that even the smallest, at 11mm in external diameter, would not have been useable with smaller inkwells, and this is before you consider that you would require clearance around the pen in order to sensibly use it. Eighteen ox goads are at or above 17mm in diameter, and as such would have been too wide to fit into the widest inkwells. With a 12mm wide shaft (Blake, 2013a), it is unlikely that the Vindolanda 'pen' could have been used with a metal inkwell either.

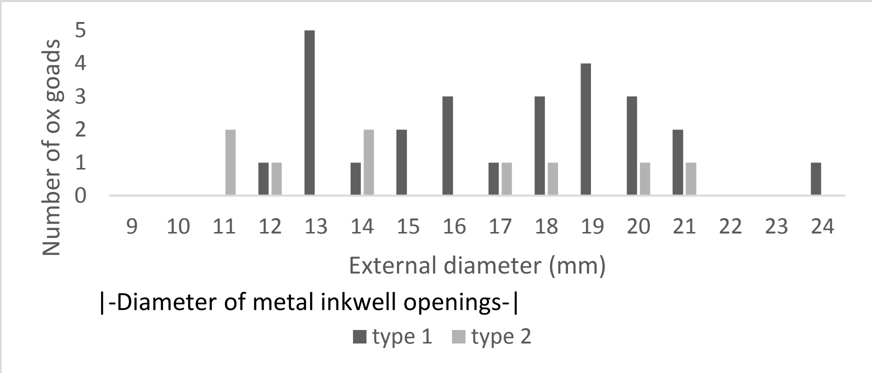


Figure 268 Graph showing the external diameters of the complete ox goads from London.

The dating of these objects also runs counter to the idea that they could have functioned as pens, with Rees (1979, p. 77) citing several examples from the Iron Age. It is therefore very difficult to come up with a convincing interpretation for these objects. The argument for them as pens has several flaws, whilst the positive evidence for them as ox goads is almost non-existent. For this reason, ox goads will not be considered in any further functional analysis of the objects from London.

Numbers

37 ox goads were found in the London collections, including 18 from recent excavations by MOLA, 13 from the Museum of London and six from the LAARC.

Typology

Rees (1979, fig. 75) divides ox goads into three types.

Type 1 is formed of a tapering strip of iron coiled into a socket two to four spirals deep, drawn out at one end to a tapering point which follows the line of the socket. Rees (1979, p. 76) found that a round cross-section was the most common, but all of the ox goads from London are made of flat rectangular-sectioned strips. This type is the most common nationally (Rees, 1979, p. 76) and in London, with 28 examples present, OXG01-28.

Type 2 consists of a single piece of metal bent into a round socket. The edges of this type are normally butted rather than welded. Nine objects of this type, OXG029-37, come from London. This type shows a high degree of diversity, with the socket ranging from a single narrow loop to a long socket, although there is no clear cut off point between the two. Most have a tapering point drawn out from one edge of the socket section, but OXG32's point is drawn from the centre of the socket.

Type 3 consists of a conical ferrule, which may be riveted. No examples of this type come from London.

Palette Knife

Palette knives are blunt knives with rounded tips and flexible blades (Clarke and Clarke, 2016) used to spread soft materials. Today they are primarily used in painting, to mix paint on a palette before it is applied to a canvas (ibid), or in cookery. It is not impossible that in the Roman period they were used in some way with wax tablet production or maintenance.

PAL01 has a form resembling that of a paring chisel with an integral handle, but it's well preserved blade is clearly blunt. A number of comparable objects from elsewhere have been interpreted as chisels (Table 79), but none are as well preserved as PAL01, and it is possible that these are also palette knives. Other objects with comparable blade shapes include a tanged palette knife with a wooden handle from Vindolanda (Blake, 1999, No. 4207) and a tanged spatula from Avenches (Duvauchelle, 1990, No. 194).

Site	Site Type	Context	Date	Reference
Great Witcombe	Villa	Unstratified	-	(Bevan, 1998, fig. 39, 18)
Haltern	Military	-	1 BC - AD 9	(Harnecker, 1997, Taf. 7, 50)
Neuss	Military	-	-	(Simpson, 2000, Pl. 41, 8)

Table 79 Comparanda for PAL01.

Picks

Technology

Picks are shaft hole tools tools with one or two robust tapering points or robust adze blades. They are used to break apart hard materials, and have a number of potential uses in digging, quarrying, and rough carving tasks.

Numbers

Nine objects are discussed in this section; eight from the Museum of London and one from recent excavations by MOLA.

Typology

The picks from London fall into three main types; quarry picks, sculptor's picks, long-bladed picks and millstone picks.

Quarry Picks

The most common type of pick is a double-sided tool, consisting of a central round or oval shaft hole, normally set in a wide diamond-shaped casing, with a robust blade at either side. Manning (1985a, fig. 6) divides these picks into three types, based on whether they have two pick blades (Type 1), a pick and adze (Type 2), or two adze blades (Type 3). Type 2 is the most common (Pietsch, 1983, pp. 18–19), and all four objects from London (PIC01-04) are of this type. Although having the same overall form, these tools vary considerably in size and robustness, as well as in the degree of curvature of the blades. Pietsch (1983, p. 19) found the same level of variability amongst continental examples.

These tools have been described as quarry picks (Blagg, 1976, p. 155) and mason's picks (Manning, 1976b, pp. 25–6); tools used for quarrying stone and rough tasks such as squaring large blocks and hollowing sarcogphagi (Blagg, 1976, p. 155; Wooton, Russell and Rockwell, 2013, p. 2). Their association with military sites (Table 80), however, shows that they were either also involved in on-site processing of masonry and construction, or in other tasks, such as digging and demolition (Blake, 1999, p. 31). In London they may have been associated with gravel quarrying. The extremely robust PIC01, however, probably had a role in stonemasonry.

Site	Site Type	Context	Date	Reference
Housesteads (x2)	Military	-	124-410	(Manning, 1976b, fig. 16, 65-6)
Newstead	Military	-	80-211	(Curle, 1911, Pl. LVIII, 12)
Vindolanda	Military	Unstratified	85-410	(Blake, 1999, No. 1217)
Saalburg (x13)	Military	-	85-260	(Pietsch, 1983, Taf. 4, 51-9, 62)
Zugmantel (x2)	Military	-	90-260	(Pietsch, 1983, Taf. 4, 60-1)

Table 80 Comparanda for the Roman mason's picks

Sculptor's Picks

PIC05 has a form similar to that of a Type 2 hammer, having a shaft hole in an expanded casing, and a short hammer head at one end. However, whilst Type 2 hammers are balanced by a cross-pein, PIC05 is balanced with a pick blade. It has been classified as a pick rather than a hammer as the pick blade is longer than the hammer head, suggesting that this was the primary working side of the tool. The form of this tool is very similar to that of a 'sculptors pick', used in Medieval Italy for roughing out sculptures (Wooton, Russell and Rockwell, 2013, p. 2). Although undated, PIC05 is one of the few tools in the Museum of London to have some form of stratigraphic provenance, coming from a drainage ditch. Other examples include a 3rd century example from a floor surface in a villa in Maidstone (Kelly, 1992, figs 10, 5), and another from a well at La Bernard (Hoffman, 1985, Pl. XI, 12).

Long-Bladed Picks

MOL 1580 is a single-sided tool, with a long, curving, continually tapering pick blade at one end and a flat poll at the other. Although catalogued amongst the Roman tools in the Museum of London, MOL 1580 is probably medieval in date. Whilst the overall form of this tool is paralleled at Pompeii (Gaitzsch, 1980, Taf. 8, 36-8; Allison, 2006, No. 840) and Boscoreale (Harvey, 2010, figs 15-7), it can also be paralleled in a number of examples from the 12th-14th centuries (Goodall, 1980, C12-14), which have more comparable shaft hole shapes. MOL 1580 has a triangular shaft hole, rather than the round or oval shaft hole typical of Roman tools.

Millstone Picks

Traditional millstone picks today consist of a stout double-sided, chisel-edged iron blade, which is mounted in a wooden handle, known as a thrift, and secured in place with a wooden wedge (Major, 1985). Whether or not this arrangement was used in the Roman period is unknown. However, four objects (PIC06-09) from the Museum of London have the shared form of a square- or rectangular-sectioned bar, tapering from its widest point in the centre to chisel edges at either end. It is possible that these functioned as millstone picks, although this must be considered a cautious identification as they are considerably smaller and less robust than modern examples. It is possible that this size difference is due to Roman querns being smaller than modern millstones.

Figure 269 Modern millstone picks

(Reading Museum).

Plane Irons

Technology

Planes are woodworking tools in which a chisel-like blade is mounted into a wooden or metal stock at a fixed angle, and pushed or pulled across the surface of the wood being worked on. Today, planes can be used for a variety of tasks, including rough shaping, preparing surfaces for joining, cutting joints and rebates, smoothing and finishing, and applying decoration (Salaman, 1975, pp. 399–301). Planes allow repetitive work to be carried out with precision and speed compared to attempting the same tasks with a hammer and chisel.

The earliest known planes come from Pompeii (Goodman, 1964, p. 43; Ulrich, 2007, p. 43), although they will have existed somewhat earlier. Planes are depicted as mint marks on Republican silver coinage (Ulrich, 2007, p. 41), and linguistics, as well as their association with the legendary figure of Daedalus, implies that they may have existed in Greek world beforehand (Goodman, 1964, p. 42; Ulrich, 2007, p. 41). Whatever their origin, they are not known in pre-Roman Britain. At least 27 plane bodies are now known from the Roman period (Goodman, 1964, Table II; Gaitzsch, 1980, Abb. 11; Blake, 1999, No. 88.578; Long, Vere-Stevens and Steedman, 2002; West, 2005; Jansma and Morel, 2007, Afb. 8.45-9; Manning, 2007; Ulrich, 2007, figs 344-6; Rupnik, 2015), and these can be divided into two main types.

The earliest plane bodies from Pompeii are short (21cm long), with wooden bodies housed inside a u-shaped iron plate, with a single slot grip at the rear (Goodman, 1964, p. 43; Ulrich, 2007, p. 43). They are similar in size to modern smoothing planes (Goodman, 1964, p. 45). A number of recently discovered planes from a grave at Turnershall Farm (West, 2004, 2005) also appear to be of this type. At least one of these planes has a rounded sole, and may have been used to smooth arrow shafts. In this type, and in the larger type below, the blade was held in place with wooden wedge against an iron pin (Goodman, 1964, pp. 43–4), although the Wilderspool plane also had a metal plate against the wedge (Manning, 2007, p. 80).

Figure 270 ‘Smoothing’ plane from Pompeii

(http://www.dartmouth.edu/~rogerulrich/tools/tl_plane_pompeii_72.jpg).

The majority of known Roman planes are of a larger type, most examples of which are standardised at between 32-8 cm long, corresponding to the length of a modern jack plane (Goodman, 1964, p. 45, Table II). An outlier from Verulamium is longer, at 44cm (Goodman, 1964, pp. 47–8; Manning, 1972b, pp. 166–8). Most have slot grips at the front and rear (Goodman, 1964, p. 45), corresponding with depictions of planes in sculpture (Goodman, 1964, figs 41-2; Ulrich, 2007, fig. 3.21, 3.24), although an example from Silchester may have only had a rear grip.

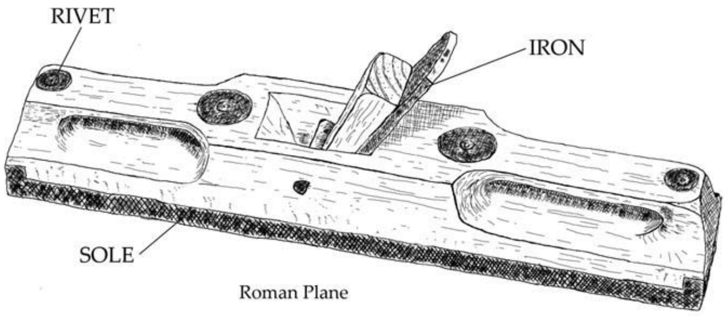


Figure 271 Reconstruction of the Roman 'Jack' plane from Verulamium by Roger Ulrich

(http://www.dartmouth.edu/~rogerulrich/tools/tl_plane_ver_72.jpg).

A plane from Saalburg (Goodman, 1964, fig. 40) and four more from De Meern (Jansma and Morel, 2007 Afb. 8.45-8) are made entirely of wood. Ulrich (2007, p. 42) suggests that the majority of Roman planes would have been made solely of wood, probably by the people who used them, with their present rarity probably being due to preservation. Beech wood is preferred for planes today (Salaman, 1975, p. 301), and was also used on Saalburg plane (Ulrich, 2007, p. 43), although the Pompeii planes may have been made of chesnut or oak (Goodman, 1964, p. 43), and one of the De Meern planes was repaired with silver fir (Jansma and Morel, 2007, p. 223).

The majority of surviving examples have an iron sole plate with up-turned ends, held on to the wooden body by long rivets (Goodman, 1964, pp. 45–7). Planes from the Limes forts and Wilderspool have metal side plates riveted to the wooden body (Goodman, 1964, p. 48; Manning, 2007, p. 78), whilst planes from Silchester and Cologne have side plates attached to the iron sole (Goodman, 1964, pp. 48–9). In overall shape the Cologne plane resembles the all-wooden Saalburg plane, but is notable for having an elaborate iron casing with harp-like decorative pieces over the slot grips (Goodman, 1964, p. 50; Ulrich, 2007, p. 43). The plane from Goodmanham is also notable for having a body made from elephant ivory rather than wood (Long, Vere-Stevens and Steedman, 2002).

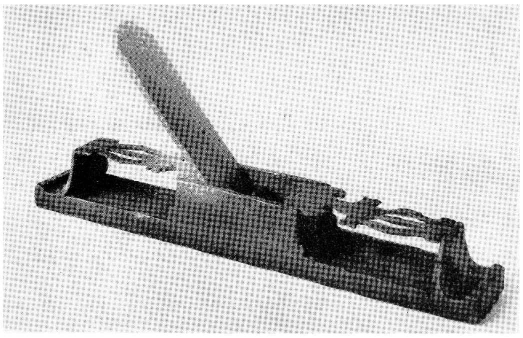
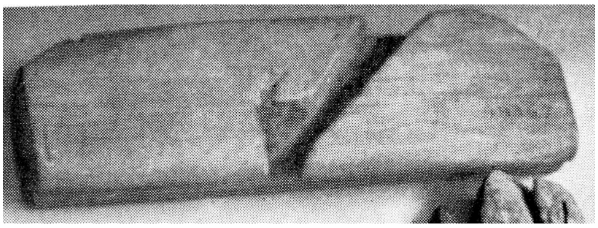



Figure 272 Planes from Cologne (left, Goodman 1964, fig.50) and Goodmanham (right, http://www.bbc.co.uk/ahistoryoftheworld/objects/25Inp7W5SeK1-Xq1coWUzw).

In addition to these common types, three rarer plane forms are evidenced. A Roman-period moulding plane in the Egyptian Museum at Cairo has an all-wooden body (Goodman, 1964, fig. 38; Ulrich, 2007, p. 43). Moulding planes are used to produce decorative mouldings, and have soles shaped in the reverse of the design they produce (Salaman, 1975, p. 338). The Egyptian plane has a rounded concave sole. Its form is similar to that seen on medieval moulding planes, being made of a single piece of wood with a slot in the side to take the blade (Salaman, 1975, pp. 338–9).



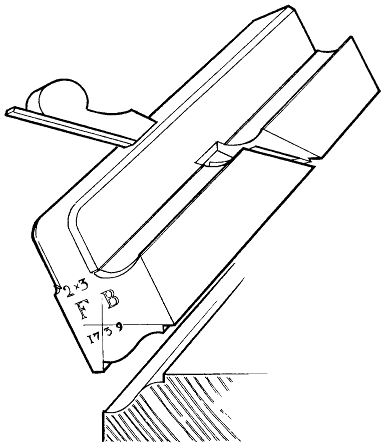


Figure 273 Roman moulding plane from Kom Wasim (left, Goodman 1964, fig. 38), and an 18th century moulding plane in use (right, Salaman 1975, fig. 495).

Another type is represented by two small fully-enclosed wooden plane bodies from a Roman Iron Age bog deposit at Vimose, Denmark (Christiansen, 2005, fig. 27). These have a ship-like shape and rounded soles, and may have been for smoothing the shafts of arrows or spears. A final type may be represented by an all-wooden 1st century object from Vindolanda (Blake, 1999, No. 88.578). This object is similar to a Lapp moulding plane figured by Goodman (1964, fig. 37), which was postulated as a link between adzes and planes. At 75mm wide, the slot of this tool is significantly wider than most Roman plane irons. It is therefore possible that this object has been misidentified, although if it is a plane the excavators are probably correct in identifying it as a tool for smoothing large timbers.

No plough plane bodies are known from the Roman period, although plough plane blades are common (below). Plough planes are used to cut a continuous groove in a piece of wood. Modern plough plane stocks have a screw-adjustable panel (fence) on one side to regulate the distance between the cut and the edge of the wood being worked on (Salaman, 1975, p. 346). The cooper's croze could also be considered a form of specialist plane, although the example from London is discussed separately (see p.468).

Pietsch (1983, p. 47) found that whilst plane irons are found in large numbers on military sites, two thirds of known examples come from civilian sites. From this he argues that planes were not a major part of the military woodworking tradition, and were instead a feature of civilian woodwork. On military sites, especially early ones, the same sort of work may have been preferentially carried out with adzes.

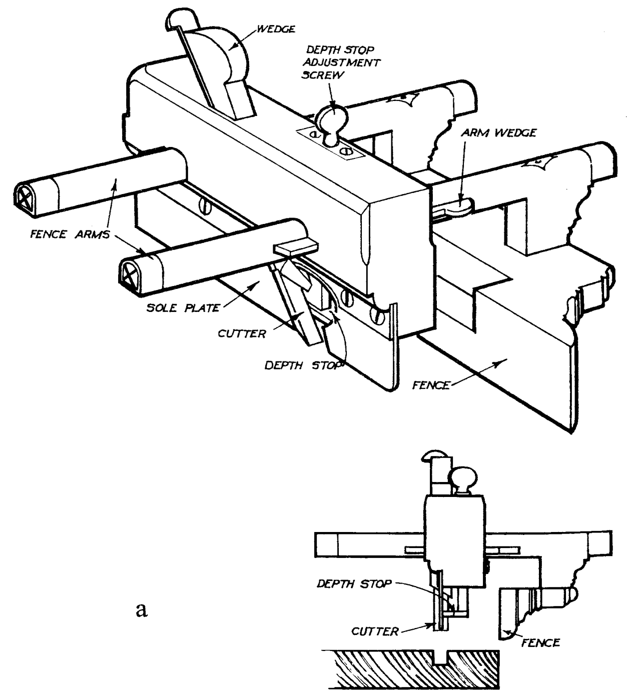


Figure 274 Schematic illustration of a modern plough plane (Salaman 1975, fig. 517a).

The elaborate forms of the Goodmanham and Cologne planes suggest that these were important objects used as markers of achievement, identity or status. This is also suggested by their appearance as signifiers of profession on tombstones (Goodman, 1964, figs 41-3). However, this status has been seen as at odds with the ways tools were treated in disposal. The Wilderspool plane was found in a clay floor in a metalworking building, and interpreted as a sign that 'high quality tools were not regarded as particularly special objects at Wilderspool' (Manning, 2007, p. 46). The Goodmanham plane was deposited in a ditch (Long, Vere-Stevens and Steedman, 2002), the Saalburg plane was found in a well (Goodman, 1964, p. 45), whilst those from Seltz (Schaeffer, 1927) and Silchester (Evans, 1894) were found in hoards. These have all been seen as examples of objects hidden from, or discarded by, raiders. However, hoards are today seen as ritual deposits (Manning, 1972a; Hingley, 2006; Humphreys, 2017a), in some cases containing objects linked to smith cults. With this in mind, could the Wilderspool plane not be seen as a votive offering integrated into the floor of a workshop?

Numbers

Six objects are discussed in this section, four from recent excavations by MOLA and one each from the Museum of London and Wessex Archaeology.

Typology

No plane bodies survive from London, and as such the following discussion will be of the plane irons. Hanemann (2014, Abb. 323) provides a seven-part typology of plane irons, largely based on the tip and therefore the functions they carried out. Plane irons can vary considerably in form beyond the tip, but this scheme is suitable for classifying the small number of tools from London.

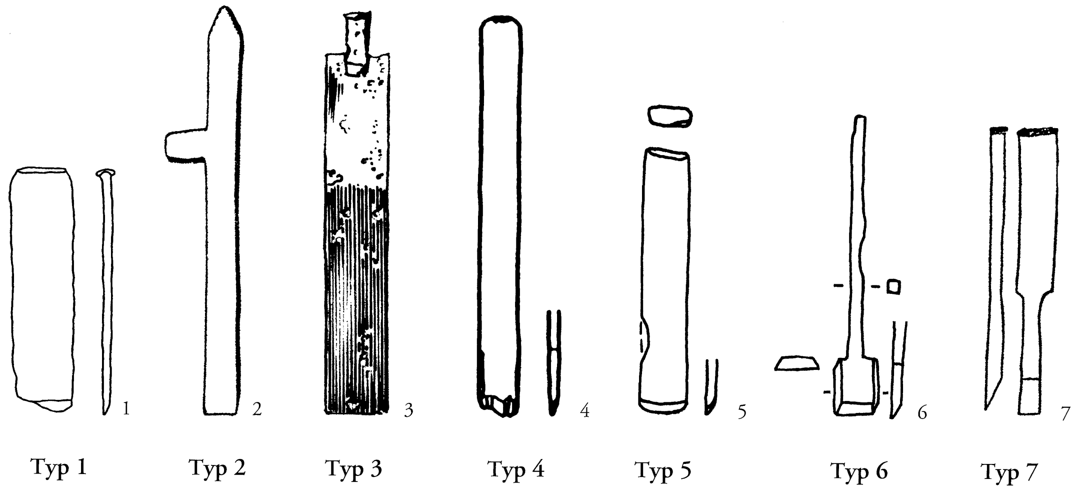


Figure 275 Hanemann's typology of plane irons (Hanemann 2014, Abb. 323).

Type 1 plane irons are the simplest type, consisting of a flat rectangular-sectioned body with a straight blade. They are often burred at the butt, suggesting that they were adjusted by striking with a hammer (Mutz, 1980, p. 125). One object from London, PLA01, may be of this type. This object is at the larger end of the size range for these objects defined by Gaitzsch (1980, pp. 113–4) and Pietsch (1983, p. 47), and is missing its cutting edge.

Site	Site Type	Context	Date	Reference
Augst (x4)	Urban	Hoard	200-300	(Mutz, 1980, Abb. 3, 7-10)
Feldburg (x5)	Military	-	150-260	(Pietsch, 1983, Taf. 15, 350, 350c, 350I, 353, 355a)
Immendorf	-	-	-	(Gaitzsch, 1980, Taf. 57, 283-4)
Magdalensberg	Urban	-	15 BC - 50 AD	(Mossler, 1974, Abb. 43)
Niederbieber	Military	-	185-260	(Gaitzsch, 1980, Taf. 46, 226-8)
Saalburg (x10)	Military	-	85-260	(Pietsch, 1983, Taf. 15, 349, 349a-b, 350a, 350k, 351, 352, 352f, 355b, 356b)
Vetera	Military	-	12 BC – AD 276	(Gaitzsch, 1980, Taf. 52, 256-7)
Zugmantel (x21)	Military	-	90-260	(Pietsch, 1983, Taf. 15, 349c, 350b, 350d-h, 352a-e, 353a-c, 354, 354a, 355, 355c, 356, 356a)

Table 81 Comparanda for Type 1 plane irons.

Type 2 plane irons are snecked; that is, they have a small extension on one side of the blade. This allows the blade to be adjusted without striking (Salaman, 1975, pp. 301–3). No objects of this type come from London.

Type 3 blades are toothed, allowing them to remove a greater amount of material quickly (Salaman, 1975, p. 301). No objects of this type come from London.

Type 4 blades are moulding plane blades. They have shaped tips, which would produce decorative mouldings. One object from London, PLA02, is of this type. This tool would have produced a design similar to the 'quirk ogee and bead' figured by Salaman (1975, fig. 505, h). A small number of other moulding plane blades are known (Table 82), but none has the same expanded head as PLA02. This head is also seen on Type 4S chisels (see p.449), indicating that PLA02 has been manufactured froma paring chisel, although it is possible that some of these chisels are also plane irons.

Site	Site Type	Context	Date	Reference
Newstead	Military	Ditch	80-211	(Curle, 1911, Pl. LIX, 2)
Vindolanda	Military	-	160-80	(Blake, 1999, No. 5345)
Saalburg	Military	-	85-260	(Pietsch, 1983, Taf. 15, 362, 364-6)
Vertault	Urban	-	-	(Tisserand, 2010, Pl. 6, 65)
Zugmantel	Military	Hoard	90-260	(Pietsch, 1983, Taf. 15, 363)

Table 82 Comparanda for Type 4 moulding plane irons.

Type 5 blades have convex rounded tips. These could be used to produce mouldings, but are also used today for rough shaping. No objects of this type come from London.

Type 6 plane irons have short, shouldered blades. Today, these are used for cleaning rebates and joints across the grain. Salaman (1975, p. 357) considered them to be a 19th development, although a number are known from Roman sites (Hanemann, 2014, p. 378). No objects of this type come from London.

Type 7 blades are from plough planes, and used to cut long channels or rabbets. This is one of the more common types of plane iron, coming from both military and urban sites (Table 83). The large number of surviving examples is perhaps because these objects are more robust and less prone to corrosion than other plane iron types, although they are often confused for mortice chisels (see p.458). Despite Type 7 plane irons being common, no Roman plough plane bodies are known. Four objects of this type, PLA03-06, come from London. However, only PLA03 can be identified with certainty. PLA04-06 are all heavily corroded, and have been identified from x rays and publications based largely on their silhouette.

Site	Site Type	Context	Date	Reference
Caernarfon	Military	-	350-400	(Allason-Jones, 1993, fig. 10.93, 294)
Hod Hill (x2)	Military	-	43-51	(Manning, 1985a, B38, B39)
Augst	Urban	Hoard	200-300	(Mutz, 1980, Abb. 3, 11)
Avenches	Urban	-	-	(Duvauchelle, 1990, No. 86)
Compiègne (x3)	-	-	-	(Champion, 1916, Pl. IV, 15909, 29051 A-B)
Magdalensberg	Urban	-	15 BC - 50 AD	(Mossler, 1974, Abb. 14)
Haut-Empire	-	Unstratified	-	(Roux, 2013, Pl. 124, 2366)
Saalburg (x6)	Military	-	85-260	(Pietsch, 1983, Taf. 8, 138d-h, Taf. 15, 370)
Waldfischbach	-	Hoard	300-400	(Hanemann, 2014, Taf. 35, Wa/H 1/34)
Zugmantel (x7)	Military	-	90-260	(Pietsch, 1983, Taf. 8, 138, 138a-c, 139, 139a, 1988, Abb. 2, 3)

Table 83 Comparanda for Type 7 plough plane irons.

Metric Analysis

Mutz (1980, p. 126) has suggested that the plane irons from Augst relate to standard Roman measurements based on the quarter *digitus*. Of the three measurable plane irons from London, PLA02 and PLA03 are both 10mm wide, which may relate to the half *digitus* (9.25mm). PLA01 (30mm) does not closely resemble any standard measurements, although this object is incomplete.

Plough Equipment

Technology

Ploughs are large, complex tillage tools, which consist at the most basic level of a ground-penetrating share attached to a wooden frame of some kind, which is pulled behind animals to break apart soil and cut a furrow, usually before seeds are sown. The technology of ancient ploughs has been subject to considerable academic discussion since the 19th century, as highlighted in Chapter 3. Some authors make a distinction between the terms 'plough', which can be reserved for sod-turning machines with mouldboards, and 'ard', used for simpler machines without mouldboards or wheels (Rees, 1979, p. 6). Here, the word 'plough' will be used, with no intended attribution of form.

Whilst almost all of the London tools will have had wooden elements which are now lost, the wooden elements of the plough are particularly important. Ploughs are large and complex pieces of machinery, of which only two principle elements, the share and the coulter, were frequently made of iron and therefore survive to us (Manning, 1964b, p. 54). Putting these pieces into context therefore requires a brief consideration of the operation of a plough, and the overall form of ploughs in the Roman period. The most up-to-date Anglophone discussions of the construction of Roman ploughs remain those of Manning (1964b) and Rees (1979, pp. 42–69). As with most plough studies, these draw on a wide range of sources, including ancient literary sources, artistic representations and models, prehistoric ploughs preserved in bogs, and Roman archaeological material. From these diverse sources, a relatively concise description of the Roman plough can be made.

Though the issue is disputed (Rees, 1979, pp. 66–9), Manning (1964b, pp. 55–7) and Rees (1979, pp. 65–9) agree that the description of a wooden plough in Virgil's Georgics matches closely with the ploughs depicted in Roman bronze models, and seen in some prehistoric bog finds. This is a bow ard, consisting of a crooked beam, which would have been attached to the yoke of the draught animals at the straight end, and had a stilt passing through the bent end. This stilt formed the handle used to control the plough. Ancient wooden plough beams and stilts from Britain are discussed by Rees (1979, pp. 42–8), although none date to the Roman period.

Also projecting from the bent end of the beam would be the **plough share**. This was the part of the plough which entered and cut the soil. On the Donnerupland ard this is constructed in two parts, with a wide wooden mainshare protected on the upper side by a narrower foreshare,

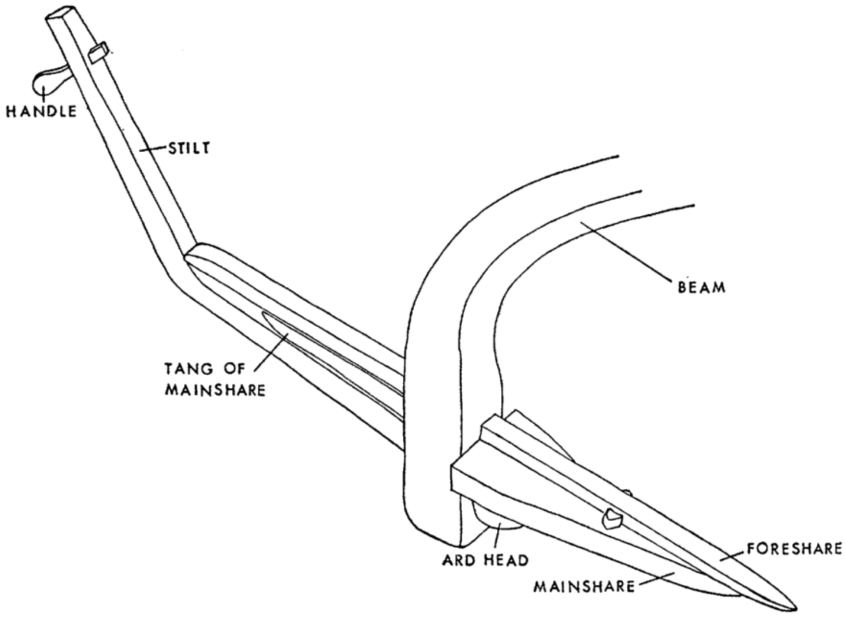


Figure 276 All-wooden bow ard construction, based on the Donnerupland Ard (Manning, 1964b, fig. 2).

also made of wood (Manning, 1964b, pp. 54–5), and a similar arrangement may be described by Virgil (Manning, 1964b, pp. 55–6; Rees, 1979, pp. 65–9). Wooden shares from Usk (Rees, 1979, p. 45; Manning, Price and Webster, 1995, pp. 238–9), Ashville (Rees, 1979, p. 46), Odell (Beds.) and Walesend Rath (Pembrokeshire) (Fowler, 2002, p. 197) show that all-wooden shares continued in use into the Roman period, but a wide variety of iron shares are also known from the Iron Age onwards (Manning, 1964b, pp. 57–62; Rees, 1979, pp. 48–59).

Although not obviously depicted in any model, and only being referred to in one corrupt passage in Pliny (Manning, 1964b, p. 62), archaeological finds indicate that **coulters** were in use by at least the Late Roman period (Manning, 1964b, pp. 63–4; Rees, 1979, pp. 59–61). Coulters are large knife-like objects attached to the plough in front of the plough share. Their purpose is to cut vertically through the soil (as opposed to the share which cuts horizontally), making ploughing easier in heavy soils (Manning, 1964b, p. 62; Rees, 1979, p. 61). They also make the use of mouldboards possible, and some may be angled (set) in the direction of the mouldboard to help in turning the soil (Manning, 1964b, pp. 63–4). However, the association of coulters with symmetrical ploughshares in hoards and the perhaps poor evidence of set on Roman coulters means that the use of mouldboards cannot be presumed on this basis (ibid). Although used on the Continent in the Iron Age (Hanemann, 2014, p. 169), coulters appear to have been a Roman period introduction to Britain (Manning, 1964b, pp. 62–3). Their appearance in Late Roman hoards may indicate that they were introduced in the Late Roman period, although this is not certain (Manning, 1964b, p. 63; Rees, 1979, p. 60). A stray find from Meering was associated with 1st-2nd century pottery (Rees, 1979, p. 290).

Mouldboards are angled wooden boards attached to the sides of ploughs, which turn the soil (sod) over as the plough moves along. They are considered a requirement by some for a machine to be considered a true plough (Rees, 1979, p. 6), but their existence in the Roman period has not been firmly established. Arrow-like wooden ground wrests are shown on Roman bronze models, and possibly described by classical writers (Manning, 1964b, pp. 56–7; Rees, 1979, pp. 62–3, 66). These may have served to push the soil away as the plough moved, perhaps to cover broadcast seeds, break clods or cut drainage channels (Manning, 1964b, p. 56; Rees, 1979, pp. 62, 66), and may also have functioned as rudimentary mouldboards if the plough was held at an angle (Manning, 1964b, p. 64). The adoption of true mouldboards has been inferred from the existence of asymmetrical plough shares in the Late Roman period (Manning, 1964b, p. 65). No models or depictions of wheeled ploughs are known from the Roman period, although a brief reference in Pliny has been used to suggest that they were sometimes used in some parts of the Empire (Manning, 1964b, p. 65; White, 1967, p. 125).

Defining the 'Roman plough' is therefore an imprecise exercise. The evidence suggests that at various times, and probably concurrently, several different types of plough were in use, including 'the bow ard, the coultered-ard, and the mouldboard plough' (Manning, 1964b, p. 65). How these plough types may have related to the iron plough furniture from London will be discussed below.

Numbers

Three ploughshares are discussed here; two from the Museum of London and one from the British Museum. Only one coulter comes from the London collections. However, whilst this object is held by the Museum of London, its provenance is completely unknown, and it may not originally have been found in London.

Typology

Ploughshares

Typologies of Roman ploughshares include those created by Rees (1979, fig. 49) and Hanemann (2014, Abb. 144, 146-7). Manning (1964b, pp. 58–62) also discusses several share forms and how they would be mounted. Rees and Hanemann's typologies are extremely similar, both dividing shares into socketed (**Type 1**) and tanged (**Type 2**) types. Both typologies are adequate to describe the small number of ploughshares from London, all of which are socketed, but Rees' typology will be used here as the London material has already been incorporated into her analysis and discussion.

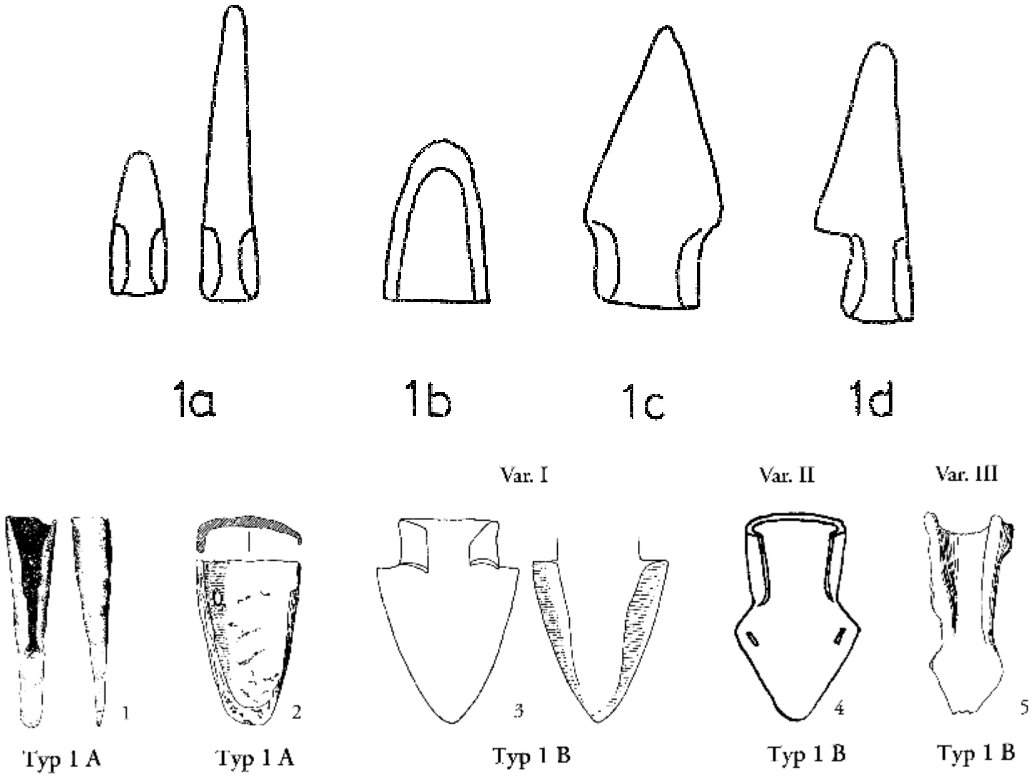


Figure 277 Rees (top) and Hanemann's (bottom) typologies of socketed ploughshares (Rees 1979, fig. 49; Hanemann 2014, Abb. 144).

Type 1A consists of a short open socket at the end of a tapering blade. Both long and short versions of this type exist. Although it has been suggested that the shorter objects are simply worn, it seems more likely that these objects were manufactured in different lengths (Manning, 1964b, p. 58). Short socketed shares such as this are common in the Iron Age and continue to be used in the Roman period (Rees, 1979, pp. 50–2; Manning, 1985a, p. 43), with Rees identifying 46 examples.

Two objects of this type, PLO01 and PLO02, come from London, although PLO01 was not included in Rees' discussion. PLO1 is of the short type, and is somewhat unusual in that the socket is fully enclosed rather than open on one side. PLO02 is of the long type. Both of these objects come from outside the City of London, and may be Iron Age rather than Roman in date.

This type would probably have been used as a protective tip for a wooden share, rather than as a true share in itself (Rees, 1979, pp. 52–3; Manning, 1985a, p. 43). PLO02 shows wear on only one side. This indicates that the split side of the socket was exposed to wear, whilst the closed side was protected by the (presumably wooden) share beneath. This is somewhat unusual, as you would expect the closed side of the socket to be mounted uppermost.

Type 1C (Hanemann **Type 1B Var.I**) also has an open socket formed by the bending of the sides of a tapering blade, but is considerably larger than Type 1A. Two objects of this type, PLO03 and PLO04, come from London. They are similar in size, although they differ subtly in their construction. PLO04 has simply been folded over at the edges to create an open socket, whilst PLO03 has a more carefully formed shoulder between the blade and socket. This type is considerably larger than other Roman share types. Rather than acting as tips for wooden shares, this type can be considered 'shares in their own right' (Rees, 1979, p. 55), and were thought by Manning (1964b, p. 60) to cover the share beam directly.

Comparable objects are difficult to find in Britain. Manning (1964b, p. 60) and Rees (1979, pp. 55–6) identify only one comparable object, from Frindsbury, although this object has a somewhat different shape, whilst an identical share from Thetford is apparently Anglo-Saxon in date (Manning, 1964b, p. 60; Ottaway, 1995, fig. 7b). A more recently discovered closely comparable example comes from Hill Farm (Manning, 1985b, figs 29, 306). This object was unstratified but associated with Roman pottery. However, a number have been found on the Continent, particularly in Pannonia (Table 84), potentially suggesting that these tools were not made in Britain.

Site	Site Type	Context	Date	Reference
Carnuntum	Military/ Urban	-	100-300	(Pohanka, 1986, Taf. 2, 6)
Côte-d'Or	-	-	-	(Champion, 1916, Pl. VIII, 1478)
Dolln bei Dellach im Gailtal	-	-	-	(Pohanka, 1986, Taf. 5, 13)
Frauenberg bei Leibnitz	Religious	-	100-300	(Pohanka, 1986, Taf. 3, 8)
Gurina bei Dellach im Gaital (x2)	Urban	-	-	(Pohanka, 1986, Taf. 5, 12, Taf. 6, 11)
Lackendorf	-	-	-	(Pohanka, 1986, Taf. 2, 3)
Liffremont	-	-	-	(Champion, 1916, Pl. VIII, 18010)
Rotenturn an der Pinka	-	-	100-400	(Pohanka, 1986, Taf. 1, 2)
Schandorf bei Pinkafeld	-	-	150-200	(Pohanka, 1986, Taf. 1, 1)
Wöllersdorf	-	-	100-300	(Pohanka, 1986, Taf. 3, 7)
Zigöllerkogel bei Voitsberg	-	-	-	(Pohanka, 1986, Taf. 4, 10)
Zugmantel	Military	-	90-260	(Pietsch, 1983, Taf. 23, 529)

Table 84 Comparanda for Type 1C ploughshares.

All of the ploughshares from London are symmetrical. PLO01-03 are worn, and show roughly symmetrical wear, which strongly suggests that they were not used with mouldboards. PLO04 exhibits no wear at all, although the surface is degraded. It is possible that this share had not been used at the time of deposition.

Coulters

As with many agricultural tools, coulters are difficult to produce neat typologies for (Hanemann, 2014, p. 171). Hanemann's (2014, Abb. 156) typology of Roman coulters breaks them down into two principle types; those with short blades and long shafts (**Type 1**) and those with long blades and comparatively short shafts (**Type 2**). Subtypes are then created based on the shape of the blade, with variations on these subtypes being based angle of the back of the blade (Figure 278).

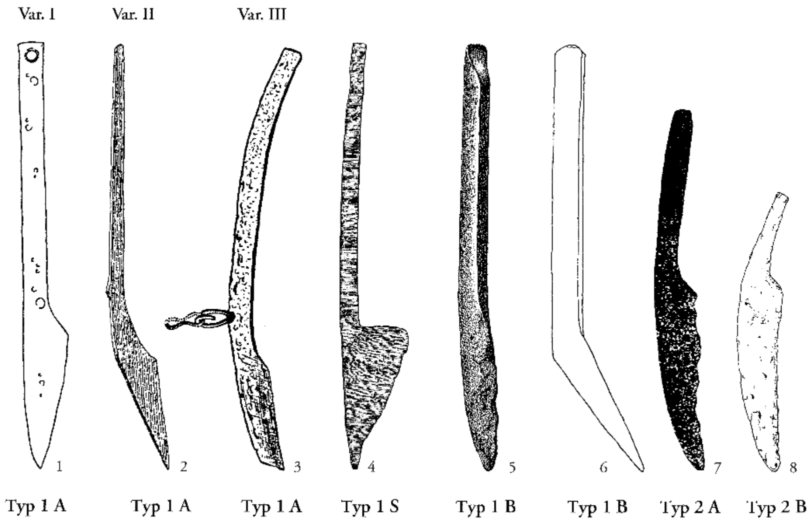


Figure 278 Hanemann's typology of Roman coulters (Hanemann 2014, Abb. 156).

The only coulter from London, PLO05, has a short, wide blade with a rounded back, conforming to Hanemann's Type 1A, Var. I or Type 1S. These closely related types are represented by a large number of examples from Britain (Table 85), and may account for all of the known Roman coulters from Britain. At 3512g, PLO05 is at the smaller end of the 7-16lb (3175-7257g) weight range defined by Manning (1964b, p. 63) for Roman coulters.

Site	Site Type	Context	Date	Reference
Coldham Common	-	Hoard?	300-400?	(Manning, 1985a, F7)
Dorchester on Thames	Urban	Hoard	300-450?	(Manning, 1984b, fig. 32, 29)
Frindsbury	Villa	-	-	(Rees, 1979, fig. 67d)
Great Chesterford (x5)	Urban	Hoard	200-400	(Neville, 1856, Pl. 2, 18)
Great Witcombe	Villa	-	-	(Rees, 1979, fig. 69a; Manning, 1985a, F6)
Sibson	-	Hoard	350-400	(Manning, 1998, fig. 2, 1)
Silchester (x6)	Urban	Hoard	200-400	(Evans, 1894, fig. 6; Payne, 1947, fig. 33-8)
Stanton Low	Villa	-	-	(Rees, 1979, fig. 69b)

Table 85 Comparanda for PLO05.

Although Manning (1964b, pp. 63–4) was sceptical about the evidence for a 'set' in the angle of the blades of the Silchester coulters, PLO05 clearly has a blade which is clearly flat on one side and angled on the other. This would have pushed material to the left as the plough was pulled along. Similar edges are apparently present on the coulters from Cirencester (Rees, 1979, p. 287). This may indicate that these tools were used with a mouldboard, although this is not certain. Billhooks (see p.416), another class of large agricultural tool, also have blades formed in this way, with one side being flat and the other angling down to meet it. Such an edge could be formed by beating the bevel into the hot tool from one side only, and not rotating it in order to produce a symmetrical product. This could indicate that PLO04 is 'set' because this was the preferred method by which blacksmiths added an edge to large agricultural tools. If so, the set of Roman coulters could have come about independent of their use with mouldboards. There is, however, no way of addressing this sequence of events when we have neither dated coulters nor extant mouldboards.

Punches ; Fine Metalworking Punches

Technology

The objects discussed in this section are fine punches used to decorate metalwork through chasing and repoussé (Figure 279). Chasing and repoussé are related techniques used to decorate metalwork through deforming the surface. Tools used in engraving, where metal is cut away from the surface, are discussed elsewhere (see p.479). In chasing, metal is placed on a hard surface and tools are hammered into the front surface, displacing material and creating depressions (Fell, 1990, pp. 154–6). In repoussé, metal is placed on a yielding surface and tools are hammered into the back of it, producing raised decoration on the other side (Fell, 1990, p. 152). Chasing was the more common technique in the Roman period (Ogden, 1992, p. 53), although chased objects are often incorrectly described as embossed (Bennett, 1985, p. 112). The two techniques were often used in combination, with repoussé decoration being refined with chasing (Fell, 1990, pp. 152–3).

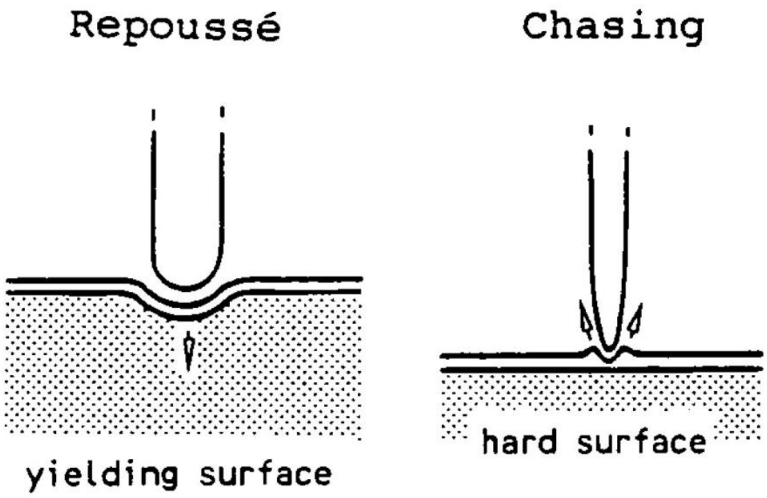


Figure 279 Diagram illustrating the difference between repoussé and chasing (Fell 1990, fig. 3:7).

Several different types of punches are used in chasing and repoussé. The most basic are liners or tracers; chisel-edged tools used to make and refine linear decoration. Wider tracers are suited for use in creating straight lines, whilst narrower ones can be used for more complex decoration. Many of the London tools have slightly rounded tips. Whilst this may be partially due to the effects of corrosion, rounded edges are also a feature of modern embossing and chasing tools, which are intentionally blunted to reduce the risk of accidentally piercing the metal.

Pointed punches can be used for decorative effect (Fell, 1990, p. 157). Textured tools are used for matting; providing texture to recessed areas of metalwork, sharpening the raised areas.

Similar tools are also used in leatherwork for the same purpose, although Manning (1985a, p. 11) was sceptical about the use of Roman examples on leather. Tools with flat tips are used for planishing; flattening areas to sharpen the design and harden the surface, although flat-headed punches are also used by carpenters to drive the heads of nails flush with the surface.

Numbers

Twenty-three objects were identified as potential fine metalworking punches. Thirteen come from the Museum of London, four from the British Museum, four from recent excavations by MOLA, and two from the LAARC.

Typology

No previous typology of fine metalworking punches exists, but the objects from London can be divided into four cohesive types based on the form of the shafts (Figure 280).

Figure 280 Fine metalworking punch types (Type 1.1, FIN02; Type 1.2, FIN10; Type 2, FIN14; Type 3, FIN17; Type 4, FIN21).

Type 1 has a flared striking head atop a narrow octagonal-sectioned shaft, which swells in the centre before tapering to the tip. Type 1 shows considerable diversity of function, with examples of tracers, points, planishing tools and matting tools all sharing the same shaft type. This type is by far the most common in London, with twelve examples (FIN01-12). Although the differences are subtle, it is possible to distinguish two subtypes.

Type 1.1 has a truly octagonal-sectioned shaft, which simply swells in the centre. This is the more common subtype, with ten examples from London (FIN01-10).

Type 1.2 has a square- or rectangular-sectioned shaft with bevelled edges. The difference between these subtypes is most obvious when looking at the swollen centre. In Type 1.1 examples this is a simple expansion, whilst in Type 1.2 the expansion forms a rectangular-sectioned tab with no edge bevels. This tab may have acted as a finger grip. Type 1.2 is less common, with three examples coming from London (FIN11-13).

A number of comparable objects can be found in Britain and Europe (Table 86), although the illustrations are not detailed enough to separate these into subtypes. The Barbury Castle find may indicate the use of tools of this type in the Late Iron Age, although the circumstances of the excavation of this material are not recorded.

Site	Site Type	Context	Date	Reference
Barbury Castle	Hillfort	Unstratified	Late Iron Age?	(Darbyshire, 1995, fig. 35, F33)
Catterick	Urban	-	170-220	(Mould, 2002a, fig. 288, 10)
Vindolanda	Military	-	97-105	(Blake, 1999, No. 4282)
Avenches	Urban	-	-	(Duvauchelle, 1990, No. 113)
Saalburg (x5)	Military	-	85-260	(Pietsch, 1983, Taf. 11, 208)

Table 86 Comparanda for Type 1 fine metalworking punches.

Another object, FIN23, does not have the swelling shaft of a Type 1, but is otherwise similar in terms of dimensions.

Type 2 has a rectangular-sectioned stem, burred at the butt, often with bowed, convex sides, coming to a chisel-like tip. Four objects of this type, FIN14-17, come from London. FIN14 stands out in this group for having a flaring blade, whilst the others are parallel-sided. FIN16 is also unusual as it is made of copper alloy rather than iron. All of these objects would have been suitable for use as tracers. Similar simple chisel-like tools come from Gorhambury (Wardle, 1990, figs 131, 394, 396).

The remaining two types can only be tentatively identified as fine metalworking punches.

Type 3 is an odd collection of objects, the only shared features of which are a narrow, burred stem, which steps out to a wide blade with a narrow chisel edge. Some of these objects could be bradawls, but the burring to their butts suggests that they were used as punches, and their narrow tips may have made them useable as small tracers. Three objects of this type, FIN18-20, come from London. Similar objects come from Caister-on-Sea (Mould, 1993, figs 91, 597) and Gorhambury (Wardle, 1990, figs 131, 395).

Type 4 tools resemble modern nails, having a round expanded head atop a round-sectioned shaft. Two objects of this type, FIN21 and FIN22, come from London, representing both tracers and points. A similar object comes from Avenches (Duvauchelle, 1990, No. 15).

A further object from London in the British Museum (BM 1863.12-23.11) was identified by Manning (1985a, p. 11, A33) as a tracer. Two further objects of the same type (MOL 16385-6) were found at the Bank of England. These objects have the shared features of a square- or rectangular-sectioned shaft, tapering continually to a chisel-like tip. However, as none of these objects have burred heads it seems unlikely that they were used as tracers. It is possible that they are simply the stems of nails with detached heads.

Punches ; Hole Punches

> *'Genteel punch… being an emblem of safety, for by the help thereof both Sandals and Shoes are made secure on the feet, by which means we may Go, Run, or Lead without Jeapardy.'* (Randle Home, 1688, in Salaman, 1986, fig. 164).

Technology

The punches discussed here are those used to cut holes, primarily in leather. Modern leather hole punches have fully enclosed blades (Salaman, 1986, pp. 164–5, 266–8), and can be used to produce a round leather disc, or more often to produce a hole. Hole punches are today used to make lace holes, belt notches and rivet holes, but in the Roman period they were also used for decorative effect. Many of the elaborately decorated openwork *carbatinae* in the Museum of London will have been produced with small hole punches.

Roman leatherworkers also used hole punches with 2/3 circle gouge-like tips. Leather objects such as the Roman 'bikini' trunks from Queen Street (Wilmott, 1982, fig. 35) exhibit C-shaped cuts used as lace holes. For this reason there is uncertainty about which tools to interpret as gouges, and which as hole punches (see p.492). Tools with 2/3 circle tips could also be used to produce complete holes by re-punching from different angles, or finishing with a knife, but this process is time consuming and difficult, especially when punching precisely-positioned or very small holes.

Numbers

For objects are discussed in this section, three from the Museum of London and one from the LAARC.

Typology

Typologies of hole punches are provided by both Tisserand (2001, pp. 30–1) and Duvauchelle (1990, pp. 37–8). Both essentially catalogue the same types, but Tisserand's will be used here.

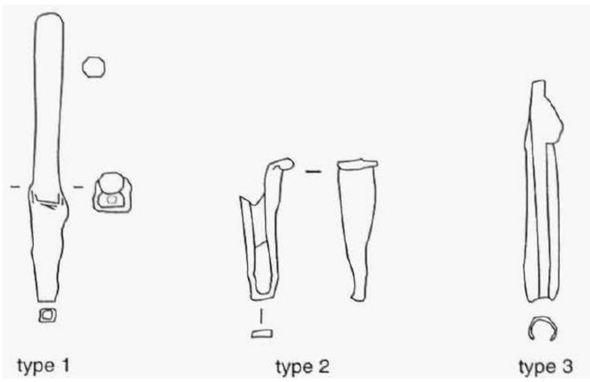


Figure 281 Tisserand's typology of hole punches (Tisserand 2001, fig.20).

Type 1 hole punches have a long, burred stem, flattened out at one end and bent into a cone-shaped head, the opening of which determines the shape of the hole created. Three objects of this type, HOL01-03, come from

London. HOLE01 and HOL02 are both very similar in form, with a slender stem and wide punching head. HOL03 differs, having a much more robust stem and paradoxically narrow tip, although its shape is obscured by corrosion. All appear to have come to round or oval tips, although this is not certain in any case.

This type is known from a number of Roman period sites, with examples from Hod Hill and Ingleby Barwick spanning a wide date range (Table 87). The majority of these tools are fully enclosed and would have punched complete circles, with the leather washers being ejected from the wider hole at the top of the head. Objects with the same form from Ingleby Barwick and Shakenoak Farm are open on one side, and will have made C-shaped cuts.

Site	Site Type	Context	Date	Reference
Dorchester	Urban	-	-	(Manning, 2014a, fig. 143, 66)
Dorchester (x2)	Urban	-	-	(Manning, 2014a, fig. 143, 67-8)
Hod Hill	Military	-	43-51	(Manning, 1985a, E34)
Ingleby Barwick	Villa	Hoard	Late Roman?	(Hunter, 2013, fig. 4.25, c)
Shakenoak Farm	Villa	Black deposit	-	(Brodribb, Hands and Walker, 2005, fig. IV.58, 407)
Shakenoak Farm	Villa	-	-	(Brodribb, Hands and Walker, 2005, fig. I.34, 26)
Conimbriga (x2)	Urban	-	-	(Alarcão *et al.*, 1979, Pl.III, 29-30)
Vertault (x2)	Urban	-	-	(Tisserand, 2010, Pl.2, 24-5)

Table 87 Comparanda for Type 1 hole punches.

Type 2 hole punches consist only of a tubular head, with signs of burring at one end. No objects of this type come from London.

Type 3 hole punches are gouge-like tools, consisting of an iron stem, burred at one end, split for most of its length, with a 2/3 circle or greater cutting edge at the other. There is considerable confusion about the functions of these tools, with Pietsch (1983, p. 30) interpreting them as woodworking gouges and Manning (1985a, pp. 31, 42) and Duvauchelle (1990, pp. 37–8) considering some them hole punches. Ten objects with half-circle sections are discussed elsewhere as gouges (see p.492), although it is not impossible that some or all of these objects were in fact leatherworking hole punches. Only one gouge-like tool from London, HOL04, clearly has a 3/4 circle section at the tip, and must therefore be seen as a hole punch. This object does not fit into the typology of solid-handled gouges proposed in the gouges section, and I know of no close parallels.

Punches ; Hot Punches and Drifts

Technology

This section discusses pointed tools used for producing holes in hot metal. These objects can be divided into two groups; punches and drifts. Punches are used to make holes in hot metal. They are held in place either in the hand, in which case they require a long handle, or in tongs or a wire or wooden grip, in which case they can be shorter (Figure 282), and struck with a heavy hammer. They need a tapered point, the shape of which will dictate the shape of the hole being produced. Drifts are used to expand holes which have already been created with a standard hot punch. Their characteristic feature is that they are widest in the centre, allowing them to be driven all the way through the piece of metal being worked on (Manning, 1985a, pp. 9–10; Fell, 1990, p. 143). Tools for decorating the surface of cold metal are discussed in the fine punches section (see p.541). Chisel-edged metalworking tools are discussed in the sections on hot-cutting tools (see p.441) and cold chisels (see p.438). Tools for cutting discs out of metal and leather are discussed in the hole punches section (see p.545).

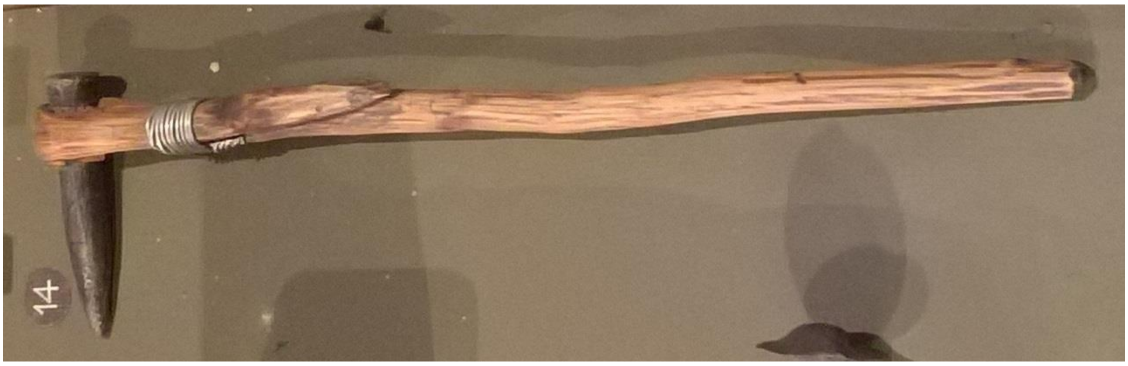


Figure 282 Metalworking punch in a wooden handle (Estonian Maritime Museum).

Numbers

Twenty-six objects are discussed in this section. Seventeen come from the Museum of London, although one of these, PUN21, could not be located, and was recorded from a published image (Shepherd, 1998, fig. 159, 42). Six objects come from recent excavations by MOLA, and one each from the LAARC, PCA and Wessex Archaeology. Two further objects from the Museum of London and one from the LAARC could not be located. Fourteen further Roman punches of various types are identified in the Drapers' Gardens finds assessment (Hawkins, 2009a), some of which are illustrated in the site's popular book (Pre-Construct Archaeology, 2009, p. 32), but these are not discussed here.

Typology

Punches can be divided into three groups; round punches, square punches, and drifts.

Round Punches

Eight punches from London, PUN01-08, have round-sectioned tips. Beyond this, no two are exactly alike, although two indistinct groups can be separated out. PUN01-03 have the shared features of a burred head on an octagonal-sectioned shaft, which then becomes round in section and tapers to a point. PUN04-08 are continually tapering round- or oval-sectioned bars, with flat, burred butts. These types are difficult to separate and easily rendered identical due to corrosion or wear, and as such are difficult to find comparanda for. Since they would have had the same function they are not split into separate types in this catalogue.

Site	Site Type	Context	Date	Reference
Carmarthen	Military/Urban	Workshop	225-75	(Scott, 2003, fig. 8.8, 6)
Chichester	Military/Urban	-	-	(Down, 1978, fig. 10.42, 166)
Chilgrove	Villa	Hillwash		(Down, 1979, fig. 47, 13)
Great Witcombe	Villa	-	-	(Bevan, 1998, fig. 39, 16)
Keston	Villa	Unstratified	-	(Philp *et al.*, 1991, fig. 50, 83)
Usk	Military	Unstratified	-	(Manning, Price and Webster, 1995, fig. 75, 5)
Usk	Military	Road	Late Roman	(Manning, Price and Webster, 1995, fig. 75, 6)
Usk	Military	Cess pit	75-100	(Manning, Price and Webster, 1995, fig. 75, 10)
Usk	Military	-	100-300	(Manning, Price and Webster, 1995, fig. 75, 11)
Vindolanda	Military	-	120-40	(Blake, 1999, No. 4486)
Vindolanda	Military	-	160-80	(Blake, 1999, No. 5635)
Aulnay	Military	-	-	(Feugère, Thauré and Vienne, 1992, No. 168)
Hofheim (x3)	Military	-	-	(Ritterling, 1913, Taf. XX, 6, 7, 30)
Les Bordes	-	-	-	(Roux, 2013, Pl. 53, 1110)
Niederbieber	Military	-	-	(Gaitzsch, 1980, Taf. 45, 220)

Table 88 Comparanda for round punches.

Square Punches

Square- and rectangular-tipped punches show a similar level of diversity to round punches, and can also be divided into two groups along similar lines.

Type 1 has a round- or octagonal-sectioned body tapering to a square- or rectangular-sectioned tip. Five objects of this form, PUN09-13, come from London. Another object, COL01, has a chisel-like tip, and has been interpreted as a cold chisel (see p.438), although it could be a rectangular-sectioned punch. A further object conforming broadly to this type, MAS01, is unusual in having a truncated cone head rather than a flat burred butt. Whilst this could have functioned as a metalworking punch, it has instead been interpreted as a mason's point chisel (see p.444).

PUN11 and PUN12 are unusual in that they have kinked shafts. An Iron Age punch from Fison Way, Norfolk, is also kinked, possibly for ergonomic reasons (Fell, 1990, figs A21, 178). PUN12 may not be a punch, and Manning (1995, figs 76, 21) identifies a similar object from Usk as a small lever or jemmy.

Site	Site Type	Context	Date	Reference
Ribchester (x2)	Military	-	-	(Howard-Davis and Whitworth, 2000, fig. 73, 139-40)
Saalburg	Military	-	85-260	(Pietsch, 1983, Taf. 12, 261)
Zugmantel (x3)	Military	-	90-260	(Pietsch, 1983, Taf. 12, 261a-c)

Table 89 Comparanda for Type 1 square punches.

Type 2 objects are simple tapering square- or rectangular-sectioned spikes. Eight objects, PUN14-21, are of this form. None has obvious burring to the butt, and many are fragments. Their identification as punches is therefore uncertain, and some may be fragments from large nails.

Site	Site Type	Context	Date	Reference
Carmarthen	Military/Urban	Floor	275-350	(Scott, 2003, fig. 8.8, 5)
Gadebridge Park	Villa	Building	-	(Manning, 1974, fig. 77, 609)
Gadebridge Park	Villa	Floor	-	(Manning, 1974, fig. 77, 628)
Ingleby Barwick	Villa	-	-	(Hunter, 2013, fig. 4.17d)
Shakenoak Farm	Villa	-	-	(Brodribb, Hands and Walker, 2005, fig. V.43, 527)
Verulamium	Urban	Workshop	150-60	(Manning, 1972b, fig. 60, 5)

Table 90 Comparanda for Type 2 square punches.

PUN22 differs from all of the above objects in that it has a tapering square-sectioned body, separated from the short round-sectioned shaft by a sharp shoulder. It is possible that this tool is related to a group of small chisel-edged punches which also have narrow shafts and wide bodies (see p.542), and a similar tool comes from Zugmantel (Pietsch, 1983, Taf. 13, 318). However, it also strongly resembles the tang of a Type C drill bit (see p.425). It is therefore possible that PUN22 is a punch made from a broken drill bit.

Drifts

Four objects identifiable as drifts, PUN23-26, come from London. All of them are small and share the same basic form of two tapering sides, one square-sectioned, the other octagonal-sectioned. PUN26 deviates from this in that one side is round-sectioned rather than square-sectioned.

PUN23 and PUN24 are both burred at the octagonal-sectioned end, indicating that the square-sectioned side is the punching tip. PUN25 and PUN26 are rounded at the octagonal-sectioned end. This may simply be because they were not as well used as PUN23 and PUN24 before they were disposed of. An example from Wilcote has signs of hammering to what is an otherwise rounded tip, as does PUN26. However, these objects are also very similar to tanged rake/harrow tines (see p.552), and as such they may not be drifts. Several very similar examples come from Saalburg and Zugmantel (Pietsch, 1983, Taf. 13, 301, 301a-e), and the Carlingwark Loch hoard (Piggott, 1952, figs 10, C66).

Rake and Harrow Tines

Technology

Rake tines are iron teeth which would have been inserted into a wooden head to form a rake. They consist of a blade, which must be wider than hole in the wooden head through which the tang passes, and a tang, which is bent or clenched around the other side of the wooden head. At least five wooden rake heads survive to us (Pietsch, 1983, p. 72), with a sixth having recently been found at Drapers' Gardens (Hawkins, 2009a, p. 273). Another well preserved example from Britain comes from Newstead (Curle, 1911, Pl. LXI, 7).

Figure 283 Rake heads from Drapers' Gardens (left, http://www.pre-construct.com/Publications/Drapers.htm) and Newstead (right, Curle, 1911, Pl. LXI, 7).

Although all-wooden rakes are likely to have existed in prehistory, iron rake tines are only found in Britain after the Roman conquest (Rees, 1979, pp. 484–5). They are found on both military and civilian settlements, including in large numbers from the Limes forts (Pietsch, 1983, p. 72), but in Britain are limited to sites which show 'a strong Roman influence' (Rees, 1979, p. 484).

Rakes are tools with highly generalised functions. The most obvious use is sweeping up leaves or stalks. In this guise they could be associated with tasks as varied as gathering hay at harvest time, moving straw for animal feed and bedding, gathering thatch, or simply clearing paths (Rees, 1979, p. 485). However, the introduction of iron teeth may suggest their involvement in heavier tasks. Pietsch (1983, p. 72) suggests that iron-tined rakes are too strong to have been used as rakes, and instead may have been cultivation tools, used to break apart earth in a similar way to the two-tined bidens (see p.510). Duvauchelle (1990, p. 45) considered this unlikely, arguing that heavy striking would quickly render them loose in the wooden head, and instead suggesting that they could be for raking out heavier materials, such as gravel. In this way, they could be considered construction tools.

It has also been suggested that these teeth could have been mounted and used as harrows rather than rakes (Rees, 1979, p. 318; Duvauchelle, 1990, p. 45; Deforce and Annaert, 2007, p. 88). Harrows are multi-tined tools which are dragged over fields behind draught animals, to break up the surface of the soil to a finer consistency. This can be done to create seed beds, remove weeds, or cover planted seeds. All known Roman-period harrows are made entirely of wood, and most come from outside the Roman Empire (Deforce and Annaert, 2007). Rees (1979, p. 318) has suggested that the sixteen tines found together in London may have formed a harrow. All other preserved rake heads have a uniform six or seven tines (Pietsch, 1983, p. 72). However, since the teeth in this group have slightly shorter, thinner blades than the other rake tines from London, it is not impossible that they were part of a wide-headed rake, similar to a modern garden rake (Figure 284).

Figure 284 A modern garden rake with 18 tines.

Numbers

49 possible rake tines have been catalogued from London. 33 come from the Museum of London, although sixteen of these were found together, and probably relate to a single object. Seven come from recent excavations by MOLA, four from the LAARC, two from the Bank of England Museum, and one each from the British Museum, Pitt Rivers Museum, and PCA. At least seven more rake tines were found by PCA at Drapers' Gardens, where they were preserved with their wooden head (Hawkins, 2009a).

Typology

Pietsch (1983, p. 72) discussed the variability of rake tine form, which Duvauchelle (1990, pp. 45–6) turned into a formal typology based on the shape of the junction between the blade and the tang. However, there is an issue with relating this typology to the London tools. Seventeen of the London rake tines, RAK23-38, came from a single object, but in this scheme they would be split between types 1, 3 and 4. Whilst the majority of the rake tines from London have a tang that is clenched downwards (**Type A**), these tines have tangs on the same plane as the blade, clenched sideways (**Type B**). Only one other rake tine from London, RAK39, has the tang on the same plane as the blade, although this object does not have a clenched end. As such, this typology will also distinguish between these two tang types.

Figure 285 Rake tine types (left; Type 1, RAK07; Type 2, RAK15; Type 3, RAK32; Type 4, RAK20) and tang subtypes (right; Type A, RAK07; Type B, RAK32). Not to scale.

Type 1 has a narrow tang attached to the underside of a rectangular-sectioned blade. This is the most common type from London, represented by twelve Type A objects, RAK01-12, six Type B objects, RAK23-28, and one object of unknown subtype, RAK40.

Type 2 has a rectangular-sectioned tang, separated from the blade by a raised semi-circular or triangular tab on the upper side. The tangs of these objects are always clenched upwards, whilst the blades can vary from round- to rectangular-sectioned. Six objects of this type, RAK13-18, come from London. Another object, MOQ10[5449]<1688>, is similar, although from a medieval context.

This type has never been found preserved in a wooden head (Horvat, 2002, p. 136), and therefore it is not certain that they are rake tines. They are similar to a double-ended hook from the Beadlam villa hoard (Neal, 1996, figs 36, 62), although the Beadlam object is perforated. Horvat (2002, p. 136) has suggested that some may be parts of weapons, on the basis of some straight examples being included in a hoard of (mainly) Republican militaria. However, the fact that all of the London finds are all clenched in the manner of the other rake tine indicates that they are indeed rake tines.

Type 3 has no clear step between the blade and the tang. Instead, the tang simply expands to join the blade. One Type A object, RAK19, and seven Type B objects, RAK29-35, come from London.

Type 4 objects have a tang joined to the centre of the blade. Three Type A objects, RAK20-22, and four Type B objects, RAK36-9, come from London.

In addition to these objects, there are several rake tines from London that do not fit Duvauchelle's scheme. RAK41 is unusual in every respect, having a round-sectioned blade similar to that of a Type 2, and a tang clenched to the side in the manner of a Type B. RAK42 could be categorised as a Type 1 rake tine, but is unique in having a round-sectioned tang bent into a neat loop. RAK43 and RAK44 survive only as blades, and therefore cannot be categorised further.

Another group of objects may also be rake tines. Pohanka (1986, Taf. 22, 91) figures a sketch of a group of double-ended spikes embedded in a poorly-preserved wooden block, which he interprets as a rake. However, these may in fact be iron harrow teeth, as similar, better preserved objects have been found made entirely of wood (Deforce and Annaert, 2007). Five objects from London, RAK45-49, have the shared form of a tapering square-sectioned tang, and a worn, rounded head at the other end. These may be rake tines or harrow teeth of this sort, although they are also very similar to objects identified elsewhere as drifts (see p.549), whilst Manning (1985a, fig. 9) identified similar objects as Type 3B awls.

Saws

Saws are serrated cutting tools, consisting of a flat strip of metal, with teeth cut into one or both sides. Other serrated objects are discussed as curry combs (see p.470) and scrapers (see p.566). Saws can be broken down on two closely related grounds; their overall shape, and their intended function.

The simplest type is the **hand saw**, which consists of a tapering serrated blade with a handle at one end. Well-preserved Iron Age and Roman examples (Figure 286) have crooked handles held in place with rivets (Gray, 1917, Pl. LX, 53). Very small hand saws with thin, tapering blades, known as compass or **keyhole saws**, are used to cut internal curves, such as holes in the centre of a piece of wood (Salaman, 1975, pp. 412, 424–5). These tools have very little set and around ten teeth/inch (Salaman, 1975, p. 412).

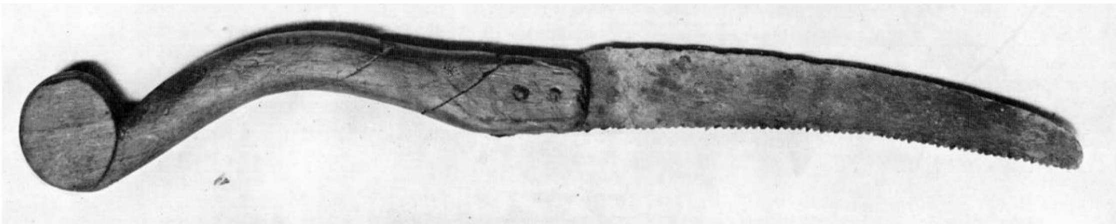


Figure 286 Iron Age hand saw from Glastonbury Lake Village (Gray, 1917, Pl. LX, 53).

In order to operate efficiently, saw blades need to be thin, which makes them flexible. This creates issues as saws get larger, as they are prone to flex and break. There are several ways of keeping these blades taut when in use, and it is on these lines that saws are typically divided.

Backed saws closely resemble hand saws, as they also have an unframed blade with handle at one end. These are kept rigid by a reinforcing strip along the back edge (Salaman, 1975, p. 407). Today these are folded-over strips of iron or brass, bur ancient examples have riveted reinforcements along the back edge (Goodman, 1964, fig. 120).

Figure 287 A modern backed saw (http://www.highlandwoodworking.com/lie-nielsen-tapered-saws.aspx).

Saw blades can also be kept rigid by holding them under tension in a wooden frame. There are several ways in which this can be achieved. **Framed saws** keep the blade in a rectangular frame, with tension maintained by screws or wedges (Salaman, 1975, p. 419). Large versions of this saw are often called **pit saws**, and may require two people to operate. A framed saw of this type is depicted in use on a fresco from Pompeii (Ulrich, 2007, fig. 3.33).

Figure 288 A modern framed pit saw (left, Salaman 1975, fig. 632f), and detail of a fresco from Herculaneum, now in the Naples Museum, showing a pit saw in use (https://uk.pinterest.com/pin/548102217128203001/).

Bow saws hold the saw blade between the ends of wooden side pieces (cheeks) separated by a wooden stretcher. These are held tight by a tensioning cord running along the other side, which is kept taut with a toggle-stick (Salaman, 1975, p. 419). Recently, two wooden bow saw frames were found in a Roman shipwreck at Der Meern, the Netherlands (Jansma and Morel, 2007 Afb. 8.58-9), and an antler example in a hoard from Bourbousson à Crest (Feugère and Gilles, 2017, fig. 4, 17). Saws of these types can also be seen in Roman sculpture, although the toggle-stick is not always shown, possibly indicating the use of wetted string to keep the blade under tension (Goodman, 1964, pp. 121–2; Feugère and Gilles, 2017, pp. 237–8).

Figure 289 Bow saws from Der Meern (left, (Jansma & Morel, 2007 Afb. 8.58-9), and a bow saw depicted on an altar to Minerva, Museo Capitolini, Rome (Hanemann 2014, Abb. 307).

An alternative form of bow saw holds the blade in a single arched piece of metal (Salaman, 1975, p. 410). Roman examples would have been kept rigid with a bent wooden rod (image).

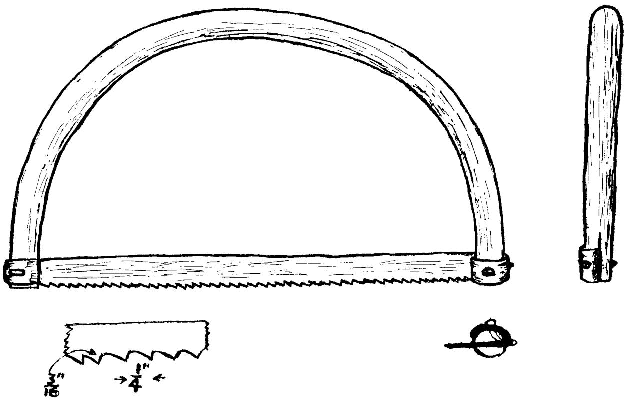


Figure 290 Bow saw with bent wooden frame, Fayoum, Egypt (Goodman 1964, fig. 125).

Modern **hack saws** are handled, with removable blades held in bow-shaped metal frames. Roman saws have also been found with blades kept taut by metal bows, although these objects have fixed blades (Hanemann, 2014, Abb. 311, 1). Large **two-man crosscut saws** have wide unframed blades with handles at either end. These are used for felling and cutting logs, and can be seen in Roman sculpture.

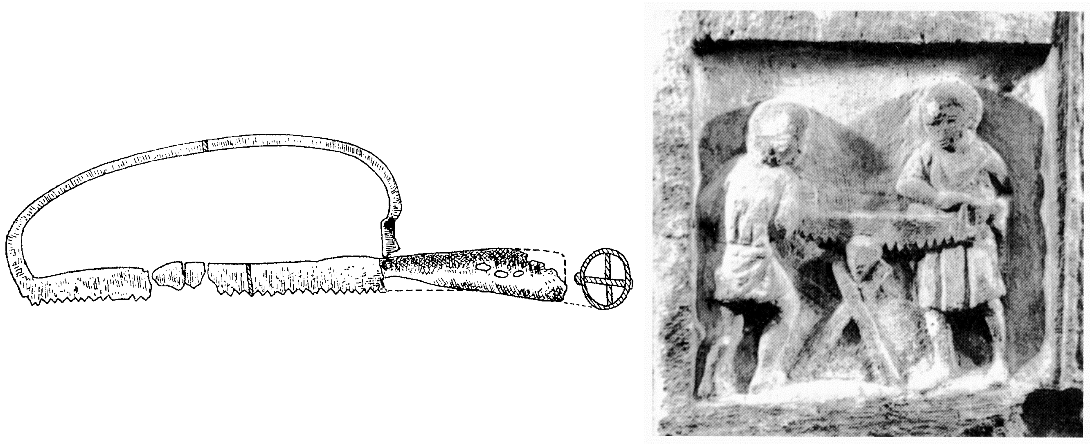


Figure 291 Roman hack saw from Grădiştea Muncelului (left, Hanemann 2014 Abb. 311, 1), and a two-man cross-cut saw depicted on a relief from Metz (Hanemann 2014, Abb. 309).

In order to prevent the blade from becoming snagged, the saw needs to create a cut (kerf) that is wider than the saw itself (Goodman, 1964, p. 116). This can be achieved by opening up the cut itself, for example by hammering wedges behind the saw, or by modifying the teeth; either by making them thicker than the back of the blade (Salaman, 1975, p. 405), or bending them outwards in alternate directions (Jones and Simons, 1961, p. 18). Saws with teeth bent outwards in this way are described as 'set'. This is sometimes described as a Roman innovation (Jones and Simons, 1961, p. 18; Goodman, 1964, p. 116; Salaman, 1975, p. 437) but can be seen on Iron Age saws (Darbyshire, 1995, p. 431). Teeth can be symmetrical or raked (slanted at an angle).

Modern saws are sold based on the number of teeth per inch, with more teeth giving a finer cut. Modern saws can be distinguished between cross-cut saws (for cutting across the grain) and rip saws (for cutting along the grain). Some (Jones and Simons, 1961, p. 18) make this distinction based on whether the teeth are raked or not. Salaman (1975, pp. 405–6, fig. 592) makes this distinction based on the angle at which the teeth are sharpened. However, even in London none of the saws are sufficiently well-preserved for this subtle distinction to be visible. As such, the terms 'cross-cut' and 'rip-saw' will not be used here.

Numbers

23 saws were recorded. Over half (12) come from the Museum of London, with one each coming from the British Museum and Bank of England Museum. Two come from the LAARC, with a large group (7) coming from recent excavations by MOLA. An additional saw from the Museum of London (MOL 29607) could not be located, whilst a combined saw/spoon is probably surgical in function, and is not discussed here (Jackson, 2008, p. 4.4.2, 5). A final saw illustrated as a Roman tool by Wheeler (1930, Pl. XXXVI) is catalogued in the Museum of London as a medieval object (MOL A27343).

Typology

Five types of saw are immediately distinguishable amongst the assemblage from Roman London. The most common are fragments of single-sided saw blades. There are much smaller quantities of double-sided saws and serrated knives.

Single-Sided Saw Blade Fragments

Single-sided saw blades are by far the most common type, with 12 examples coming from London, all of which are only fragments of larger saw blades. Most authors (Duvauchelle, 1990, fig. 7; Hanemann, 2014, Abb. 311) follow Gaitzsch (1980, Abb. 34) in dividing saws by the manner in which they are mounted in a handle or frame (above). However, it is extremely difficult to tell what sort of saw a blade belongs to, especially if it survives only as a small fragment (Pietsch, 1983, p. 48). As such, the discussion in this section will focus on the minute differences that can allow us to make positive identifications of the saws from London (Table 91).

Number	Type	Parallel/tapering	Teeth/25mm	Raked?	Set?
SAW01	Body	Parallel-sided	5	Y	N
SAW02	Tip	Tapering	12	N	N
SAW03	Terminal?	Tapering	7	Y	Y
SAW04	Body	-	2	Y	N
SAW05	Body	-	5	N	N
SAW06	Body	Tapering	5	Y	Y
SAW07	Body	Parallel-sided	5	Y	-
SAW08	Body	Parallel-sided	10	Y	N
SAW09	Body	Tapering?	7	Y	Y
SAW10	Terminal	-	10	N	N
SAW11	Terminal	-	6	N	n
SAW12	Body	Tapering	10	Y	n

Table 91 Breakdown of the characteristics of the single-sided saws from London.

Blade Shape

From Table 91 we can see that it is possible to tell whether eight saws were tapering or parallel-sided. This gives an indication of the shape of the blade, and therefore potentially the way in which it was mounted. Tapering saw blades are likely to have been mounted in handles, whilst parallel-sided blades are thought to belong to bow- or frame-saws (Manning 1972, 166). However, this is not certain. Salaman (1975, fig. 632, f) figures modern frame saws with tapering blades, whilst framed saws on Roman sculpture (Gaitzsch, 1980, Taf. 65, 308) and from the Neupotz hoard (Künzl, 1993, Taf. 598) sometimes swell in the centre. Parallel-sided blade fragments could also be from the central parallel-sided sections of hand saws.

SAW02 tapers almost to a point. It must therefore have been mounted as a hand saw. The current reconstructed handle is highly inaccurate, however. The rivets for the handle mounts do not survive, so we cannot know how long this blade was originally. SAW03, SAW06 and SAW12 also taper noticeably, and are likely to have been handled saws. SAW12 is particularly small, and may have been from a tool similar to a modern keyhole saw (Salaman, 1975, fig. 625). SAW09 tapers very slightly, but it is unclear if this indicates that it is a tapering hand saw blade, or if this is simply a variation in the width of a handmade object.

Rivet Holes

Another indication of whether or not a blade was handled is the position of rivets. The two rivet holes on SAW03 may indicate the position of a handle at the wider end of the blade. However, as the teeth run beyond these rivets, towards the broken end, this may be a later modification or repair, and not the original position of the handle. A double-sided saw from Newstead has been repaired in the same way (Curle, 1911, Pl. LXVIII, 6). SAW10 has two holes at the terminal, which may indicate that it is also part of a hand saw. However, as the holes are different sizes, they could represent repairs to a frame saw. SAW11 appears to have a tapering blade, although this is unclear due to the small amount surviving. Although no perforations survive, the wide blank area resembles the riveted tang of the double-sided SAW13, indicating that this may also be a hand saw. SAW01 is pierced by a single hole, and may therefore have been mounted in a frame. However, as there are teeth on both sides of this hole, this could also be regarded as a repair.

Tooth Shape

Manning (1985a, p. 21) has suggested that saws with raked teeth are likely to have had handles, whilst saws with symmetrical teeth would have been kept under tension in frames. This is because frame saws could be operated with either a push or pull stroke, whilst hand saws are restricted to one, normally the pull stroke. However, we can see that all of the parallel-sided blade fragments from London, which may be from frame saws, have raked teeth. Complete frame saw blades from Neupotz also have raked teeth (Künzl, 1993, Taf. 598). From this it is clear that tooth shape is not an accurate indication of how a blade fragment was mounted.

Of the four saws with obviously tapering blades, three have raked teeth. SAW03 and SAW12 would cut on the pull stroke, but SAW06 would cut on the push stroke. If SAW09 is seen as tapering, it would also cut on the push stroke. Other raked hand saws, from Shepton Mallet (Moscrop, 2001, figs 70, 4), Vindolanda (Blake, 1999, No. 5112) and Aquileia (Gaitzsch, 1980, Taf. 41, 194) would also have been used with a push stroke. The most obvious hand saw,

SAW02, has symmetrical teeth, and could therefore have been used with a push or pull stroke. These saws provide direct contradiction to suggestions that Roman saws were not capable of being used with a push stroke (Jones and Simons, 1961, p. 19), although it is not impossible that some of these fragments represent the tapering ends of bellied frame saws.

SAW03, SAW06, and SAW09, all possible handsaws, are set. Both SAW06 and SAW09 appear to have been push saws, and the teeth may have needed to be set to prevent the blade buckling in use. Only one Roman saw, SAW01, has teeth which are measurably thicker than the back of the blade. The remaining saw blades appear to have no features to ensure that the kerf is wider than the blade itself.

The teeth of SAW05 are particularly interesting, as they are extremely jagged and uneven. It is not clear whether this fragment is tapering or parallel-sided, as the line of the teeth is so variable. This saw could have been produced by an amateur craftsman, although the teeth are so uneven that it is hard to see how they could have been cut by someone attempting a straight line of teeth. It is therefore possible that the teeth were deliberately cut unevenly. This saw bears some resemblance to large cross-cut saws used today to cut logs (Salaman, 1975, pp. 414–6). These have very varied and often eccentric-looking tooth patterns, which combine gaps between the teeth with short 'raker' teeth, to provide gaps for sawdust to gather in before being swept out as the saw moves (ibid; Figure 292). This ensures that the saw continues to move freely though a large log. It is possible that SAW05 was used in this way, although the teeth are very small compared to those on modern saws used for this purpose. Teeth which closely match those of modern cross-cut saws are unknown in the Roman world (Gaitzsch, 1980, p. 200), and appear to be a 15th century innovation (Salaman, 1975, p. 416).

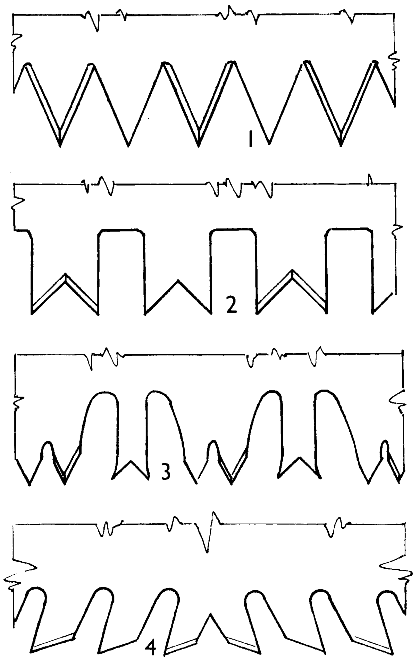


Figure 292 Modern cross-cut saw tooth patterns (Salaman 1975, fig. 611, f).

Tooth Size

Finally, we can look at the size of the teeth of a saw. Figure 293 shows the number of teeth per 25mm of the saw blade fragments from London. The coarsest saw, SAW04, has only two teeth per 25mm. This blade is also comparatively wide, and the teeth survive to a height of 7mm. It would be appropriate to see this as a saw for roughly hewing timbers, comparable to a modern framed pit saw (Salaman, 1975, p. 428).

Five saws have four or five teeth per 25mm. Slightly finer are a pair of saws, SAW09 and the jagged possible cross-cut SAW05, with seven teeth per 25mm. All but one of the saws in this group has raked teeth, and this group includes all of the saws with set teeth, indicating that these saws were for rougher cutting tasks than the finer saws from London.

Three saws, SAW08, SAW10 and SAW12 have 10 teeth per 25mm. SAW10 and SAW12 are likely to have been hand saws. SAW12 is particularly narrow, and may have functioned as a keyhole saw. SAW08 is a parallel-sided fragment, and may have been mounted in a frame. As none of these saws are set, they would have produced fine cuts, making them suitable for very delicate work, such as comb-making or fine carpentry.

The finest saw is SAW02, with 11 teeth per 25mm. This saw is the only unmistakable hand-saw fragment in the collection. Its slender form and fine, un-set teeth would make it suitable for delicate work, although Rees (1979, p. 473) also suggests that it could have functioned as a pruning saw.

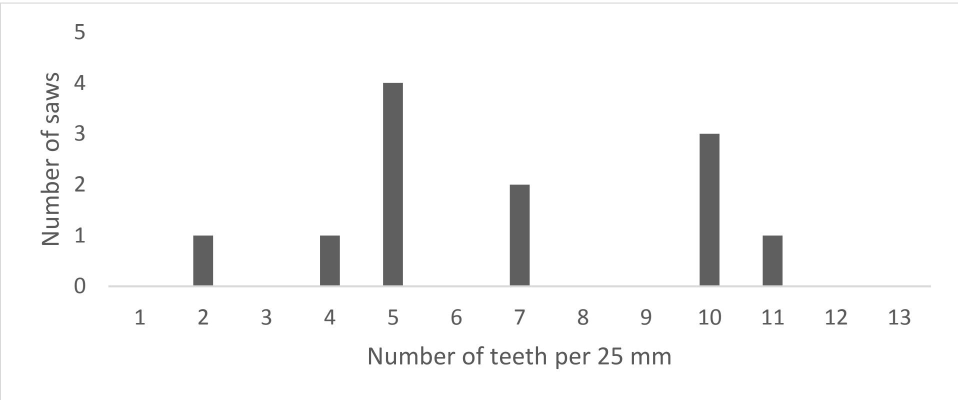


Figure 293 Graph showing the average number of teeth/25mm for single-sided saw blade fragments from London

Double-Sided Saw Blade Fragments

Three saw blades (SAW13-15) appear to have teeth on both sides of the blade. In all cases one side is coarser than the other. These saws fit into a small group of double-sided saws known from the Roman period, with other examples coming from Newstead (Curle, 1911, Pl. LXVIII, 6), Avenches (Duvauchelle, 1990, No. 52) and Vertault (Tisserand, 2010, Pl. 4, 53).

Whilst these tools may have had very specific functions, these are difficult to infer from the surviving objects. Historically, double-sided saws have been used for a range of purposes. Salaman (1975, fig. 616, 633, d) illustrates double-sided pruning saws and special saws for cutting floorboards, whilst Tisserand (2001, p. 20) identifies the tool from Vertault with double-sided veneer-cutting saws. Japanese *Ryoba* saws have cross-cut teeth on one edge and ripping teeth on the other.

SAW15 is unusual in being made of copper alloy. It has well-defined, partially raked teeth on one side, and low scallops on the other, but its identification as a saw is uncertain. Gaitzsch (1980, pp. 197–8) suggests that small surgical saws would have been made of bronze, but gives no reason for this. The only comparable objects known to the author are single-sided, serrated strips of copper alloy from Bloomberg Place (BZY10, Marshall and Wardle, forthcoming) and Aldborough (Bishop, 1996, fig. 29, 300). The example from Aldborough was interpreted as a bracelet fragment. Another similar fragment in iron, with scalloped teeth on one side, comes from Vindolanda (Blake, 1999, No. 4567), where it was seen as a small saw. Owing to the small size of this object, the fact that it is not made of iron, and the unusual shape of the scalloped side, it is interpreted here as a decorative strip rather than a fine saw blade.

Serrated Knives / Pruning Saws

One of the key criteria for a good saw is that the toothed blade is wider than the back edge (Salaman, 1975, p. 405). Whilst this is not the case with all Roman saws (above), we can separate out a group of eight small tools (SAW16-23) in which the back of the blade is considerably wider than the toothed cutting edge. Such objects will be described from here on as 'serrated knives' rather than 'saws'.

These objects have the shared features of a handled (or tanged), triangular-sectioned blade, which is serrated on one side only. None have set or raked teeth. Most of the straight-bladed examples (SAW16-8, 22) can be categorised according to Manning's (Manning, 1985a, figs 28-9) knife typology (Table 92). This provides further support to the argument that they should not be considered true saws, as they are in fact serrated versions of known knife types. The curved examples (SAW19-21) cannot be easily accommodated in Manning's typology, although Types 6 and 7 are similarly composed of a curved blade with a looped handle. SAW23 also cannot be easily accommodated in Manning's scheme, as it does not have a complete tip or butt.

Number	Type (Manning 1985)
SAW16	Type 1b
SAW17	Type 8
SAW18	Type 2
SAW19	-
SAW20	-
SAW21	-
SAW22	Type 11a
SAW23	-

Table 92 Concordance between serrated knives and Manning's (1985, fig. 28) knife typology

The function of these tools is not obvious. For Goodman (1964, p. 117), they were not effective woodworking tools. The lack of set, and the fact that these tools become thicker towards the back of the blade, prevents them from being able to efficiently cut objects that are as thick as, or thicker than, the blade is wide. Since they closely resemble recognised knife types, the straight-bladed examples could have had functions such as cutting bread and meat, and need not be seen as related to craft and industry.

Some of the serrated knives from the Museum of London have been interpreted as 'pruning saws' (Goodman, 1964, p. 117; Rees, 1979, p. 473). Like serrated knives, modern pruning saws can have curved or straight blades (Salaman, 1975, fig. 633, e-f). Rees (1979, p. 473) considered their small size and normally un-raked teeth to be advantageous in cutting in small spaces, where both strokes would be needed to cut efficiently. However, Rees is correct in saying that this can be no more than a suggestion. Another way of seeing these objects would be not as pruning saws, but as serrated pruning knives.

The curved serrated knife from the Bank of England Museum (SAW20) was thought to have possibly had a medical function. These tools may have been useful for cutting bone, as the blade would not become snagged cutting around the comparatively thin edges of long bones. However, the inefficient cutting edges of these tools perhaps make this unlikely in surgical situations, where speed is key. Modern surgical saws are typically backed saws or hack saws (Salaman, 1975, p. 433). Whilst butchers today use hack saws (Salaman, 1975, p. 411), saws were not part of Roman butchery (Pipe, 2011b, p. 400).

Roux (2013, p. 291) saw the tanged form as analogous to the modern compass or keyhole saws. It is possible that the thin-bladed SAW22 was used this way. However, it seems unlikely that objects of the same form from Kingscote and Wanborough (Table 93) could have been used this way, as they have triangular, wedge-shaped sections. It is therefore perhaps more likely that these tanged examples are serrated knives rather than keyhole saws. SAW23 is somewhat similar to an example from Vertault (Table 93), which in turn resembles a blitz saw. This small saw has a handle at both ends, to enable precision work (Salaman, 1975, p. 409). However, this identification cannot be made with confidence for SAW24, as the blade is not complete.

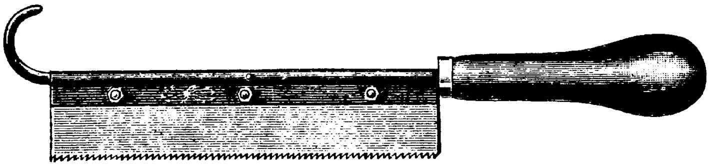


Figure 294 A modern blitz saw (Salaman 1975, fig. 597).

Comparanda are difficult to find, partially due to the fact that when corroded these tools would be indistinguishable from normal knives. Several examples of tanged serrated knives are known (Table 93). Two curved examples come from Vertault (Table 93), although one is considerably wider than the London examples, whilst the other has teeth on the outside of the curve. Another from Vertault may be a more complete example of the type represented by SAW23.

Type	Site	Site Type	Context	Date	Reference
Tanged	Wanborough	Urban	-	-	Isaac 2001, fig.50, 24
	Kingscote	Villa	Quarry	-	Scott 1998, fig.60, 10.4
	Beaune-La-Rolande	Rural?	-	100-300	Roux 2013, Pl.111, 2161
Curved	Vertault (x2)	Urban	-	-	Tisserand 2010, Pl.4, 48-9
Straight	Vertault	Urban	-	-	Tisserand 2010, Pl.4, 47

Table 93 Comparanda for the serrated knives from London.

Scrapers and Ribs

Technology

Scrapers are tools used to smooth and scrape materials of different kinds. The most basic consist of thin, flat sheets of metal, which are used in a huge variety of processes. Scrapers used on hard materials include cabinet scrapers/card scrapers, which are used to clean paint from wood, and to finish the surfaces of hardwoods, acting like fine planes (Salaman, 1975, p. 444). Those used by cabinetmakers can have 'turned up' edges, with a small lip formed at the edge.

Figure 295 A cabinet scraper in use (https://www.wonkeedonkeetools.co.uk/cabinet-scrapers/what-is-a-cabinet-scraper).

Scrapers are also used with plastic materials. In pottery making, they are used to cut and move clay. Those used to shape pots on the wheel are known as ribs. These tools can be serrated, and often have curved edges which can be used to achieve the desired curvature of a pot. Scrapers are also used by bakers to cut, move and shape dough.

Figure 296 A set of modern wooden potter's ribs (https://www.fineartstore.com/p-3959-set-of-six-boxwood-potters-ribs.aspx).

Tanged, serrated scrapers are used in leatherwork and taxidermy to clean hides, make them more supple, and roughen leather surfaces for gluing (Salaman, 1986, pp. 180, 334). Similar scrapers can also be used in stonework to smooth the surface of soft stones, although there is evidence that they were also used for marble sculpture in the Roman period (Rockwell, 1990, p. 220).

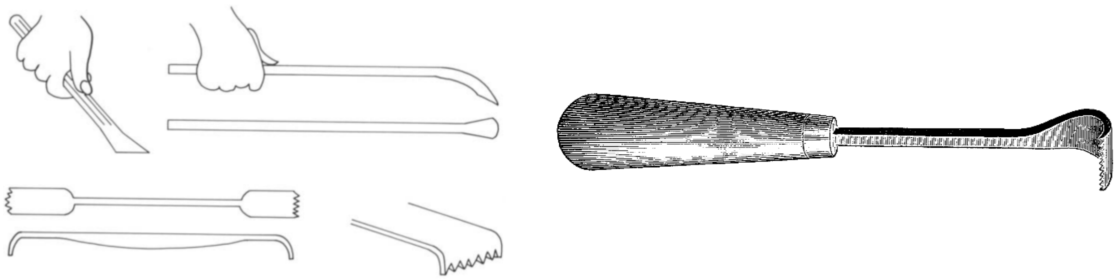


Figure 297 Scrapers used on stone (left, Rockwell, 1990, fig. 2) *and leather* (right, Salaman, 1986, fig. 13:19, 7).

Numbers

Four flat metal scrapers are discussed here, three from the Museum of London and one from recent excavations by MOLA. Another object from the Museum of London, SCR05, may be a form of tanged scraper.

Typology

Ribs

SCR01-03 all have the same basic form, with a rounded butt at one end, with one straight edge, the other curving downwards to create a point at the other end. SCR01 has serrations on the straight edge for a short length near the rounded tip. Another object with this form comes from Drapers' Gardens (Pre-Construct Archaeology, 2009, p. 32). Although SCR01 and the Drapers' Gardens tools were originally categorised as saws, this seems unlikely for two reasons; there are no rivets to hold these tools into a handle, and their similarity to SCR02 and SCR03, which have no serrations, indicates that these serrations were not vital to their functionality. They cannot be fragments of saw blades, as SCR01 is clearly complete, as presumably is the Drapers' Gardens tool.

SCR02 and SCR03 have no serrations. These were both originally categorised as knife blades, and they do strongly resemble the blades of Manning's (1985a, p. 108) Type 1 knives, which are now thought to have been pen knives (Bozic, 2001; Feugère, 2003). However, SCR01 and SCR02 have no rivet holes, whilst this type of knife blade is usually riveted to the handle plates. SCR03 has a single perforation at the rounded end, but I am not aware of an example of this type of knife held together by a single rivet. SCR01-03 are all thin, and do not have the normal wedge shape of a knife blade. These objects also all have rounded butts, whilst knife blades of this type from Newstead have flat butts (Feugère, 2003, figs 1-2).

It is possible that these objects are scrapers. SCR01 and the Drapers' Gardens tool closely resemble some modern ribs, which have rounded tips and short serrated sections along one edge (Figure 296), and the curved edges of this type more generally implies that these may be potter's ribs.

Card Scraper

SCR04 is a flat, trapezoidal sheet. It is well shaped and appropriately sized to be used as a hand tool, and as such may be a scraper, although it's exact purpose it unknown. It could have been used in any of the tasks assigned to scrapers (above), although the fact that it was found within a wattle and daub wall may indicate that it was used to spread daub.

Tanged Scrapers

Two objects from London, SCR05 and SCR06, appear to be tanged scrapers. Both have the same form of a tapering tang, expanding to a wide, downturned edge. SCR05 has a serrated edge, whilst SCR06's edge is corroded. SCR05's Roman date cannot be confirmed as it was found in a soil layer. These objects could have been tanning tools or stonemason's tools, whilst Manning (1976b, p. 34) highlights a number of similar objects, which may alternatively be scrapers or curry combs.

Shears

Technology

Shears are sprung cutting tools consisting of two blades connected by a bent metal spring. Pivoted scissors are rare in Roman period (Manning, 1985a, p. 34; Swift, 2017, p. 58). Heavy-duty pivoted shears for cutting metal, such as those discussed by Gaitzsch (1980, pp. 216–9) are not discussed here, although a pair may come from London (TON10, see p.603). The terminology used to describe shears is given in (Figure 298).

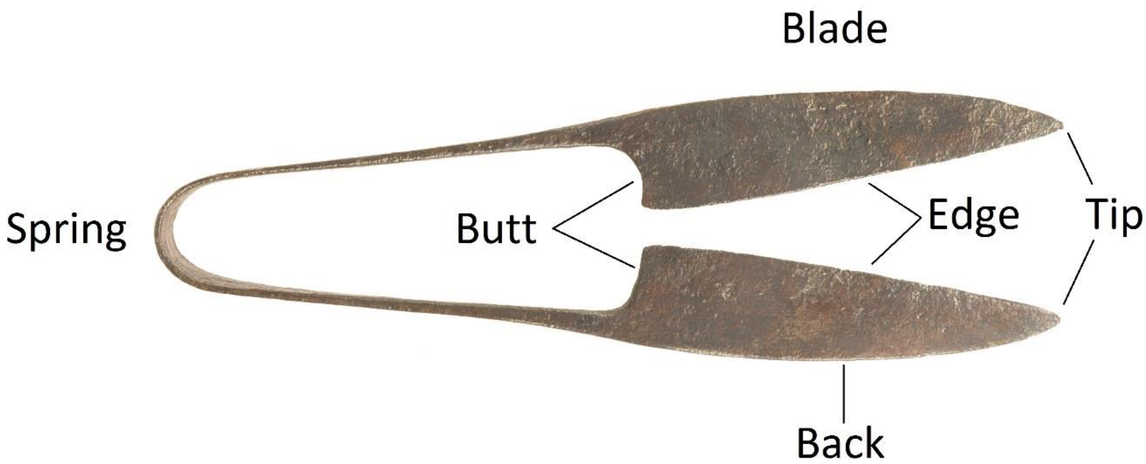


Figure 298 Terminology used to describe shears.

The technological properties of the various features of shears have recently been comprehensively examined by Swift (2017, pp. 56–99). As well as having blades of different lengths, widths and tip shapes, shears can be 'set' to the right or left, depending on which blade overlaps the other. This may be related to function, and can be seen to change over time. Shears can be made of iron or copper alloy, or a combination of the two (see Type 3, below). Copper alloy is generally found in shears only up to the 1st century AD, and may relate to the improvement of iron tempering technologies (Notis and Shergar, 2003; Swift, 2017, pp. 60–1), although it continues to be used in various ways in the Roman period after the invention of iron springs (see SHE19 for the decorative use of copper alloy in London). Copper alloy shears may have been associated with medicine, although this is uncertain (Humphreys in Marshall and Wardle, forthcoming; Swift, 2017, p. 60).

Today, shears of this kind are associated almost exclusively with the shearing of sheep, but in the Roman period they could have fulfilled many of the functions of modern scissors.

Considerable work has been undertaken to understand the functions of shears, using their associations with grave goods or design characteristics (Notis and Shergar, 2003; Kaurin, 2011; Swift, 2017). However, very few types can be associated with confidence with craft work (although see Swift, 2017, pp. 92–6 for shears strongly associated with leatherwork), and as such shears will not be incorporated into any further functional analysis.

Numbers

Twenty-six pairs of shears and detached shear blades come from London. The majority (16) come from the Museum of London. Four come from recent excavations by MOLA, three from the LAARC and one from an excavation by PCA. Six shears came from the Pitt Rivers Museum, although the majority appear to be medieval (below).

Typology

Manning (1985a, p. 34) divides shears into three groups based on size. However, whilst the large Type 1 is a distinct type, the boundary between the smaller Types 2 and 3 is not obvious. As Roman shears are found in a continuous range of lengths (Swift, 2017, fig. 2.34), including in London (Figure 299) this division seems arbitrary. Type 1 was probably used primarily for cropping cloth (Gaitzsch, 1980, pp. 213–6; Manning, 1985a, p. 34), but no large cloth-cropping shears were found in London. The following discussion will therefore focus on the differences between the smaller shears types.

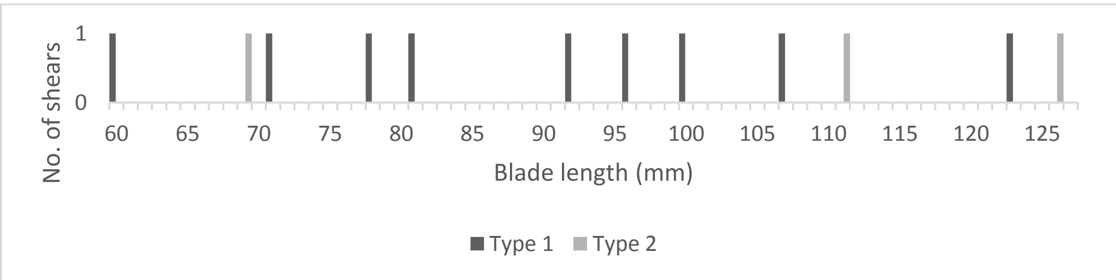


Figure 299 Blade lengths of the complete Type 1 and 2 shears from London (no Type 3 shears had complete blades, whilst Type 4 has been excluded due to uncertainties about the dating of these objects).

A typology of Late Iron Age and Early Roman Continental shears types is provided by Kaurin (2011, fig. 2). Shears from across the north-western provinces have also recently been studied in detail by Swift (2017, pp. 56–99), who provides a typology of the common types based on blade shape. However, this typology was only published after the London shears had been divided into a custom four-part typology focussing on spring form and construction. This typological discussion is therefore ordered based on spring form, with discussion of blade shape given within individual types.

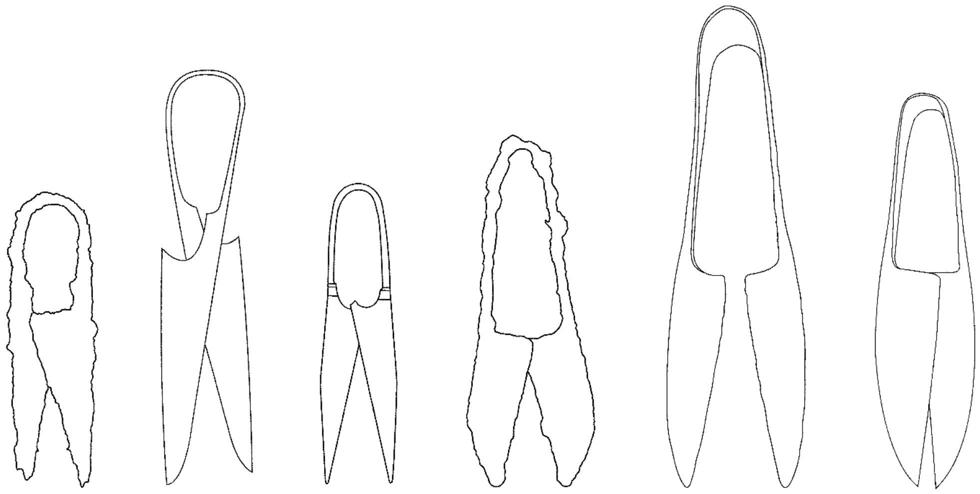


Figure 300 Swift's typology of Roman shear blade types (Swift, 2017, fig. 2.24-32). Not to scale.

Type 1

Type 1 shears are single-piece shears with flat springs which expand to be widest in the centre. This is the most common type in London, with 12 examples (SHE01-12), and can be subdivided into those with **U-shaped** springs (SHE01-04) and those with **omega-shaped** springs (SHE05-6), although many are not well preserved enough for this to be apparent (SHE07-11). SHE12 is unusual as it conforms to the general shape and construction of this type, but differs in having a spring which steps inwards before being bent in a U-shape. The author is aware of no other examples of shears with this spring form.

The majority of Type 1 shears have short, wide blades with curved backs, rounded butts, and no decoration; unsurprisingly conforming to Swift's (2017, p. 92) 'London' type. This type is found throughout the Roman period, and demonstrates little specialisation, being suitable for any task dependant on the size of the example in question (ibid).

SHE07 and possibly SHE06 conform to the 'Pompeii' form (Swift, 2017, pp. 89–90); a sharply pointed type suitable for use in tailoring or medicine, dated to the 1st century. SHE11 may also be of this type, but the blade shape is obscured by heavy wear. This wear, and the twisting to the spring, may indicate that this blade was re-used as a knife after the spring broke. SHE11 is also unusual for having a curved decorative extension at the butt. This feature is unusual in Roman shears, but can be seen on an example from Vindolanda, tentatively dated to 180-200 AD (Blake, 1999, No. 3497). Decoration of this kind is also commonly seen on medieval examples (Cowgill, de Neergaard and Griffiths, 2000, pp. 106–13).

SHE13 and SHE14 are made of copper alloy rather than iron. Copper alloy was more commonly used in early Roman shears (Swift, 2017), although neither example from London can be contextually dated. SHE13 has stepped decoration at the butt, also seen on a 'Merida' form example from Corbridge (Swift, 2017, fig. 2.24, D), although SHE13's blade shape is not clear. SHE14 has an angular blade of Swift's (2017, pp. 91–2) 'Cortrat' form, which may have been used for personal grooming or textiles work. However, SHE14 is very crudely made, with a fold visible in one side, and was thought by the excavators to possibly have been a votive miniature. SHE14's blade is nevertheless longer than that of the (presumably functional) Type 4 SHE26.

Type 2

Type 2 shears have the same spring form as Type 1 shears, but differ in having a decorative moulding at the junction between the blade and the spring. These mouldings appear to be skeuomorphs for sockets. Similarly-shaped sockets can be seen on the ends of springs used in three-piece tongs (Gostenčnik, 2008, Taf. 3), and can be seen on a pair of shears from Pompeii which appears to have separate tanged blades inserted into a socketed spring (Allison, 2006, fig. 34, 34.4).

SHE15 conforms to Swift's (2017, pp. 73–7) 'Merida' type; an early type suitable for personal grooming and possibly used in medicine or surgery. SHE16-17 are of Swift's (2017, p. 89) 'Vindonissa' type; an earlier precursor to the more common 'London' type. Both examples from London are dated to the mid-1st century. These long-bladed tools may have been used primarily for cloth cutting or similar tasks, although in graves they are associated with personal grooming. SHE16 is unusual in having a copper alloy plate soldered to the rear of the spring. The purpose of this is unclear, although it may have acted to increase the tension of the spring. Copper alloy may indicate a medical function (Swift, 2017, p. 60), although this cannot be confirmed in this case (Humphreys in Marshall and Wardle, forthcoming).

Type 3

Type 3 shears have the same overall shape as Type 1, but rather than being made in a single piece of metal, they have a separate spring attached to the blades with rivets. Four objects of this type, SHE18-21, come from London. Two, SHE18 and SHE19, have the remains of copper-alloy springs in place. No spring fragments are visible on SHE20 or SHE21, so it is unknown whether the spring was made of copper alloy or iron.

SHE18-19 appear to be of the common 'London' type. SHE19 is notable for having decoration on the spring in the form of lobes or petals. An extremely heavily decorated example of Type 2 shears in Egyptian style from Turkey is in the Met Museum (Acc. No. 39.2.2). SHE20 is too fragmentary to accurately categorise based on blade shape. SHE21 has the triangular blade of Swift's (2017, pp. 73–7) 'Merida' type. Whilst Swift (2017, p. 73) dates this type to the 1st century BC – 1st century AD on the basis of the frequent use of copper alloy, SHE21 can be stratigraphically dated to the late 2nd century. The only other dated example known to Swift (2017, p. 73) could also have dated to as late as the 2nd century.

Type 4

Type 4 shears have round- or square-sectioned arms joining a rectangular-sectioned omega-shaped spring. Unlike omega-shaped Type 1 shears, the spring is thicker, and does not get wider towards the back. This manufacturing method probably produced a stronger spring. This type strongly resembles medieval examples (Cowgill, de Neergaard and Griffiths, 2000, pp. 106–13), and SHE22 has a museum label questioning whether it is in fact medieval. SHE24 and 25 come from the Pitt Rivers Museum, which also contained medieval shears mislabelled as Roman (below). A number of 'Roman' examples of this type are poorly provenanced (Manning, 1985a, D9-11; Bishop, 1996, figs 48, 573, 575), although stratified examples come from Dorchester (Manning, 2014a, figs 143, 82) and Wilcote (Hands, 1998, figs 24, 47). It is therefore possible that these examples are Roman, although their date is uncertain.

This type of spring is found with a wide range of blade types. SHE22 has slender 'Vindonissa' type blades. SHE24 and SHE25 are of the simple 'London' type, although are slightly unusual in having decorated butts. SHE26 has a short 'Cortrat' blade. It is also the only object of this type for which a Roman date is certain, as it comes from a stratified context.

Four other pairs of shears from the Pitt Rivers Museum (PRM 1884.33.42, 1884.33.43, 1884.33.45 and 1902.69.15) were recorded as Roman, but are of clearly medieval form. The ridged springs and recessed arms of these examples are not seen on Roman examples, but are paralleled on numerous examples from the 14th and 15th centuries (Cowgill, de Neergaard and Griffiths, 2000, figs 71-3).

Shovels

Shovels are tools used to scoop and move material, differing from spades, which are used primarily for digging. Here, the distinction is made on the basis that spades (see p.587) have flat blades, whilst shovels have raised edges. Two iron shovels come from London, both from the Museum of London, although neither is certainly Roman. A third shovel from the Museum of London (MOL 20837) is probably a cooking item, such as a baker's peel, and is not discussed here. Other small shovels are discussed elsewhere as hearth tools (see p.502).

SHO01 has a tapering head formed from a single piece of iron, folded and welded into an open-fronted box. This object has no provenance associated with it, and as such may not be Roman, although a somewhat similar socketed shovel comes from Wroxeter (Shrewsbury Museum Service, 2003), where it was interpreted as a 'furnace shovel' (Figure 301). A similar object made of wood comes from the Roman ship at De Meern (Jansma and Morel, 2007, Afb. 8.13).

Figure 301 Socketed iron shovel from Wroxeter (Shrewsbury Museum Service, 2003).

SHO02 resembles a modern coal shovel, and may not be Roman, although the construction, with a triangular reinforcing strip on the underside blade, is similar to that seen on broad-bladed Roman agricultural tools (see p.505, 508). No comparable Roman objects are known to the author.

Sickles, Reaping Hooks and Pruning Hooks

Technology

This section describes tools with the shared basic form of a curved, handled blade. More robust objects are discussed in the billhooks section (see p.416). A range of terms can be used to describe these tools. Roman writers discuss twelve types of *falx* (a term which probably also encompassed billhooks), used for cutting grain, grapes, reeds, trees, broom, foliage and bracken (White, 1975, pp. 72–103; Rees, 1979, p. 451), although it would be unwise to use these terms to categorise the archaeological material. Most authors reserve the term 'sickle' for those tools which have a balanced blade, i.e. one which curves backwards from the handle before bending forwards again (Manning, 1985a, p. 51). Manning (1985a, pp. 51–8) uses the term 'reaping hook' to refer to non-balanced tools likely to have been used for harvesting grain, whilst describing smaller tools as 'small hooks'. Rees (Rees, 1979, pp. 450–67) avoids the term 'sickle' altogether, instead using 'reaping hook' to refer to harvesting tools and 'pruning hook' to refer to small hooked knives. The terms used to describe hooked craft knives are also numerous. This section will refer to all objects as 'hooked blades' unless a specific function is being attributed to them. Only balanced sickles will be referred to as 'sickles'.

Although it may be obvious to interpret these objects as agricultural tools, their functions are potentially extremely varied. The most obvious is for cutting the stalks of crops in the field (Rees, 1979, p. 451), but they could also be used to cut grain from the heads of corn stalks in the home as they went into the quern (ibid). Other plant-related tasks include pruning small trees and bushes (ibid), harvesting fruit, cutting leaves for fodder (Manning, 1985a, p. 51), or harvesting other natural products, such as reeds or bracken (Rees, 1979, p. 451). Craft uses are also possible. Salaman (1986, pp. 135, 256) describes a range of curved knives used by leatherworkers, including head knives (hooked blades used by saddler's where a half-moon knife is not precise enough) and some forms of clicker's knives (gently curved blades which are used for cutting out shoe uppers). Curved knives are also used to harvest, cut, shave and prick rods in basketry (Salaman, 1975, pp. 70, 524). The fact that sickles and pruning hooks appear on a relief of a cutler's stall alongside writing equipment (Fünfschilling, 2012, Abb. 12) may indicate that they were used in making reed pens. A main aim of this section will therefore be to see if it is possible to identify tools of different functions amongst the hooked blades from London.

Numbers

34 hooked blades are discussed here. 23 come from the Museum of London, nine from the British Museum, one from the Bank of England Museum and one from recent excavations by MOLA. Two further 'sickles' from the Museum of London, MOL 13683 and 13693, could not be located.

Typology

The most comprehensive English-language typology of the Iron Age and Roman tools remains that of Rees (1979, pp. 450–67). Rees distinguishes between lager 'reaping hooks' and smaller 'pruning hooks', dividing each group between socketed (type 1) and tanged (type 2) tools, before subdividing them based on the shape of the blade. Material from the Guildhall and British Museums, representing the majority of sickles from London, was incorporated into Rees's dataset, and was used in the building of her typologies.

However, when the London objects are examined in isolation, problems arise with Rees' scheme. The London tools were clearly problematic for Rees, who expresses doubt in her catalogue that many of them were of Romano-British date (Rees, 1979, pp. 637, 649–50, 661, 665, 668–9, 684, 693). Objects that appear very similar to each other (such as SIC04 and SIC05) are split up based on comparatively minor differences, whilst objects with few similarities (such as SIC02 and SIC06) are grouped together.

Typologies of the Continental material have also been produced by Pohanka (1986) and Hanemann (2014). Both distinguish between sickles (Pohanka, 1986, Textabb. 7; Hanemann, 2014, Abb. 175), billhooks (Pohanka, 1986, Textabb. 10; Hanemann, 2014, Abb. 178), and vine knives (Pohanka, 1986, Textabb. 10; Hanemann, 2014, Abb. 181), but the forms of these objects are different to those seen in Britain.

The complexity of these objects, and the difficulties of creating universal typologies, were noted by Manning (1985a, pp. 50–1), who suggested that rather than looking for clear types 'one can only attempt to define a series of internally consistent groups; the anomolous examples have to be treated as such.' Whilst this is the case, another way of making sense of the London tools is to separate out the forms of the blades and handle attachments. This is not intended to be a universal scheme for categorising Romano-British reaping tools. Instead, it is simply a device for breaking the dataset into groups of similar objects in order to structure the discussion of the London tools.

Handle Attachment Types

Five main types of handle attachment can be seen amongst the London sickles.

Type A is a short tapering tang, which would have been inserted into a wooden handle. This is the most common type in London, with 12 examples. Two objects of this type, SIC24 and SIC28, retain their wooden handles, although both are too badly warped to comment on their manufacture.

Type B is a long tang which would have been threaded all the way through a handle and then clenched at the other end. This is the second most common type, with nine examples, although the manner of clenching is highly variable. The majority (five) are bent into a loop, with one example each of the others being clenched, hammered flat, peened over a rivet, or expanded to a bulbous end.

Type C is a flat rectangular-sectioned tang which would have been riveted to the handle. Two examples of this type come from London. A balanced sickle with a tang of this type was found at Blackburn Mill (Piggott, 1952, fig. 12) with a wooden phallic handle still intact.

Type D is a simple socket. Six examples of this type come from London, all of which are open on one side with a single nail hole near the opening.

Type E combines a socket and tang, consisting of an open socket with an extended piece of metal continuing down from the socket along the side of the handle, before being clenched around the bottom of the handle. Only one object of this type comes from London, although the type is not uncommon in Roman Britain (Rees, 1979, fig. 160a, 164c, 170a, 196a, b, e, 197a, 198a). Examples discovered since Rees' work include those from the Ingleby Barwick hoard (Hunter, 2013, fig. 4.25, I) and Milton Keynes (Manning, Marney and Zeepvat, 1987, figs 52, 286).

Type F is a flat iron handle with an integral iron loop in the butt. Only one object from London, SIC22, has this handle, and it is not seen on any of the objects figured by Rees (1979). However, handles of this type can be seen on several harvesting tools from Austria (Pohanka, 1986, Pl. 39-40).

Blade Types

Eight blade types are visible amongst the London tools (Figure 302).

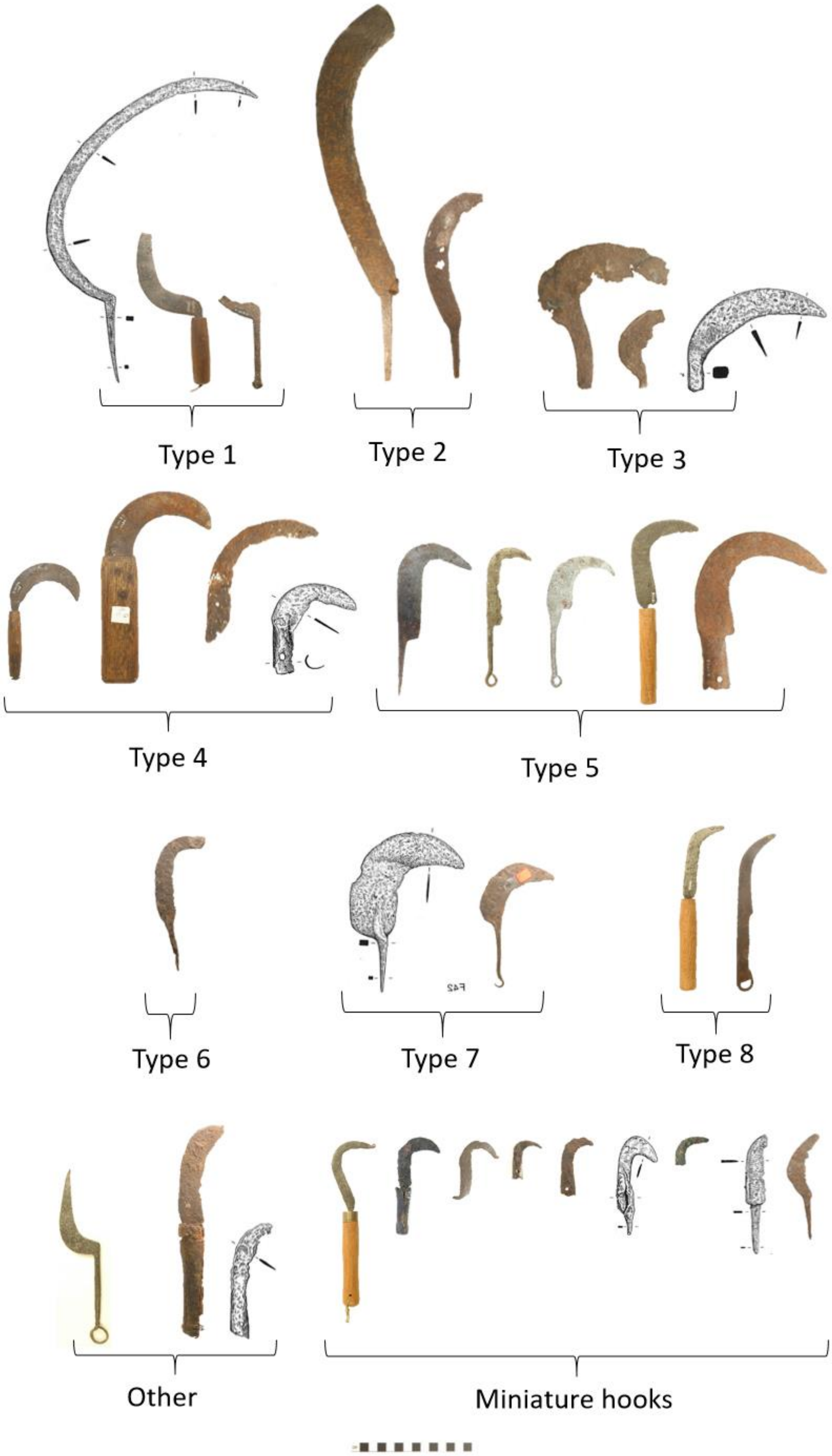


Figure 302 Sickles and reaping hooks from London, organised by blade type.

Type 1 and 2 blades are balanced; that is, they curve backwards from the handle before curving forwards again and tapering to a point. The balanced shape of these tools makes them particularly well suited to reaping (Manning, 1985a, p. 51), and they must therefore be agricultural tools. Five balanced sickles, SIC01-05, comes from London. They vary widely in size and blade shape, but can be divided into two main groups.

Type 1 sickles curve backwards from the handle at a sharp angle before curving forwards again. Three sickles from London, SIC01-03, are of this type. SIC01 is much larger than the others, and is the only Type 1 sickle. SIC02 is much smaller, and incomplete. It is possible that SIC02 had an upward-pointing tip, similar to SIC23, rather than a balanced sickle blade. SIC03 survives only as a handle and fragment of a blade, but also appears to have been sharply angled backwards in the manner of a Type 1 sickle. Rees (1979, figs 189-90) figures a number of complete examples.

Type 2 sickle blades are curved backwards from the handle at a much shallower angle than Type 1. Two sickles of this type, SIC04 and SIC05, come from London. SIC04 is large, but incomplete. This object may have been miscategorised in the past, as the original catalogue entry described it as an 'axe?' The smaller SIC05 and the miniature SIC29 have similar blade shapes, although SIC05 is probably less curved than SIC04 would have been when complete. SIC05 was originally catalogued in the Museum of London as Iron Age, but has no associated stratigraphic information. Type 2 sickles are known from the Late Iron Age (Rees, 1979, p. 458), and a similar Iron Age tool comes from Glastonbury (Gray, 1917 Pl. LXI, 128). SIC04 has a small tab, now bent over itself, at the junction between the blade and tang. Although the purpose of this tab is unclear, it can be paralleled on a find from Aldborough (Bishop, 1996, fig. 48, 569).

Type 3 blades project forwards from the tang at roughly a right angle, although beyond this the tools from London have little in common. This type is well suited to reaping. SIC06 has an expanded back edge that extends behind the handle, but is not a true balanced sickle as the cutting edge does not. SIC07 may be similar, but survives only as a fragment. Both SIC06 and SIC07 were originally catalogued as Iron Age, although neither has associated dating evidence, and no directly comparable objects are known the author. SIC08 has a tapering, pointed blade, which can be paralleled in a number of mostly Iron Age objects (Rees, 1979, fig. 159c, 160b, 161a-b). These are socketed, and SIC08's extremely robust solid tang is very unusual.

Type 4 blades curve forwards immediately from the handle attachment until they are pointing downwards. Heavily curved blades such as this have few obvious uses outside of agriculture, and reaping hooks with downward-pointing tips are famously shown being used by soldiers on Trajan's column (Figure 303). It is therefore reasonable to see Type 4 primarily as reaping tools.

Figure 303 Detail of Trajan's Column, showing a soldier harvesting grain with a Type 4 reaping hook (http://www.trajans-column.org/?page_id=276).

Four objects of this type, SIC09-12, come from London. SIC11 was thought to be Iron Age, but closely resembles the more complete SIC10, which comes from a site in the Upper Walbrook valley and is therefore probably of Roman date. This type can be paralleled on a range of sites (Table 94).

	Site	Site Type	Context	Date	Reference
4A	Camerton	Military?	-	100 BC – AD 100?	(Jackson, 1990, Pl. 27, 268)
	Newstead	Military	-	80-211	(Rees, 1979, fig. 181a)
4C	Alcester	Urban/ Military	-	-	(Rees, 1979, fig. 173b)
4D	Caerwent	Urban	-	75-450	(Rees, 1979, fig. 166c)
	Hambleden	Villa	-	-	(Rees, 1979, fig. 165c)
	Irchester	Urban	-	-	(Rees, 1979, fig. 162a)
	Dorchester	Urban	Building?	-	(Manning, 2014a, fig. 144, 94-5)
	Harlow Temple	Religious	Unstratified	-	(Gobel, 1985, fig. 49, 55)
	Keston	Villa	Ditch	250-325	(Philp *et al.*, 1991, fig. 49, 68)
	Vindolanda	Military	-	160-80	(Blake, 1999, No. 1632)
4E	Ingleby Barwick	Villa	Hoard	Late Roman?	(Hunter, 2013, fig. 4.25, L)

Table 94 Comparanda for Type 4 reaping hooks.

Type 5 blades are upright, with a blade which steps out from the front of the handle, continuing the line of the handle before curving forwards to form a pointed tip, which is usually downward-pointing. This blade type is very similar to Manning's (1985a, pp. 58–9) Type 1 billhooks, although all of the examples from London are too small to have been used in this way, and would have been well suited to reaping. Five objects of this type, SIC13-17, come from London. They display a wide range of handle attachments, which can be paralleled in the Iron Age and Roman periods. SIC17 is the most heavily curved example. It was catalogued at the Museum of London as Iron Age, although it is effectively unstratified, and comparable Roman objects also exist (Table 95).

	Site	Site Type	Context	Date	Reference
5A	Colchester	Urban	-	-	(Rees, 1979, fig. 214a)
	Usk	Military	-	100-200	(Manning, Price and Webster, 1995, fig. 73, 7)
5B	Caerwent (x3)	Urban	-	75-450	(Rees, 1979, fig. 203 a-c)
5D	Camerton	Military?	-	100 BC – AD 100?	(Jackson, 1990 Pl.26, 261)
	Dorchester	Urban	Building	-	(Manning, 2014a, fig. 144, 93)
	Gorhambury	Villa	Building	250-300	(Wardle, 1990, fig. 132, 418)
	Gorhambury	Villa	Building	200-300	(Wardle, 1990, fig. 132, 419)
	Hod Hill	Hillfort	-	43-51	(Rees, 1979, fig. 208b; Manning, 1985a, F41)
	Shakenoak Farm	Villa	-	-	(Rees, 1979, fig. 208a)
	Silchester	Urban	-	-	(Rees, 1979, fig. 163d)

Table 95 Comparanda for Type 5 reaping hooks.

Type 6 blades are also upright, with blades curving forward until they are at around a right angle to the handle and terminating in a blunt tip with a small raised tab on the upper side of the blade. One object of this type, SIC18, comes from London. A blunt tip would make it unsuitable for use as a craft knife, and SIC18 is therefore likely to be a pruning or harvesting tool. No similar objects are known from Britain, although Hanemann (2014, Abb. 178, Type 2D) identifies examples from Mainz and Osthofen. SIC18 may therefore have been imported.

Type 7 blades are similar to type 5, but are much wider, stepping out sharply at the back edge. Two objects of this type, SIC19 and SIC20, come from London, both with different tang types. It is possible that Type 7 tools functioned as craft knives, but the wide back of these blades may have acted in a similar way to the backs of Type 3 tools, to balance them out when reaping. As such they are interpreted here as agricultural tools. SIC20 is much smaller than SIC19, and could be considered a miniature.

	Site	Site Type	Context	Date	Reference
7A	Barbury castle	Hillfort	-	Iron Age/ Roman	(Rees, 1979, fig. 176a)
	Coygan Camp (x2)	Hillfort	-	-	(Rees, 1979, fig. 183d, 184c)
	Ham Hill	Hillfort	-	Iron Age/ Roman	(Rees, 1979, fig. 180b)
	Rockbourne	Villa	-	-	(Rees, 1979, fig. 183a)
	Sutton Walls	Hillfort	-	Iron Age/ Roman	(Rees, 1979, fig. 184b)
7B	Caerwent	Urban	-	-	(Rees, 1979, fig. 184a)
	Camerton (x2)	Military?	-	100 BC – AD 100?	(Jackson, 1990, Pl. 32, 309-310)
7D	Carlisle	Urban	-	-	(Rees, 1979, fig. 164b)
	Nantwich	Industrial	Brine tank	190-250	(Cool, 2012, fig. 7.6, 4.32)
	Wroxeter	Urban	-	-	(Rees, 1979, fig. 164a)

Table 96 Comparanda for Type 7 reaping hooks.

Type 8 objects are curved knives in which the blades do not curve as far forward as a true right angle. Two objects of this type, SIC21-22, come from London. Both have slender blades which simply curve forward and taper to sharp tips. Blades of this shape would have been awkward to use as reaping tools, although they could certainly have had a role in pruning. Their gently curved blades are similar to those on come modern clicker's knives, and a craft function is perhaps more likely. A note on the Museum's database records that SIC22 was 'Found unaccessioned in Tudor and Stuart collection', and it is therefore uncertain whether it is Roman, although its unusual handle can be paralleled in Austria (Pohanka, 1986, Pl. 39-40), suggesting that it may be an imported object.

Miscellaneous Reaping Hooks

SIC23 has a blade which curves backwards from the handle in the manner of a Type 1 sickle, but instead of curving forwards again it instead tapers to an upward-facing point. Its function is unclear; whilst it is unlikely to have been a reaping tool, it has the same tang type as several reaping hooks from London. It is possibly a pruning tool, but could also be a craft knife. Two objects, SIC24-25, have upright blades, but are too corroded to tell what their blade shape originally was.

Miniature Hooked Blades

In addition to these objects, the London collections contained nine objects, SIC26-34, described here as miniature hooked blades. These objects were described by Manning as 'small hooks' and Rees as 'pruning hooks', and can be catalogued in the same way as the larger tools. Rees

(1979, pp. 461–4) presents large amounts of comparable objects to these tools, which are found on all site types from the Iron Age onwards (Rees, 1979, p. 464).

Rees suggests that some of these objects could be non-functional miniatures or craft tools rather than agricultural tools. This interpretation is accepted for a miniature socketed billhook from London (MOL A27592), which closely resembles the larger objects in form (see p.416). This is also a possibility for SIC27, which has an extremely small wooden handle. Modern pruning hooks often have handles large enough to be gripped comfortably, even if the blade is small. However, the other miniature hooked blades are interpreted here in functional terms, as they strongly resemble modern pruning hooks (used to tend to plants and harvest fruit) and do not adhere so closely to the form of the larger objects that they become obviously non-functional.

SIC26 has the form of a Type 2 balanced sickle. Its tang is obscured by a replica handle. I am not aware of any close matches for this tool, although its curled tip is also seen on SIC28 and related objects with unbalanced blade types (Rees, 1979, fig. 175a, 184a; Isaac, 2001, figs 51, 37).

SIC27 closely resembles a miniature tanged Type 5A reaping hook. SIC32-33 were probably similar, although both are fragmentary. Tanged miniature pruning hooks are less common than other types, with only seven examples with upright blades known to Rees (1979, p. 464), almost all of them from Roman sites. SIC28 also has a nominally Type 5 upright blade, but with an unusual curled-over tip, paired with an unusual tang that projects backwards from the blade into the handle. This may constitute a type of its own, as SIC28 can be closely paralleled in finds from Caerwent (Rees, 1979, fig. 184a), Wanborough (Isaac, 2001, fig. 51, 37), and one of unknown provenance figured by Rees (1979, fig. 175a). Curled tips can also be seen on less similar reaping hooks from Dorchester(Manning, 2014a, fig. 144, 93) and Shakenoak Farm (Brodribb, Hands and Walker, 2005, fig. 1.34, 21).

SIC29 and SIC30 have Type 4 blades and small, nailed sockets (Type D). This is the most common type of miniature hooked blade, with Rees (1979, p. 461) identifying 81 examples. The majority of these have simple Type D sockets, although a number have flanged/tanged Type E sockets, as does SIC31. Although superficially unusual, this is a common attachment that can be seen on a range of hooked blades of various sizes.

SIC34 is unusual amongst this group. SIC34 has an angular back edge which projects behind the tang, with a curved cutting edge that does not reach a right angle. Because of the expanded back, this is probably a pruning or reaping tool. Similar objects are known from the Continent (Pohanka, 1986, Abb. 39, 157; Hanemann, 2014, Abb. 181, Typ 1), where Hanemann (2014, pp.

207–8) interprets them as vine cutting knives. SIC34 may therefore be imported. Another object, BEN01, may also be a form of vine cutting knife (see Hanemann, 2014, Abb. 181, Typ 5), but has instead been interpreted as a bench knife (see p.414).

Soldering Irons

Technology

Soldering is the process of joining two metal surfaces by melting another metal (solder) between them (Gaitzsch, 1980, p. 127). This can be part of the manufacturing process (e.g. attaching feet to a vessel, or sealing lead piping) or used to repair broken objects. Soldered objects are known from at least as early as 3000 BC (Lang and Hughes, 1984, p. 78), but soldering irons are not essential to the soldering process, which can be achieved by pouring liquid metal from a crucible, or placing the objects and solder together into a fire (Gaitzsch, 1980, p. 131; Ogden, 1992, p. 51).

Soldering irons are tools which are heated in a fire, over a torch, or with an internal heating element, and used to melt solder directly onto the object being soldered. Soldering irons from recent centuries consist of an axe-shaped, pointed or chisel-tipped block of iron or copper alloy on a long tang, set into a wooden handle (Figure 304). Although there is no Latin word for soldering irons (Gaitzsch, 1980, p. 127), and the earliest literary reference to soldering irons is from an 8th century text (Lang and Hughes, 1984, p. 83), several soldering irons have been identified in Roman contexts since Schaeffer (1927, fig. 1K) first identified one amongst the Seltz hoard. Soldering irons may have been a Roman innovation (Gaitzsch, 1980, p. 131; Lang and Hughes, 1984, p. 94).

Figure 304 A group of antique soldering irons (http://www.ebay.com/itm/LOT-7-ANTIQUE-SOLDERING-IRONS-WOOD-HANDLE-COPPER-MARKED-BLACKSMITH-TOOLS-/261175954888?pt=LH_DefaultDomain_0&hash=item3ccf4ccdc8).

Numbers

Two possible soldering irons come from London, both from the Museum of London.

Typology

Roman soldering irons are discussed by Gaitzsch (1980, pp. 127–32), who identifies seven objects of the same form, consisting of a short wedge-shaped head at the end of a long bar, which can terminate as either a handle or tang. These objects resemble modern 'hammer soldering irons' (Figure 304, centre), which are today sold for use on sheet metal, such as panelling, roofing, and vehicle bodywork, as well as for stained glass making. One object of this form, SOL01, comes from London. As SOL01 is broken it is not possible to say how it was mounted.

An alternative interpretation of these tools would be as metal-cutting sets (see p.441). The robust wedge-shaped head of SOL01 would make it suitable for this purpose. However, an example from Augsburg-Oberhausen with a copper alloy head (Gaitzsch, 1980, p. 130), and another from Pompeii with a blunt head (Gaitzsch, 1980, Abb. 24, 164), would not be suitable for use as sets, whilst an example from Vindonissa retains traces of tin solder on the tip (Gaitzsch, 1980, p. 130).

Objects of this type are found from across the Roman period (Table 97), with examples from Pompeii and Augsburg-Oberhausen indicating that they were perhaps an innovation of the Late Republic or early Roman Empire (Gaitzsch, 1980, pp. 30–1).

Site	Site Type	Context	Date	Reference
Augsburg-Oberhausen (x2)	Military	-	27 BC - AD 16	(Gaitzsch, 1980, pp. 30–1)
Compiegne	-	-	-	(Champion, 1916, Pl. III, 15890)
Pompeii	Urban	-	Before 79	(Gaitzsch, 1980, Abb. 24, 164)
Seltz	Industrial	Hoard	150-300	(Schaeffer, 1927, fig. 1K; Gaitzsch, 1980, Abb. 14, 3)
Vindonissa	Urban/Military	-	-	(Gaitzsch, 1980, Abb. 14, 1)
Waging	-	-	-	(Gaitzsch, 1980, Abb. 14, 2)

Table 97 Comparanda for SOL01.

SOL02 has a very different form, consisting of a short round-sectioned handle and a long, broad, chisel-tipped blade. This blade resembles those seen on antique soldering irons, but the relatively short handle is unusual in a tool designed to be heated to a high heat. The identification of SOL02 as a soldering iron is therefore uncertain. Another object with a similar form, HEA07, is much longer, and has been interpreted as a poker (see p.502).

Spades

Technology

Spades and shovels are closely-related tools consisting of a wide blade at the end of handle. Spades differ from shovels in that they are primarily digging tools, whilst shovels are used to scoop and move material, although there is obviously considerable overlap between the two. The objects discussed here as spades have flat blades, whilst those discussed elsewhere as shovels (see p.566) have raised edges.

Today, spades have blades made entirely of iron. Whilst all-iron spade blades are known from the Roman period (Hanemann (2014, Abb. 165) provides a typology) they are rare, and none come from London. All-wooden spades are also known from the Roman period (Rees, 1979, pp. 320–2), including a possible example from Bloomberg (BZY10, Marshall and Wardle, forthcoming). The spades discussed in this section are iron tips (shoes) which would have been fitted to wooden spades. The terminology used to describe spade shoes is shown below (Figure 305). Complete examples of Roman iron-tipped spades include an example from Stonea Grange (Jackson and Potter, 1996, fig. 205), and a partially complete example comes from London (SPA11). Iron spade shoes were a Roman-period introduction (Rees, 1979, p. 326), and are only found on sites in 'Romanised' areas of the country, although a separate type of 'peat spade' is known from Scotland in this period (Manning, 1970a, pp. 24–6).

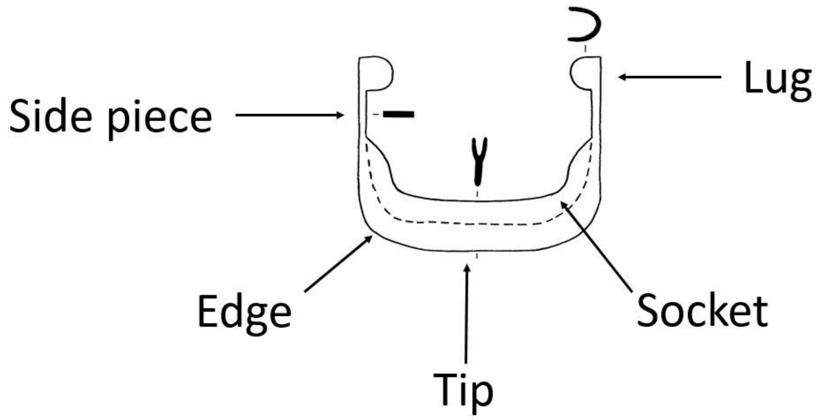


Figure 305 Schematic view of an iron spade shoe.

Numbers

Sixteen iron spade shoes have been recorded in London. Almost uniquely amongst the London tools, the majority, nine objects, come from recent excavations by MOLA. One more comes from excavations archived at the LAARC and two from the Pitt Rivers Museum. The remaining four objects come from the Museum of London. A seventeenth spade shoe from excavations by

MOLA, MOQ10[5269]<3221>, is probably post-Roman. A further spade shoe, described by Corder (1943, p. 230) as having been found in 1865 during the digging of the foundations of the London and Westminster Bank, is not illustrated, but may be the same object as SPA06, now in the Pitt Rivers Museum.

Typology

Spade shoes have been studied in detail in the past, but have been found to be extremely difficult to make neat typologies of, with Manning (1970a, p. 21) remarking that any typology 'which demands a really close resemblance between the specimens will finish with almost as many types as there are examples.' Corder (1943, pp. 225–7), for example, created a four-part typology based primarily on five spade shoes from Verulamium.

The most commonly used typology today is that of Manning (1970a, pp. 21–4). Manning broke spade shoes into those with round (Type 1) and straight tips (Type 2), before subdividing them based on the form of the attachment to the wooden bladde. This typology was also used by Rees (1979, pp. 322–6, 398–400), and as such these types are well understood in terms of distribution and dating within Britain. Rees (1979, p. 325) tentatively suggests that spades with rounded noses may be later than those with square ones, but this is not borne out in the London data, with examples of both types coming from early and late Roman contexts.

This scheme is somewhat problematic due to the considerable overlap between some forms (Rees, 1979, p. 323), with the vague criteria of some forms leading them to be collections of unrelated objects (see Rees' (1979, p. 324) discussion of Type 1a examples). In order to better accommodate the London artefacts, a new pair of types (Type 1d and 2d) has been added to Manning's original typology, and some others have been re-numbered (Figure 306).

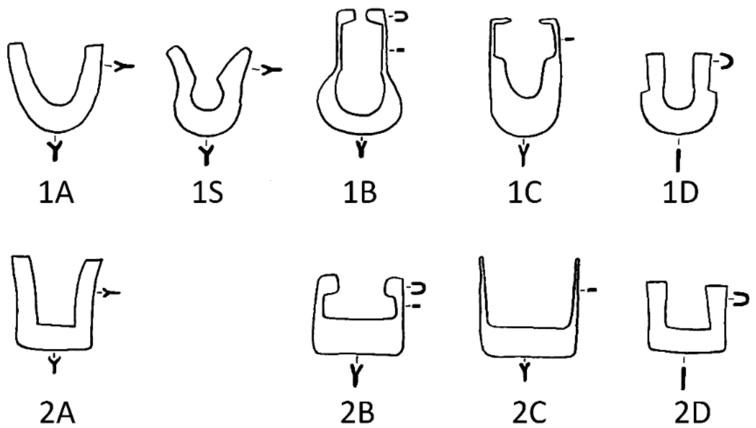


Figure 306 Typology of spade shoes, after (Rees, 1979, fig. 108).

Type 1 spade shoes have rounded tips, whilst **Type 2** have straight tips. Four objects, SPA13-16, survive only as undiagnostic fragments, and can only be categorised as Type 1 or Type 2.

Type A

Type A spade shoes are U-shaped, with a Y-shaped cross-section forming a socket which runs all the way around the inside edge of the sheath. There is usually no other means of attachment, as is the case with the objects from London, so presumably this type was heated and shrunk into place through cooling (Manning, 1970a, p. 22).

Type 1A (Manning Type 1A) has a rounded tip. Two objects of this type, SPA01 and SPA02, come from London. A variation on this type, **Type 1AS** (Manning Type 1B) also has a socket running all the way around the inside of the shoe, but differs from Type 1A in that the arms flare outwards after the rounded tip. No objects of this type come from London.

SPA01 is unusual in being extremely small. SPA01 is only 78mm long, whilst the smallest spade shoes of this form recorded by Rees (1979, p. 324) were 156mm long. The author has discussed elsewhere the possibility that this was a non-functional miniature (Humphreys in Marshall and Wardle, forthcoming), but because it was manufactured in exactly the same way as larger tools, and has damage to the tip commensurate with wear, it is accepted as a full-sized, although very small, functional tool. Another extremely small spade iron comes from Cirencester (Rees, 1979, p. 330), and a possible fragment comes from Wilcote (Hands, 1998, figs 26, 108). SPA02 survives as only a fragment. It is possible that this represents the blade of a Type 2B, but has been interpreted here as the side piece of a Type 1A.

Site	Site Type	Context	Date	Reference
Caerwent	Military/Urban	-	-	(Manning, 1970a, fig. 2e)
Chedworth	Villa	-	-	(Manning, 1970a, fig. 2f)
Chesters	Villa	-	100-50	(Rees, 1979, fig. 114a)
Yorkshire	-	-	-	Yorkshire Museum

Table 98 Comparanda for Type 1A spade shoes.

Type 2A (Manning Type 2A) has a straight tip. One object of this type, SPA03, comes from London, and it appears to be less common than Type 1A.

Type B

Type B spade shoes have a Y-sectioned socketed tip, sometimes extending a short way up the sides of the blade, with short rectangular-sectioned side pieces terminating in nailed lugs.

Type 1B (Manning Type 1C) has a rounded tip. SPA04 may be of this type, but is in a highly fragmentary condition and so this identification is uncertain, especially as this type is so rare in Britain. Rees (1979) lists only two examples, and no others are known to the author (Table 99).

Site	Site Type	Context	Date	Reference
Verulamium	Urban	-	-	(Rees, 1979, fig. 114b)
Worlington	Rural	-	-	(Corder, 1943, fig. 1, 1)

Table 99 Comparanda for Type 1B spade shoes.

Type 2B (Manning Type 2B) has a straight tip. Two objects of this type, SPA05 and SPA06, come from London, although it is also possible that SPA02 is a fragment of this type of object. This is one of the more common types, and several comparable objects can be cited (Table 100).

Site	Site Type	Context	Date	Reference
Chedworth (x2)	Villa	-	-	(Manning, 1970a, fig. 3l; Rees, 1979, Table X)
Chesters	Military	-	-	(Rees, 1979, Table X)
Fishbourne	Villa	-	250-300	(Rees, 1979, Table X)
Sherwood Drive	Rural?	-	100-400	(Rees, 1979, Table X)
Silchester	Urban	-	-	(Manning, 1970a, fig. 3h; Rees, 1979, Table X)
Spoonley	Villa	-	-	(Rees, 1979, Table X)
Verulamium (x4)	Urban	-	300-400	(Manning, 1970a, fig. 3n; Rees, 1979, Table X)
Wilderspool	Urban/ Industrial	-	100-200	(Manning, 1970a, fig. 3k; Rees, 1979, Table X)

Table 100 Comparanda for Type 2B spade shoes.

Type C

Type C spade shoes have a Y-sectioned socketed tip, which may extend up the sides of the blade, which tapers into rectangular-sectioned side pieces which can be nailed to the side of the blade or clenched over the top of the blade.

Type 1C (Manning Type 1D) has a rounded tip. One object of this type, SPA07, comes from London. Comparable objects come from Frocester Court (Rees, 1979, fig. 115) and Wesbury (Rees, 1979, fig. 116).

Type 2C has a straight tip. Three possible objects of this form, SPA08-10, come from London. Outside of London only three objects of this type are known, all from mid-1st century Colchester (Manning, 1970a, fig. 3m; Rees, 1979, figs 120-1), although it is possible that some of the fragmentary objects listed by Rees (1979, p. 325) as Type 2B are in fact of this type. The London objects therefore extend the dating of this type significantly.

Type D

Type D spade shoes have a solid un-socketed tip, with Y- or U-sectioned socketed side pieces.

Type 1D has a rounded tip. Rees (1979, p. 398) categorises these tentatively as Type 1A, but they are perhaps better discussed as a separate type. One object of this type, SPA11, comes from London. SPA11 is the only spade from London to have preserved wooden elements. This object has fragments of leather adhering to it, and a pair of nails in the blade which do not have any use in securing the tip in place. It is possible that these elements were part of a leather 'hood', which allowed this spade to act as a mud scoop for clearing ditches (Hill and Rowsome, 2011, p. 393).

Site	Site Type	Context	Date	Reference
Catterick	Military/Urban	Unstratified	-	(Mould, 2002b, fig. 272, 51)
South shields	Military	-	-	(Rees, 1979, fig. 113a)

Table 101 Comparanda for Type 1D spade shoes.

Type 2D has a straight tip. One object from London, SPA12, is of this type. Similar objects come from a range of site types (Table 102).

Site	Site Type	Context	Date	Reference
Caistor	Urban	-	-	(Rees, 1979, fig. 117b)
Corbridge	Military	-	-	(Rees, 1979, fig. 118b)
Gorhambury	Villa	Building	175-250	(Wardle, 1990, fig. 131, 405)
Housesteads	Military	-	124-410	(Allason-Jones, 2009, fig. 14.15, 328)
Strageath	Military	Posthole	142-61	(Grew and Frere, 1989, fig. 83, 121)

Table 102 Comparanda for Type 2D spade shoes.

In addition to these objects, two fragmentary pieces from the Museum of London were identified as spade shoe fragments (MOL 19633 and 19783). Both consist of rectangular-sectioned strips, which split into two thinner pieces at a right angle to the main strip (Figure 307). Whilst these in some ways resemble side-pieces with the fragmentary remains of split sockets, this is seems unlikely. If they were side pieces, they would sit with their narrow edges flush with the wooden blade, whilst those surviving spade shoes sit flat, with the wide edge against the wood. In addition, it would be extremely unusual for the thinner edges of the socket to be preserved, but not the usually thicker blade from which they split. The purpose of these fragments is unknown, but they will not be included in further discussion of the London spade shoes.

Figure 307 Unidentified object from Bucklersbury House (MoL 19633).

Spatulas

Technology

The objects described here as ‘spatulas’ make up probably the least well-defined group of tools in this thesis. Broadly speaking, spatulas a blunt tools, presumably used for manipulating plastic substances, although their range of functions within this is extremely wide. Manning (1985a, p. 31) interpreted many of the objects discussed here as ‘modelling tools’ and ‘plasterer’s tools’, and these interpretations are still widely followed, especially in Anglophone literature. Three subsets of these objects were later reidentified by Feugère (1995) as tools for erasing text on wax tablets, although this interpretation is not always followed (Humphreys in Marshall and Wardle, forthcoming). Often spatulas are confused with chisels (see p.448) as they have chisel-shaped ends.

Numbers

This section discusses 87 spatulate tools, split into a number of types. A separate class of spatulate tool, spear-shaped spatulas, are possibly related to pottery and are discussed elsewhere (see p.596). Copper alloy spatulas of known types associated with medicine are not discussed here.

Typology

Manning (1985a, p. 31) provides a three-part typology of ‘modelling tools’, but this section will follow (with additions) the typology more recently developed by Feugère (1995).

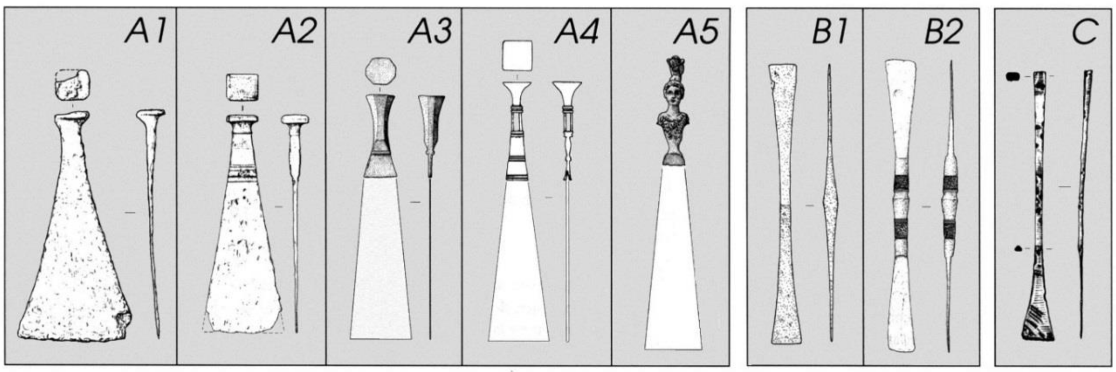


Figure 308 Feugère's typology of spatulas (Feugère, 1995, fig. 1).

Type A

Type A spatulas have wide triangular blades and short handles. Feugère defines a number of subtypes (Figure 308), of which Type A5 is the most often discussed (Franken, 1994; Feugère, 1995; Crummy, 2002; Worrell, 2003), although Type A5 objects were not catalogued here. Five

Type A1 spatulas (WXS01-05), one Type A4 (WXS06), and one blade fragment (WXS07) come from London.

Because of its wide flaring blade, Type A spatulas are often identified as craft tools (Manning, 1974, p. 347; Gaitzsch, 1984, p. 193). WXS01 was originally identified as a leatherworker's stamp and WSX03 was interpreted as a mosaicists chisel or oyster knife. However, these spatulas can be confidently associated with writing through their depiction on frescoes and in carvings in association with wax tablets and other writing equipment (Feugère, 1995). Nevertheless, the large WXS05 was found in a possible workshop building, and may have been used in craft in some capacity, whilst WXS03 has been sharpened at some point, potentially indicating its use in craft. WSX07 may be the blade of a Type A spatula, although it is not pierced for a rivet. This object is burred at the butt from striking, and may have been a chisel of some kind, although the heavy damage to this object implies that whatever its original use, it was later used as a piece of scrap in the workshop.

Type B

Type B spatulas are double-ended tools with a central handle and flaring blade at either end. Feugère defines two subtypes. However, because of the large number of such objects from London, it is possible to break these down beyond Feugère's scheme. As such, Feugère's Type B2 has been split here into Types B2 and B3.

Type B1 has a swelling diamond-shaped longitudinal section. Although simpler than Type B2, only one object of this type (CIM01) comes from London. It appears to have been re-used as a chisel.

Type B2, has round-sectioned, slightly swelling barrel-shaped handle, separated from the blades by a small step at the shoulder. This type is often decorated with incised lines, bands of hatching and copper-alloy inlay. Eighteen objects of this type (WXS08-25) come from London, making it the most common spatula type.

Type B3 resembles Type B2, but has a parallel-sided handle rather than as swelling one. This type also often has decoration, although less than Type B2. WXS33-34 are somewhat odd, having no step between the handle and blades, and may constitute a further subtype.

These tools can be confidently associated with writing, due to the appearance of these tools in graves alongside writing equipment (Feugère, 1995). However, it is not impossible that some in London were used in craft in some way. WXS21 was associated with an industrial hearth. CIM02 was re-used as a chisel (see p.443), and the same may also be true for WXS13 and WXS31. Three of these tools (WXS19, 33 and 34) have serrated blades, the purpose of which is not clear (Humphreys in Marshall and Wardle, forthcoming). WXS09 has a re-shaped end, the purpose of which is also unknown.

Type C

Type C spatulas consist of a long rectangular-sectioned handle with a socket at the butt, and a short, flaring triangular blade. Sixteen objects of this type (WXS35-50) come from London. The shoulders of all well-preserved examples have the same form of decoration, consisting of notches and incised lines. Some have incised zig-zag decoration on the surface, similar to that seen in three-piece tongs and extenders (Humphreys and Marshall, 2015).

Although considered to be writing equipment by Feugère, this type lacks the strong associations with other writing equipment seen in Types A and B (Humphreys in Marshall and Wardle, forthcoming). WXS40 is serrated, however, indicating that they were used in similar ways to serrated Type B spatulas. WXS44 has plaster adhering to the blade and handle, potentially indicating a use in plastering, as suggested by Manning (1985a).

The purpose of the sockets in the handles is not clear (Humphreys in Marshall and Wardle, forthcoming). Due to their rectangular shape and similar dimensions, they may be associated with three-piece tongs or extenders (see p.601) in some way. However, one example (WXS49) has wood preserved in the socket, whilst another (WXS39) has had a nail inserted as a decorative terminal. These indicate that Type C spatulas cannot always have been used with extenders.

Type D

To Feugère's typology can be added a fourth type of spatula common in London, here labelled Type D. These objects consist of a round-sectioned socket, stepping out to a long, flat, slightly tapering leaf-shaped blade, often decorated with edge notches. Thirteen objects of this type (WXS51-62) come from London. Again, the function of the socket is unclear; one example (WXS51) has a copper alloy stud inserted as a terminal, but another (WXS58) has fragments of wood preserved inside. WXS63 is solid-handled, but otherwise comparable. The function of this type is obscure. Manning (1985a, p. 80) associates them with surgery, although this is not certain.

Other Spatulate Tools

In addition to the types discussed above, a wide range of other spatulate tools (OSP01-26) can be identified in London. Their functions are extremely obscure, and it is unknown if any of them functioned as craft tools.

Spear-Shaped Spatulas

Technology

Spear-shaped spatulas are single-piece iron tools, consisting of a pointed spear-shaped head, which is sometimes sharpened on the front edges, attached to an integral iron handle, which is usually twisted. Their function is unknown. Previous identifications as cauteries (Gilson, 1982; Jackson and La Niece, 1986, pp. 15–6), domestic knives (Manning, 1985a, p. 119; Shepherd, 1998, p. 206), surgical knives (Riha, 1986, p. 83) or leatherworking tools (Ritterling, 1901b, pp. 126–7; Gansser-Burckhardt, 1942, pp. 18–9; Hoffman, 1985, p. 90; Fingerlin, 1998, pp. 29, 91; Simpson, 2000, p. 105) can be dismissed (Humphreys in Marshall and Wardle, forthcoming). It has also been suggested that these objects functioned as potters' tools (Champion, 1916, p. 244; Hoffman, 1985, p. 90; Desbat, 2004, pp. 150–1). They may have been used as fettling knives, with the bent panels on Types 2-3 acting as shavers (Humphreys in Marshall and Wardle, forthcoming). Whilst this identification is not certain, this is at present the most plausible suggestion.

Numbers

Twelve tools (SPE01-12) are discussed here. Seven come from the Museum of London, three from recent excavations by MOLA, and one from the LAARC. A further object (SPE07) could not be located in any collection, and was recorded from publication (Shepherd, 1998, fig. 240, 13).

Figure 309 Spear-shaped spatula types.

Typology

Whilst the author has previously broken this class of object into two types (Humphreys in Marshall and Wardle, forthcoming), examination of the London tools reveals that there are four principal types of spear-shaped spatula (Figure 309).

Type 1 has a barley-twist handle, bent into a loop at one end, flattening into a spear-shaped head at the other. One of these objects (SPE04) is extremely small, and may be a miniature rather than a full-sized tool. This is the most common type in London, with seven examples (SPE01-07). A number of other objects in the Museum of London resemble this type, but have fragmentary heads. As such it is impossible to differentiate them from broken iron rattles, which also have barley twist shafts and looped butts. This type is common on a range of site types across Europe. It appears to have been more long-lived than other types (Humphreys in Marshall and Wardle, forthcoming; Harnecker, 1997, p. 13). Some examples are known with untwisted shafts (Roux, 2013, No. 2015, 2176, 2412).

Type 2 has a flat, semi-circular panel at the butt, bent at a right-angle to the handle and pierced with a single hole. This type is also very common, but has a much more restricted chronological and geographical range than Type 1. Type 2 is found mainly on military sites on the German frontier in the Augustan-Tiberian period (Humphreys in Marshall and Wardle, forthcoming; Harnecker, 1997, pp. 12–13; Deschler-Erb, 2014, p. 13), although some examples with untwisted handles date to the 3rd century (Roux, 2013, p. 292). Only one example, SPE08, comes from London. As this object dates to 65-80AD, it may have been quite old when it was deposited.

Type 3 has a solid, unperforated panel at the butt, bent at an angle to the handle. This type is not common, although two objects (SPE09-10) come from London. Several similar objects with bent backs have been found on pottery production sites at Aspiran (Peacock, 1982, figs 26, 3) and Beuvraignes (Desbat, 2004, figs 26, B9).

Type 4 has a straight handle and a spear-shaped extension at the butt. One object of this type (SPE11) comes from London, and no other examples are known, although a possible hearth shovel from London (HEA09) has a similar spear-shaped tip.

A final object, SPE12, is missing its butt, and cannot be assigned to a type.

Spuds and Barking Knives

Technology

Spuds are short, wide-bladed tools resembling large chisels, which would be attached to a wooden haft. In British archaeology, spuds are primarily interpreted as small agricultural or gardening tools, for weeding, delicate digging tasks (Rees, 1979, p. 330; Manning, 1985a, p. 49; Museum of English Rural Life, 2017c), and cleaning the shares and mouldboards of ploughs (Manning, 1976b, p. 30, 1985a, p. 49; Museum of English Rural Life, 2017b).

However, Hanemann (2014, pp. 372–3) interprets tools of the same type as barking knives; tools used to peel the bark off of felled trees in order to begin turning them into suitable timber for craft or building purposes (Adam, 1994, pp. 92–3). Bark spuds are also used to harvest bark for leather tanners (Salaman, 1986, p. 299). Salaman (1975, fig. 213) also illustrates similar objects as 'pruning chisels', for removing small branches, presumably also from felled logs.

Unfortunately, there seems to be no clear consensus on how to distinguish between even the modern examples of these tools. Modern spuds with a curved prong on one side of the blade are interpreted by the Museum of English Rural Life (2017c, 73/188) as gardening spuds, by Salaman (1975, fig. 213) as pruning chisels, and on several websites as bark spuds. The following section will examine whether it is possible to distinguish between Roman examples of these tools. All objects discussed here will be referred to as 'spuds' for simplicity.

Numbers

Seven spuds are discussed here. Six come from the Museum of London, one from the LAARC. A further spud, MOL A146, was recorded on the Museum of London's database, but was sold in 1920. Rees (1979, p. 433) records another spud from London, but this could not be identified. The accession number given (MOL 268) refers to a bone needle. A final object, CID90[204]<97>, was listed as Roman on the LAARC Excel database, but consultation of the archived records revealed it to be from a Late Saxon context. Its form is similar to that of modern bark spuds.

Typology

Rees (1979, fig. 129) provides a schematic overview of the various blade shapes of the 'spuds' she examined, but no formal typology. Hanemann (2014, Abb. 319) provides a four-part typology of spuds, which, with modifications, will be followed here.

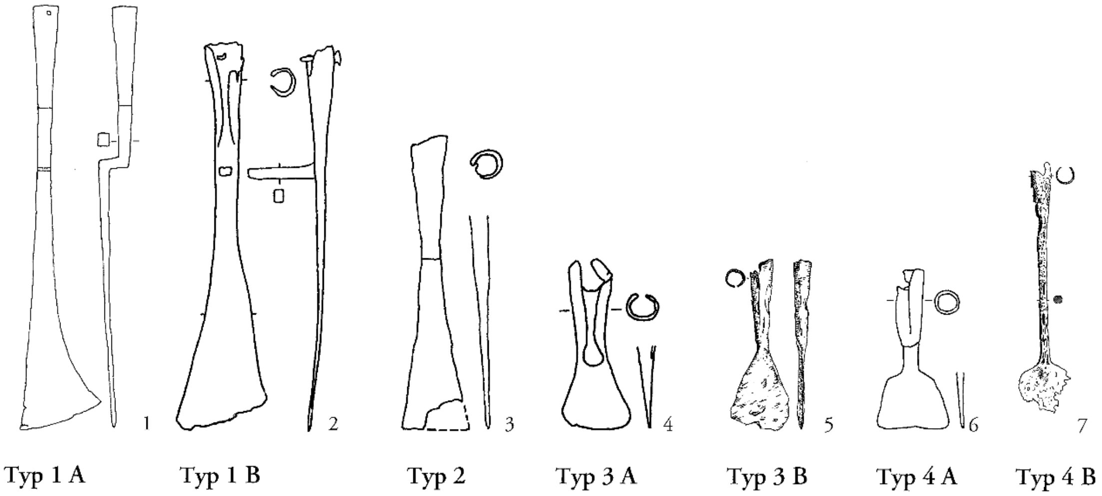


Figure 310 Hanemann's typology of spuds and barking knives (Hanemann, 2014, Abb. 319).

Type 1 spuds have flaring, angled blades. Hanemann identifies two subtypes, both socketed, but the only object from London which fits this type, SPU01, conforms to neither. SPU01 has a short tang, which appears similar to a Type 3 chisel tang. Whilst Hanemann interprets tools of this type as woodworking tools, Manning (1970a, pp. 26–7) and Rees (1979, p. 332) see them as a form of turf cutter. The short tang of SPU01 indicates that it is from a short-handled woodworking tool rather than an agricultural tool, however.

Type 2 has a flaring blade and a long socket. Any tools fitting this profile from London have been interpreted as chisels.

Type 3 spuds have a flaring triangular blade at the end of a short open socket. Hanemann divides this type into two subtypes. **Type 3A** has a relatively wide socket and narrow blade. One spud of this type, SPU02, comes from London. SPU02 has a heavily worn and burred blade. This suggests that it was used as an agricultural rather than woodworking tool, as a woodworking tool would become ineffective long before it reached this level of wear. **Type 3B** has a narrower socket and wider blade. Two objects of this type, SPU03-04, come from London. SPU03 has a neatly formed blade with a cutting edge formed by a bevel on one side. This would make it suitable for use in woodwork. SPU04 is badly corroded, but has a much thinner blade than SPU03.

Rees (1979, p. 330) found this to be the most common type in Britain, and several more recent finds can be added to those in her catalogue (Table 103). Although Rees (1979, p. 330) found these tools to be poorly dated, several new finds have contextual dates (Table 103), all of which are in the Late Roman period, conforming with the data from ironwork hoards. SPU02 is therefore significant, as it can be closely dated to 80-95 AD. This tool is very worn and possibly repaired, and was therefore presumably a number of years old when deposited.

Site	Site Type	Context	Date	Reference
Coldham Common	-	Hoard?	300-400?	(Manning, 1985a, F17)
Ivy Chimneys	Religious	Pond	325-375	(Major, 1999, fig. 68, 3)
Kingscote	Villa	-	-	(Scott, 1998, fig. 62, 12.1)
Milton Keynes	Rural	Unstratified	300-400	(Manning, Marney and Zeepvat, 1987, fig. 51, 274)
Shakenoak Farm	Villa	-	350-400	(Brodribb, Hands and Walker, 2005, fig. I.34, 24)
Vindolanda	Military	-	213+	(Blake, 1999, No. 2184)

Table 103 Comparanda for Type 1 spuds

Type 2 spuds are also socketed, with rectangular or trapezoidal blades. Hanemann divides this type into two subtypes, although the two objects from London (SPU05 and SPU06) do not closely resemble either. Neither is certainly a Roman spud. Although highly corroded, SPU05 retains a rounded corner at the tip. This may imply that it is a worn agricultural tool rather than a woodworking tool, modern examples of which have sharp corners. No directly comparable Roman objects are known to the author, although Rees (1979, pp. 434–5) describes tanged objects with rectangular-sectioned blades from Silchester and Wroxeter as spuds. SPU06 has a very unusual form, with a fully enclosed square socket and concave shoulders. The cutting edge, formed by a sharp bevel on one side, perhaps implies that it is a woodworking tool. No close parallels for this object are known, and it may not be Roman.

SPU07 does not fit into Hanemann's typology. It is the only tanged spud from London, with a shield-shaped blade, flat on one side and bevelled all the way around the other. No directly comparable Roman objects are known to the author, and as such its date is in doubt. An identical tool is featured on an internet blog as a bark spud (VanNatta, 2013).

Three-Piece Tongs

Technology

Three-piece tongs are enigmatic composite objects, which have recently been discussed in detail elsewhere (Gostenčnik, 2008; Humphreys and Marshall, 2015). These objects consist of a rectangular-sectioned stem, bent at one end to form a gripping surface, which has a tang or socket at the other end. Pairs of these arms would have been attached to a spring, forming a tweezer-like implement. Extenders, consisting of a rectangular-sectioned bar with a socket at one end and tang at the other, may be associated with these tools, or with Type C spatulas. Their function is unknown, and as such these objects will not be included in any subsequent analysis.

Numbers

16 possible three-piece tong arms and related objects come from London. Nine come from the Museum of London, six come from recent excavations by MOLA, and a final example comes from the LAARC.

Typology

Three-piece tongs can be divided into two main types; tanged and socketed. THR15 appears to be a bent three-piece tong blade, but is broken at the butt, and may have been socketed or tanged.

Tanged Three-Piece Tongs

Tanged examples have a rectangular-sectioned tang, which steps in sharply from the blade at the shoulder. These have been discussed in detail elsewhere (Gostenčnik, 2008; Humphreys and Marshall, 2015). Nine examples (THR01-09) come from London.

Socketed Three-Piece Tongs

In addition to these, a number of objects were found in the London which have the same ribbon-shaped blade as the tanged three-piece tongs, but have a round closed socket at the butt end, rather than a tang. These objects presumably paired with tanged springs, although no examples are known. Five examples (THR10-14) come from London. Two more come from early 2nd century contexts at Vindolanda (Birley, 1996, fig. 14, 95-6).

Extenders

A final object, THR16, has a rectangular-sectioned tang at one end and a rectangular socket at the other. These have been interpreted as socketed extenders, and may have functioned to extend the reach of tanged three-piece tongs or Type C socketed spatulas.

Tongs and Pincers

Technology

Tongs and pincers are pivoted gripping tools made of two near-identical pieces, each consisting of an arm/handle (reins) at one end and a jaw at the other, held together by a rivet which allows them to pivot (Tisserand, 2001, p. 46). An important distinction is that between tongs and pincers. Tongs are gripping tools with flat jaws. Their most obvious use is in holding hot metal in blacksmithing, but they are also used to move crucibles, and possibly to hold blooms together during bloomsmithing (Sim, 1992). Tongs are also used in other industries, for example to move leather hides between tanning pits (Salaman, 1986, fig. 305). Pincers have jaws with chisel-like or pointed tips, which meet each other directly. Pincers can therefore dig into the object being gripped. They are used by carpenters and shoemakers to extract and trim nails (Salaman, 1975, p. 295, 1986, p. 161; Hanemann, 2014, p. 327), and by metalworkers to bend rods and pull wire (Hanemann, 2014, p. 327). Pincers are also used by farriers, to clip hooves and extract nails (Goodall, 1980, pp. 10–11).

Tweezers, in which the arms are held together by a fixed spring at one end, are discussed in a separate section (see p.615). Medical forceps, used for removing teeth and foreign bodies from wounds, have recently been examined by Dude (2006), who identifies their key characteristics in the Roman period (ibid, pp. 179-80). Objects of this type are outside the scope of this study, and none were identified in London. A twitch from London (TWI01), previously thought to be pair of castration tongs, is discussed elsewhere (see p.615).

Numbers

Ten pairs of tongs and pincers are discussed in this section. Six come from the Museum of London, one from the British Museum and three from recent excavations by MOLA. A further set of tongs from the Museum of London, MOL 13525, could not be located.

Typology

Several authors have created schemes for dividing up Roman tongs. Gaitzsch (1980, pp. 228–32) created a typology based on the form of a tong's jaw. This typology has since been followed by both Duvauchelle (1990, pp. 10–11) and Tisserand (2001, p. 46). Manning (1985a, pp. 6–8) took an alternative approach, dividing tongs by size into two groups based on overall length; 'large' and 'small'. Recently, a new typology by Hanemann (2014, pp. 323–30) has adopted and expanded upon both of these, and as such Hanemann's typology will be used here.

Hanemann (2014)	Gaitzsch (1980)
Typ 1A	Flachzange Typ B
Typ 1B	Flachzange Typ A
Typ 2	Flachzange Typ C
Typ 3A	"
Typ 3B	"
Typ 4	Winkelzangen
Typ 5	-
Typ 6A	Kneifzangen
Typ 6B	"

Table 104 Correspondence of the tong jaw form typologies of Hanemann (2014) and Gaitzsch (1980).

Size

Hanemann (2014, pp. 323–4) breaks tongs down into three size groups, which are very comparable to those identified by Manning (1985a, pp. 6–8) (Table 105).

	0-25 cm	25-40 cm	40-70 cm
Hanemann (2014)	Group I	Group II	Group III
Manning (1985)	Small tongs	Large tongs	

Table 105 Correspondence between the tong size groups of Hanemann (2014, pp. 323-4) and Manning (1985a, pp.6-8).

Group I tools have a total length of under 25cm. Manning does not define the size range of his 'small tongs', although they are presumably smaller than the 25.4cm overall length of the smallest tools he assigns to the 'large tongs' group. Group II is composed of tools between 25 and 40cm long. Group III is composed of tools between 40 and 70cm long. Manning does not have a comparable 'very large' category of tongs, although he does discuss tools within his 'large tongs' category which are larger than usual (Manning, 1985a, p. 7). Manning (1985a, p. 7) also identifies clusters of 'large tongs' at around 34, 41, 46 and 55cm long.

An issue with these size groups is that it is not clear how many tools Hanemann examined before deciding upon them. Manning's (1985a, p. 7) groups and size clusters are based on a sample of 16 tongs. Hanemann (2014, pp. 323–4) does not directly reference Manning, and as such it is unclear whether the division at 25cm was something both observed independently, or an element of Manning's groupings which Hanemann adopted. Nevertheless, these divisions provide a convenient way of breaking down the discussion of the London tools.

Jaw Form

Hanemann (2014, Abb, 285) provides a six-part typology (nine including subtypes) of Roman tong jaws (Figure 311).

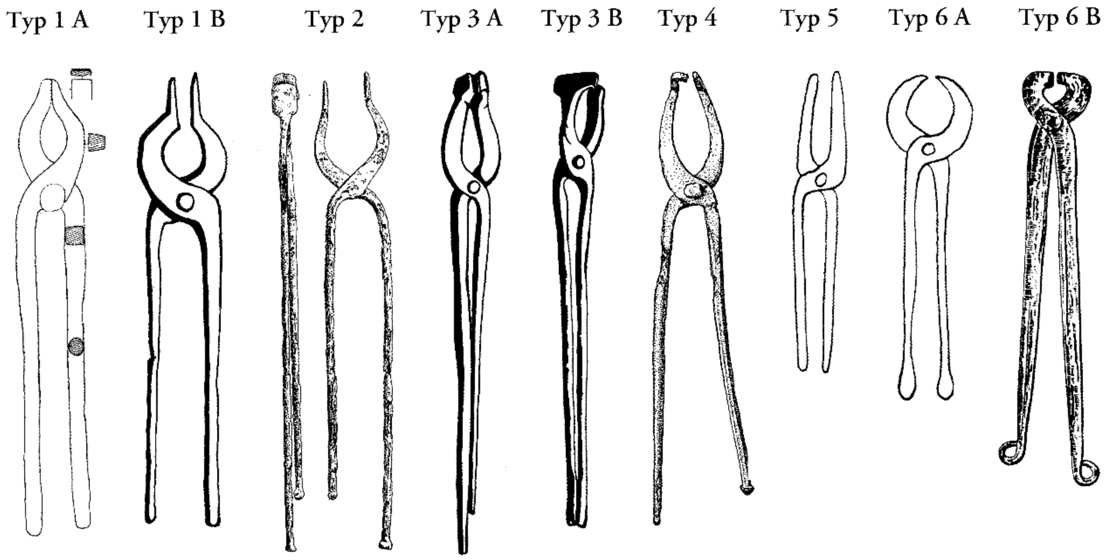


Figure 311 Typology of Roman tongs (Hanemann 2014, Abb. 285).

Type 1 tongs have an oval eye with extended gripping surfaces at the end. This is the most common form of tong jaws in both the Roman and Iron Age periods (Manning, 1985a, p. 7), and five objects of this type (TON01-5) come from London. Hanemann breaks this into two subtypes based on how long the gripping surfaces are. **Type 1A** has gripping surfaces which only touch for one or two centimetres, whilst on **Type 1B** they can be considerably longer. Distinguishing between these types is somewhat subjective, however, as tongs of this form are found in all of Hanemann's (2014, pp. 324–5) size groups, and therefore have very different overall lengths. Hanemann does not provide a ratio of eye size to grip length, which would be a more objective way of differentiating between these subtypes.

Although TON01 survives only as a fragment, its extremely robust form and heaviness (being almost four times as heavy as the complete TON02 and TON03) indicate that it belonged to an extremely large pair of tongs, probably belonging to Hanemann's Group III. Its comparatively short gripping surfaces identify it as a Type 1A. Objects of this type are found from the Iron Age to the Late Roman period (Table 107).

Site	Site Type	Context	Date	Reference
Garton Slack	Cemetery	Pit	250-110 BC	(Fell, 1990, fig. A5, 38)
Kilverstone	Rural	Hoard	200-400	(Garrow, Lucy and Gibson, 2006, fig. 4.24, 2)
Llyn Cerric Bach	-	Hoard	300 BC – AD 50	(Fell, 1990, fig. A5, 39)
Newstead	Military	Pit	80-105	(Curle, 1911, Pl. LXIII, 4)
Waltham Abbey (x5)	-	Hoard	50 BC –AD 50	(Manning, 1985a, A11-15)
Pompeii	Urban	-	Before 79	(Gaitzsch, 1980, Taf. 17, 89)
Saalburg (x2)	Military	-	85-260	(Pietsch, 1983, Taf. 18, 426, 428)

Table 106 Comparanda for very large Type 1A tongs.

TON02 and TON03, are both over 250mm in length, qualifying for Manning's (1985a, p. 6) 'large tongs' category, and Hanemann's Group II. TON02's gripping surfaces are considerably shorter than those of TON03, although they are otherwise very similar. TON03 is unique in having bent handles. The most likely explanation for this is that the arms were deliberately bent to form pistol-like grips. This would make the tool almost impossible to use with one hand, and suggests instead that it was used with two hands, perhaps to carry and pour crucibles (Humphreys in Marshall and Wardle, forthcoming). It is possible that this tool was originally made with straight handles, and was bent to this shape by the user. The tool is also bent sideways. Whilst it is likely that this is a secondary bending, perhaps caused after disposal, it is also possible that the object was originally straight and was bent as part of a destructive pre-depositional activity. Bent tongs were also found in the Waltham Abbey hoard, where this has been thought of as a ritual activity (Manning, 1977, 1985a, p. 7).

Site	Site Type	Context	Date	Reference
Santon Downham	-	Hoard	*c*. 60	(Smith, 1909, Pl. XVII, 1)
Sibson	-	Hoard	350-400	(Manning, 1998, fig. 3, 7)
Pompeii	Urban	-	Before 79	(Gaitzsch, 1980, Taf. 17, 88)
Seltz	-	Hoard	150-300	(Schaeffer, 1927, fig. 1F)
Xanten-Wardt	Urban	River	-	(Gaitzsch, 1993, Taf. 69, Ger 21)

Table 107 Comparanda for large Type 1A tongs.

TON04 and TON05 both qualify for Hanemann's Group I, although they are not very similar beyond this. TON04 has very short jaws, whilst those on TON05 are very long. Comparanda can be found for both, but TON05 in particular appears to be an established form, with other objects matching it very closely.

Site	Site Type	Context	Date	Reference
Kingsholm	Military	-	49-69	(Manning, 1985a, A9)
Silchester	Urban	-	-	Reading Museum
Vindolanda	Military	-	160-80	(Blake, 1999, No. 3812)
Haltern	Military	-	1 BC - 9 AD	(Harnecker, 1997, Taf. 20, 208)
Pompeii	Urban	-	Before 79	(Gaitzsch, 1980, Taf. 17, 87)

Table 108 Comparanda for small Type 1A tongs.

Site	Site Type	Context	Date	Reference
Vindolanda	Military	-	120-40	(Blake, 1999, No. 5301)
Avenches	Urban	-	-	(Duvauchelle, 1990, No. 12)
Aquileia	Urban	-	-	(Gaitzsch, 1980, Taf. 37, 173)
Vertault	Urban	-	-	-
Vetera	Military	-	12 BC – AD 276	(Gaitzsch, 1980, Taf, 52, 261)

Table 109 Comparanda for small Type 1B tongs.

Types 2, 3 and 4 all have specially formed tips to fulfil a variety of specialist functions. No tongs with these jaw forms come from London.

Type 5 tongs have jaws which run parallel to each other, rather than curving to form an oval-shaped eye. Two objects fitting this broad description, TON06 and TON07, come from London. Beyond this, however, they are both unusual.

TON06 has jaws which step out after the pivot to be the same width as both parts of the handles. On all other tongs from London the jaws are similar in thickness to the arms or the area around the pivot. This is not seen on other Roman tongs, although it would not be obvious on the often schematic depictions of tools in archaeological catalogues. A possible exception is a very similar pair of small tongs from Zugmantel (Pietsch, 1983, Taf. 18, 433). Similar steps are also seen on some Roman dividers (e.g. MOL 50.2/70, 1521, A20891). However, this feature is seen on Medieval tongs (Goodall, 1980, figs 25, 19-24), and there is therefore doubt about the date of TON06. Pietsch (1983, p. 54) considered the Zugmantel object to be suitable for working small metal objects, and a similar function seems likely for TON06.

TON07 has a very peculiar form, being almost symmetrical, and having loops at the end of the arms and hooks at the jaws. An almost identical object, with knob terminals rather than loops, comes from Avenches (Duvauchelle, 1990, No. 13). Duvauchelle (1990, p. 11) was unaware of any parallels, instead tentatively suggesting that the object took inspiration from '*celto-germanique*' culture. The author is not aware of any similar objects from the Iron Age, however, and all of the British Iron Age tongs featured by Fell (1990) and Darbyshire (1995), and those from the Oppidum of Manching (Jacobi, 1974), are of the simple Type 1. This type may therefore have been a Roman period innovation, although a somewhat similar fragmentary object comes from a 12th-13th century context at Winchester (Goodall, 1980, figs 25, 25). Goodall (1980, p. 10) suggests that the Winchester object was for delicate work, although the function of the looped ends remains completely obscure. TON07 is possibly a medical tool.

Type 6 objects are more correctly termed pincers rather than tongs. They have chisel-edged jaws which meet each other directly at the end of an oval eye. Two objects of this type, TON08 and TON09, come from London.

TON09 is a combined pair of pincers and claw hammer. Its Roman date is not certain, as it has no contextual information associated with it. Claw hammers appear to be a Roman innovation (Gaitzsch, 1980, pp. 90–1), and are known from a range of sites (Hanemann, 2014, p. 429), although they are considerably rarer than other hammer types. The form of the pincers is unusual, in that the jaws step out to be the full width of the two halves of the pivot. This is unusual for Roman tools, but is seen on medieval pincers (Goodall, 1980, figs 25, A26). I am aware of no exact matches for this object, although a number of tools combining hammers and tongs were produced in the 20th century. Salaman (1986, fig. 2:160) illustrates pliers with a hammer head attached to the jaws, which were used in shoemaking. Others combining hammers, pincers, axes, screwdrivers etc. were sold as novelty DIY tools, or used in shops to cut toffee or sugar (Salaman, 1975, p. 230). If this object is Roman, a tool combining these functions is likely to have been used by a carpenter or farrier, as both pincers and claw hammers can be used to extract nails.

A final pair of tongs, TON10, have corroded away to nothing, and can only be recorded from X-ray. These may in fact be snips (or metal shears) rather than tongs; hinged tools similar to modern scissors which are used to cut sheet metal (Salaman, 1975, p. 271). Snips are rare in the Roman period, but can be seen in use on a grave stone from an unknown location (Gaitzsch, 1980, Taf. 72, 317), and in excavated examples from Mainz (Gaitzsch, 1980, Taf. 58, 291), and Augsburg-Oberhausen (Deschler-Erb, 2014, Abb. 4, O/1241). However, this identification cannot be made with certainty as the object is too poorly preserved.

Trowels

Technology

Trowels are tools with wide, thin blades attached to cranked (offset) handles. Today, trowels serve two main functions. Trowels are used in construction to carry and spread soft materials such as plaster or cement, especially in brick laying. Trowels are also used for digging; in gardening and, of course, in archaeology. It is unlikely that trowels were used for digging in antiquity, however. Trowels spread across the Northern provinces with the Roman Empire and the introduction of masonry buildings (Duvauchelle, 1990, p. 32), implying that this was their primary function. An early 2nd century trowel from Vindolanda has plaster preserved on the blade (Blake, 2013b, p. 18). Since no Roman trowels have the curved form of modern gardening tools, it seems likely that they remained primarily mason's tools.

Numbers

Six trowels are described here. Five come from the Museum of London. Although catalogued as a Roman object, consultation of archive records revealed that one of these, TRO01, was found in a post-medieval feature, and is probably not Roman. The sixth was found during excavations at Regis House in the 1930s (Waddington, 1954, p. 10), but has since been lost. It has been recorded from Waddington's publication.

Typology

Tanged Trowels

Whilst solid-handled (Pietsch, 1983, Taf. 19, 451-3) and socketed (Pietsch, 1983, Taf. 20, 458; Duvauchelle, 1990, No. 116) trowels are known in the Roman period, all of those from London are tanged. The majority of the London trowels have simple tapering tangs, but two, TRO02 and TRO05 have clenched tangs, indicating that the tangs protruded from the back of the handles. Two trowels, TRO02 and TRO03, retain ferrules.

Several authors have created typologies of trowels, all based on the shape of the blade. Manning (1976b, fig. 5) provides a simple four-part typology, whilst Hanemann's (2014, Abb. 333) is in nine parts. The most comprehensive typology of trowel blade form is that of Gaitzsch (1980, Abb. 15), which is in six main parts, subdivided into 20 subtypes. This typology was also followed by Duvauchelle (1990, pp. 30–2) and Tisserand (2001, p. 36). As Duvauchelle (1990, p. 32) points out, this typology is perhaps too precise for cataloguing the relatively small number of surviving Roman trowels. Many have badly corroded blades, and this is especially the case in

London where only three of the trowels retain their original blade shape. Nevertheless, Gaitzsch's scheme will be followed here as it is the most comprehensive typology available.

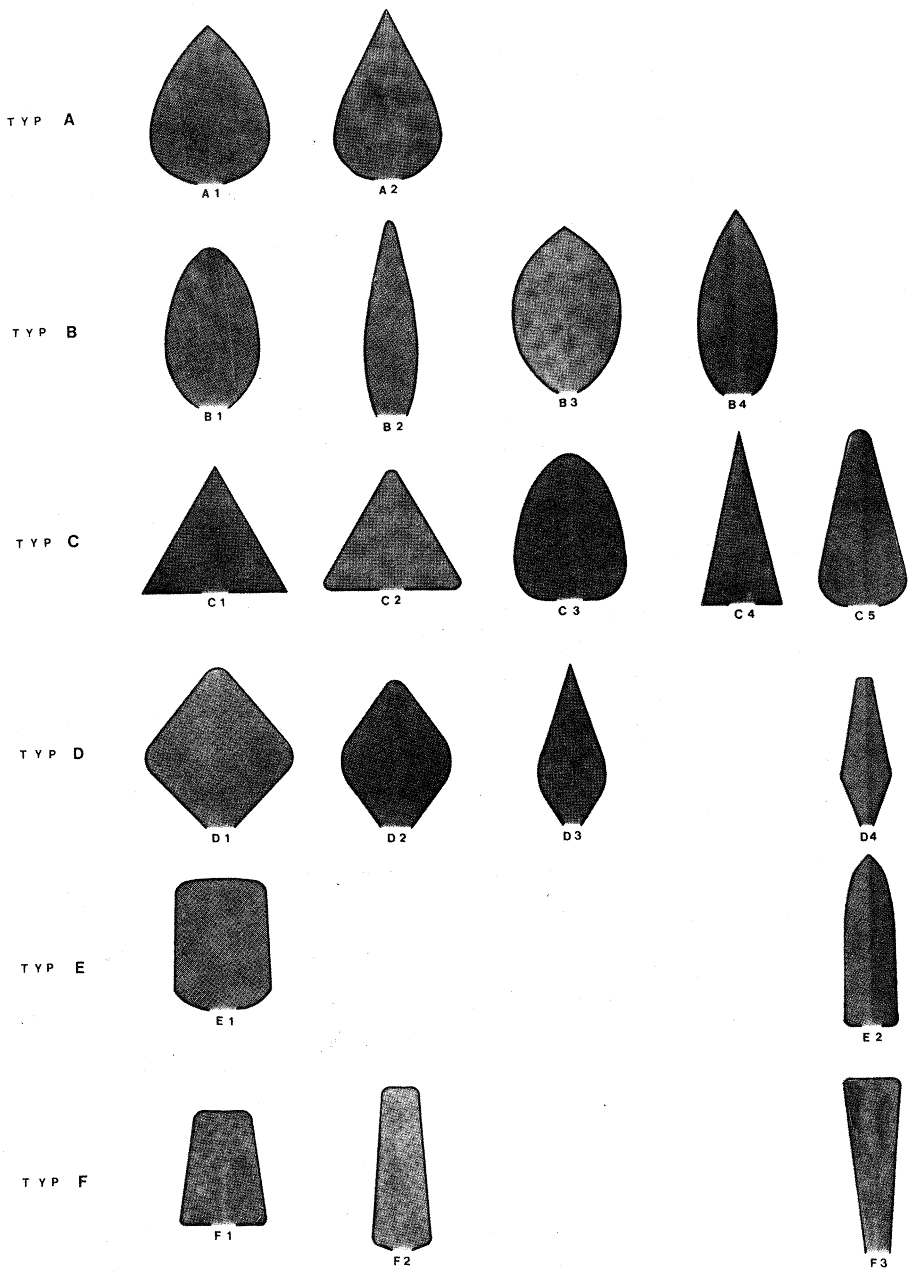


Figure 312 Gaitzsch's (1980, Abb. 15) typology of Roman trowel blade shapes

TRO01 has a **Type B** elliptical blade, although it is too corroded to be confident of which subtype it belongs to. This type is among the most common, with several similar tools coming from across the Empire (Table 110), although TRO01 may not in fact be Roman.

Site	Site Type	Context	Date	Reference
Housesteads (x2)	Military	-	124-410	(Manning, 1976b, fig. 17, 71, 74)
Shakenoak Farm	Villa	-	200-350	(Brodribb, Hands and Walker, 2005, fig. I.34, 31)
Aquileia (x2)	Urban	-	-	(Gaitzsch, 1980, Taf. 40, 189, 193)
Feldburg	Military	-	150-260	(Pietsch, 1983, Taf. 20, 459)
Niederbieber	Military	-	185-260	(Gaitzsch, 1980, Taf. 49, 251)
Novaesium	Military/ Urban	-	-	(Gaitzsch, 1980, Taf. 53, 262)
Saalburg (x2)	Military	-	85-260	(Pietsch, 1983, Taf. 20, 459b, 460)
Zugmantel (x3)	Military	-	90-260	(Pietsch, 1983, Taf. 20, 459a, 460a-b)

Table 110 Comparanda for TRO01.

TRO02-04 all have **Type C** triangular blades. TRO02 has the sharp-cornered equilateral shape of type C1. Gaitzsch (1980, p. 142) was aware of only one example of this type, from Strasbourg, but another comes from Avenches (Duvauchelle, 1990, No. 117). TRO03 strongly resembles TRO02, but has the round corners of Type C2. As this object no longer exists, it is not possible to say whether this was intentional or the result of wear. Gaitzsch (1980, p. 142) was only aware of one other object of this form, from Caerleon (Nash-Williams, 1932, figs 25, 2), although this object is heavily corroded and its blade shape is unclear. The rarity of both of these types may be due to the fragility of their wide blades. Both TRO02 and TRO03 came from waterlogged contexts, which may have ensured their survival. Both of these objects would have been suitable for smoothing plaster as well as laying mortar, their wide blades acting as small floats.

TRO04 has the long isosceles form of Type C4 or C5, although the wear to this tool makes it hard to tell if it originally had sharp or rounded corners. Gaitzsch (1980, footnote 329) cites a number of Continental examples, to which can be added a C5 trowel from Vindolanda (Blake, 1999, No. 3007)

Two further trowels, TRO05 and TRO06, are too corroded for the original shapes of their blades to be ascertained. Other trowels of various forms, often fragments, come from a variety of sites in Britain. Identical trowels were also used in the middle ages (Goodall, 1980, pp. 47–8, fig. 39), however, and there must be some doubt as to the true age of the unstratified examples from London.

Barley Twist Trowels

Three further trowels in the Museum of London (MOL 84.207, 1612 and NN19115) are different from those above in that they have very small leaf-shaped blades at the ends of integral barley-twist handles with looped butts. All are unstratified. Two (MOL 1612 and NN19115) were thought to be Roman, but the third was catalogued as a 14th century object. It is not clear why this date was assigned to it. MOL 84.207 was found at a fly tip in Dagenham, which contained other objects of both Medieval and Roman date. Identical objects were found at a cemetery at the Marne (Champion, 1916, Pl. VI, 12930) (although it is not clear whether they came from a Roman grave), and at La Grava Priory, Bedfordshire. Whilst Roman activity was recorded at the Priory, the trowels came from demolition and abandonment deposits thought to relate to post-Medieval use of the site (Duncan, 2013, p. 45, No. 216). It is therefore doubtful that these objects are Roman in date.

Turf Cutters

Technology

Turf cutters are spade-like tools consisting of a small semi-circular or crescent-shaped blade attached to a long haft. They are easily confused with half-moon shaped leatherworking knives (see p.512), and it is not certain that the objects discussed here are turf cutters rather than lunette knives. Turf cutters have a range of possible uses, the most obvious being to cut blocks of turf for use as fuel or rampart construction. Today they are commonly used in gardening as edging and bordering tools (Manning, 1970a, p. 26; Rees, 1979, p. 331).

The earliest known turf cutter from Britain is from Newstead (Curle, 1911, Pl. LXI, 3; Manning, 1970a, p. 26; Rees, 1979, p. 331), and this tool is thought to have been a Roman period introduction to Britain, brought by the Roman army as part of their standard kit (Manning, 1970a, p. 26; Rees, 1979, p. 331). Nevertheless, the majority of known examples from Britain do not come from military sites, and these tools are common in towns and villas (Rees, 1979, p. 331).

Numbers

Rees (1979, p. 436) interpreted two objects from the Museum of London, LEA01 and LEA02, as turf cutters. Another possible turf cutter, LEA03, is held by the LAARC. However, all are interpreted here as leatherworking knives rather than turf cutters.

Typology

Turf cutters come in a range of sizes and shapes, but the possible British examples can be divided into two broad groups based on the shape of the blade (Figure 313).

Type 1 has a narrow blade (c.100-130mm wide) with heavily curved horns. The long sockets on some examples of this type confirm that these are turf-cutters, not leatherworking knives. No examples of this type come from London, although they are common elsewhere in the country (Rees, 1979, fig. 132a, 133, 134).

Type 2 has a wider blade with less heavily curved horns. Because of their less distinctive shape, objects of this type cannot be definitively stated not to be leatherworking knives. The two objects of this type from London (LEA01-02), which Rees (1979, p. 436) interpreted as turf cutters, are instead interpreted as leatherworking knives on account of their short tangs. LEA02 in particular is nevertheless closely paralleled by an example from South Shields, which Rees (1979, fig. 135) also interpreted as a turf cutter.

Another type of tool, represented in Britain by an example from the Great Chesterford hoard

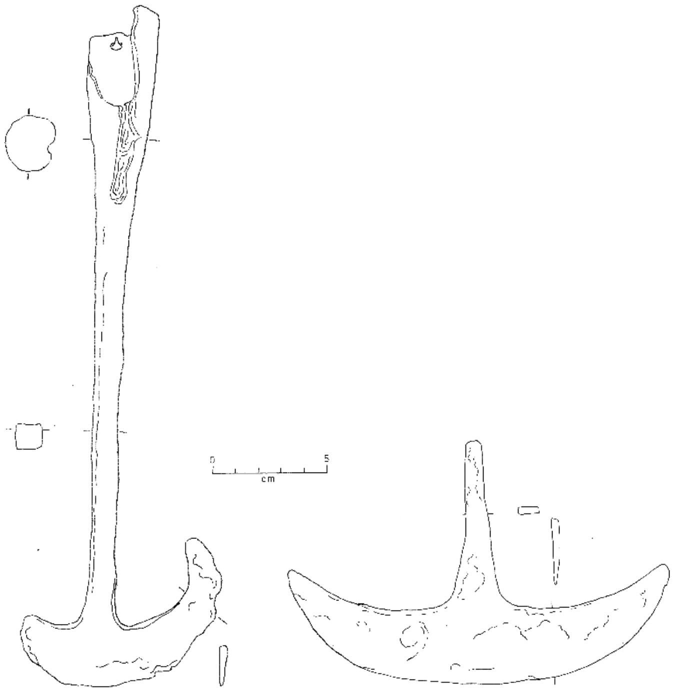


Figure 313 Turf cutter types. Left, Type 1 (Housesteads, Rees, 1979, fig. 132a). *Right, Type 2* (South Shields, Rees, 1979, fig. 135).

(Neville, 1856, Pl. 1, 11), has also been seen as a turf cutter (Manning, 1970a, p. 26; Rees, 1979, p. 332), although its shape is completely different to those of the types discussed above. A similar object from London, SPU01, is discussed amongst the spuds (see p.592).

Tweezers

The objects under discussion here are large tweezers. Tweezers had a wide range of functions in the Roman period, including in cosmetic/toilet sets and surgical equipment. These objects fall outside the scope of this study, which is only concerned with large tweezers which may have had a role in craft or industry. As such, those presented here are only substantial iron tweezers with a complete length over a nominal boundary of 100mm. These objects are generally interpreted as metalworking tools (Wilmott, 1991, p. 128), and they have been found in ironwork hoards (Schaeffer, 1927, fig. 1e), and in ethnographic metalworking kits (for example, in the Pitt Rivers Museum). However, they have a range of other potential uses outside of this (Humphreys in Marshall and Wardle, forthcoming), and cannot be connected with certainty to metalwork.

Numbers

Thirteen pairs of large tweezers come from London; ten from the Museum of London and three from recent excavations by MOLA.

Typology

Large tweezers can be divided into two main types: omega-shaped and welded.

Omega-shaped tweezers are made of a single piece of iron, usually a flat rectangular-sectioned strip, bent into an omega shape similar to that seen on some types of shears (see p.569). This is the most common type, with 11 examples from London (TWE01-11). TWE01 and TWE02 have iron suspension loops in the springs. TWE08 differs from the other objects of this type in being made of a round-sectioned bar rather than a flat iron strip. This tool also has a collar near the spring, which may have been used to lock the arms in place, although it is currently obscured by corrosion. Comparable objects in iron and copper alloy come from Bays Meadows (Lloyd-Morgan, 2006, fig. 136, 12), Chichester (Down, 1989, fig. 28.3, 28), Pompeii (Allison, 2006, Pl. 73, 5), and Seltz (Schaeffer, 1927, fig. 1e), whilst Petrie (1917, Pl. LXIV) figures several more, some with suspension loops.

Welded tweezers are made either of two separate pieces of iron, welded together at one end, or by bending one bar in half and welding the bend. Two objects of this type, TWE12-13, come from London.

Twitches

Technology

The object described here, TWI01, has had several interpretations attached to it in the past; as a pair of tongs, as nutcrackers or as a torture device (Francis, 1926, pp. 96–7). The longest-held interpretation, and the one given in the current display at the Museum of London, is that this object functioned as a ritual castration clamp for the priests of Cybele (Francis, 1926). However, they cannot have functioned as castration clamps, as most examples do not close fully (Heeren, 2009a, p. 91).

Heeren (2009a) has recently persuasively argued that these tools should be seen as twitches. A twitch is a tool used to clamp the upper lip of a horse. This has the effect of calming the horse, and is normally employed during grooming or veterinary work (Heeren, 2009a, pp. 87–8). Twitches are thought to work by releasing endorphins, in a similar way to acupuncture (Lagerweij *et al.*, 1984).

Figure 314 A modern 'humane' twitch in use. Left (https://www.paulickreport.com/wp-content/uploads/2016/08/Twitch.jpg). Right (http://www.leedstone.com/media/catalog/product/e/q/equine_humane_twitch_m00-1707_c_1.jpg).

That they are twitches is strongly suggested by a relief on an altar from Aix-en-Provence, which shows a twitch between two grooms tending to horses (Heeren, 2009a, p. 90). This relief also shows that the hole at the end of the handles of these tools would have held a length of rope, like a modern twitch (Figure 314), rather than the screw mechanism previously conjectured (Roach Smith, 1844, p. 549; Francis, 1926, fig. 3).

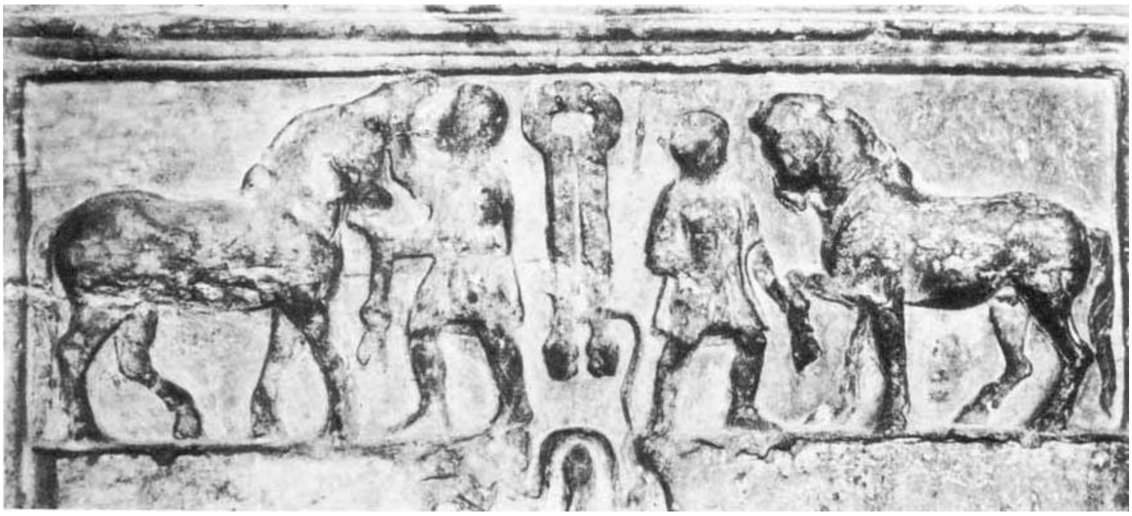


Figure 315 Relief from an altar from Aix-en-Provence, showing a twitch (centre) between two grooms and their horses (Heeren, 2009a, fig. 2).

Typology

A number of twitches are now known from the Roman world, in both copper alloy and iron (Heeren, 2009a, fig. 5), but no two are exactly alike. The London twitch is unique in its elaborate decoration, consisting of cast busts of animals and deities (Figure 316), which have been linked to the cult of Attis-Cybele (Francis, 1926). The uppermost busts have been interpreted as the 'Divine mother' and 'Divine consort' (Attis-Cybele), the presiding figures of the cult. The eight busts on the handles are thought to represent the 'Astral cult', through representing the days of the week (with the addition of Ceres to even out the numbers), and/or the five planets, sun, moon and stars (Francis, 1926, p. 103). This tool was dated by Francis (1926, pp. 101–2) to the 2nd-3rd century, on the basis that this is when the 'Astral cult' was popular. The object has been repaired, and so may have been deposited later.

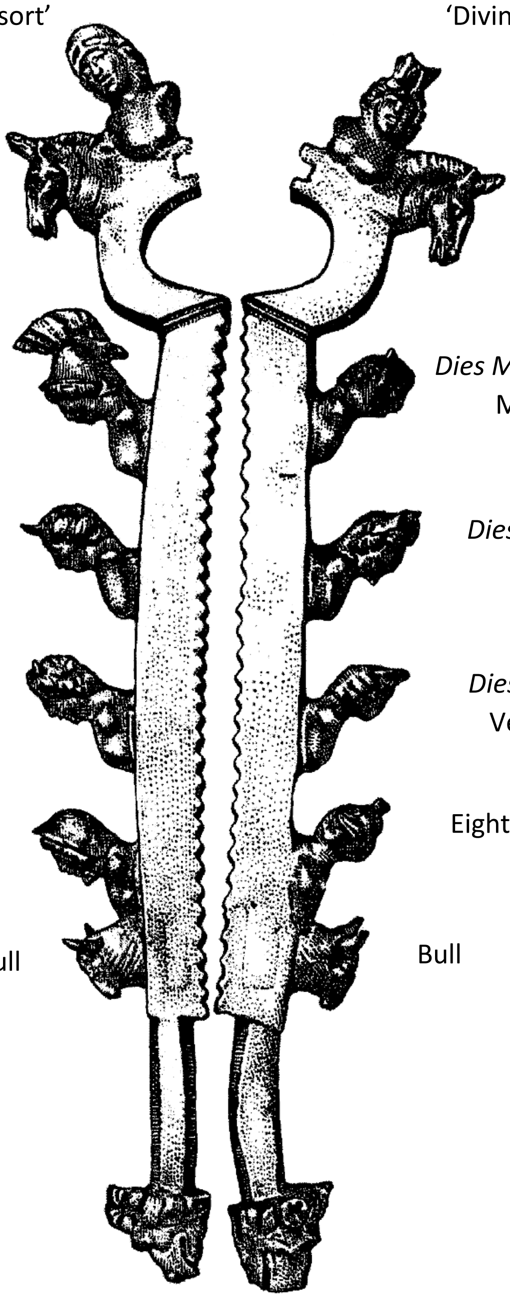


Figure 316 Annotated drawing of the twitch TWI01 (Francis, 1926, fig. 3, with modifications).

Wedges

Wedges are simple tools that are used in a variety of industrial tasks. They can be used to split logs into planks (Salaman, 1975, p. 503), and to split stone in quarrying and carving (Blagg, 1976, pp. 154–5; Wooton, Russell and Rockwell, 2013, p. 3). Both operations involve hammering a series of wedges in a line along the desired point of fracture. Wedges are used in tree felling, where they are hammered into a cut behind the saw in order to increase the size of the gap, preventing the saw from becoming lodged. This also directs the way in which the tree falls (Salaman, 1975, p. 503). Wedges can also be used as hot or cold sets in metalworking (Manning, 1985a, p. 9).

One wedge, WED01, comes from London. It is an extremely robust tool, and could have been used for splitting stone, although perhaps its most likely use in London would have been as a woodworking wedge or metalworking set. Another tool, ADZ08, was probably originally the blade of an adze hammer (see p.371). However, burring to the broken edge shows that it was reused as a chisel or wedge, perhaps by the woodworker whose tool it was when it broke.

Decoration

A small number of tools from London are decorated. Of the objects catalogued, those not thought to be related to craft are much more frequently decorated than those which are tools in the strictest sense. Type B2 wax spatulas almost always have some form of decoration, often bands of hatching, incised lines and bronze inlay around their handles. Type C spatulas all have a very formulaic decorative scheme of notches and lines at the shoulder. Three-piece tongs and related objects are also often decorated with notches and rocked lines (Humphreys and Marshall, 2015, p. 9).

Only 10 true tools have surface decoration of some kind (Table 111). Easily the most elaborately decorated is TWI01, which is decorated with cast busts of gods and animals on both handles. This decoration references the days of the week, and may relate to the possible religious function of this tool (Francis, 1926). The remaining tools have much simpler decoration, consisting of incised lines and notches cut into the corners. This decoration could have been achieved by filing or forging, so it is uncertain whether it was added at the point of manufacture or by the owners of these tools. This decoration is always on the 'handle' elements of these tools, and not on the blades or working edges. It is likely that a higher proportion of tools had decoration of some form on their organic handles, although this has not survived. The curry comb CUR01 has incised lines on its wooden handle. Nevertheless, the majority of the tools from London appear to have been unadorned.

Cat. No.	Object Type	Decoration
AWL007	awl ; type 1.2	Incised lines and edge notches
AWL021	awl ; type 1.5	Incised lines, edge notches and extended langets
BOR39	drill bit ; type C-3.5	Edge notches
BRU01	brush handle ; type 2	Central bead and incised lines
BRU07	brush handle ; type 3b	Edge lines
CHI16	chisel ; type A-6	Incised reversed-'Z' and potential struck-through 'X' on opposing sides of handle
CUR01	curry comb	Turned lines on handle
GOU10	gouge ; solid handled ; type 3	Edge notches and incised lines.
HOL04	punch ; hole punch ; type 3	Incised lines
TWI01	Twitch	Cast busts of gods and animals

Table 111 Decorated tools from London.

Makers' Marks

Makers' marks (also referred to as makers' stamps) are impressed marks made on objects at the point of manufacture. These marks are found on a wide range of object types, and may have had diverse functions. Stamps on pottery, glass and leather are typically associated with workshop organisation and the need to mark objects in 'communal' kilns, tanning vats etc. (Rhodes, 1987; DeRose Evans, 1998, pp. 259–61; Hartley and Dickinson, 2008). However, the extreme variability with which different samian vessel types are stamped is a source of confusion, and the true reasons behind marking these vessels are unknown (Hartley and Dickinson, 2008, pp. 8–9, 22–3). It has also been suggested that stamps were used as a form of proto-trade-mark or customs markers, although this is now considered unlikely (DeRose Evans, 1998, p. 260). Stamps on metal objects may have been used slightly differently, however. With no need for communal kiln firing etc., they are unlikely to represent workshop organisation. As stamps are mainly found on particularly well-made tools, they are thought to have been marks of quality (Hanemann, 2014, pp. 477–80), particularly for items which were exported beyond local markets, and which faced competition from other manufacturers (Gostenčnik, 2002, p. 231).

The most common makers' stamps are rectangular depressions containing raised letters, usually giving the name of the manufacturer. Other types of makers' stamp include rosettes, circular lettered stamps, and bronze inlays (Gaitzsch, 1980, pp. 262–7; Hanemann, 2014, pp. 477–80), but none of these were found on the London tools. Rectangular stamps are found on a range of artefact types, most prominently on pottery (Hartley and Dickinson, 2008), but also on bronze vessels and steelyards, and a range of iron objects (Hanemann, 2014, pp. 477–80; Hanemann and Petrovsky, 2015). Stamps are found more commonly on tools than other metal artefact types (Hanemann, 2014, pp. 477–80), appearing on a wide range of types. Stamps on pottery, glass and metal vessels have been intensively studied (DeRose Evans, 1998, pp. 259–61; Hartley and Dickinson, 2008), and related to the organisation of the manufacture and distribution of these artefact types. However, whilst catalogues of known stamps on tools have been given by Gaitzsch (1980, pp. 262–7) and Hanemann (2014, pp. 482–3), no comprehensive survey or study has ever been carried out on them.

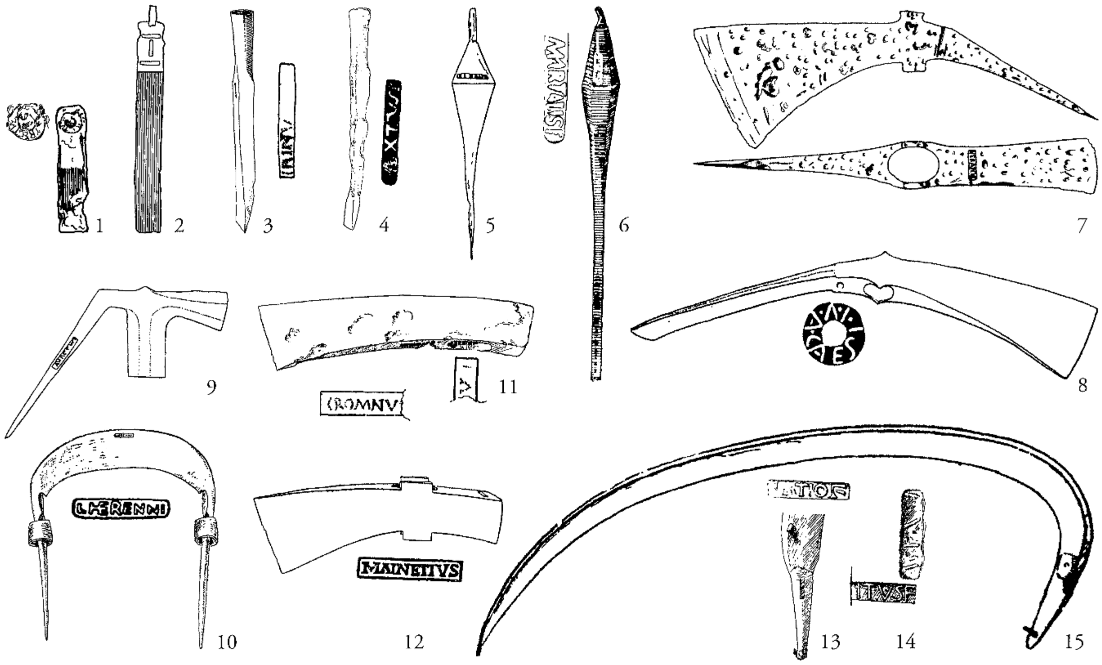


Figure 317 Roman tools with makers' stamps (not to scale, Hanemann, 2014, Abb. 390).

Stamps on iron tools were impressed whilst the object was hot from the forge. Dies for making this kind of stamp have been found in a range of materials, including bone, pottery, and wood (Hartley and Dickinson, 2008, p. 10), but those used on metal objects will have required harder striking, and were probably made of iron. An iron die of this type, DIE01, comes from London, but does not match any of the stamped tools, and may have been used for marking ingots (Wright, 1984). These stamps are almost always placed on visible parts of tools (Gaitzsch, 1980, pp. 262–7; Hanemann, 2014, pp. 477–80) (i.e., those not covered by organic handles). The London tools demonstrate that there were established conventions about the placement of stamps. On both chisels and bradawls the stamp is always placed on a rear facing surface of the handle or blade.

Figure 318 DIE01, from London. The striking face reads 'MPBR' © Museum of London.

Makers' Names in London

Twelve of the tools from London have makers' stamps, six of which are legible, giving five different names of tool makers (Table 112). Notches and other marks, which can be made when the metal is cold, are not discussed here.

Stamp	Cat. No.	Object Name	Location	Inscription
	AWL002	bradawl ; type 1.1	Rear face of handle	Illegible.
	AWL003	bradawl ; type 1.1	Rear face of handle	'TITVLI'
	AWL010	bradawl ; type 1.3	Rear face of handle	'...INI...'
	AWL019	awl ; type 1.4	Four stamps on rear faces of handle	Illegible.
	BRU03	brush handle ; type 2	Blade	'HERMAE'
	BRU07	brush handle ; type 3b	Handle	'AGATHANGELUS F'
	CHI09	chisel ; type A-4	Rear face of handle	'MARTALIS F'
	CHI29	chisel ; type C-2	Rear face of blade	'APRILIS F'
	CHI31	chisel ; type C-2	Rear face of blade	'MARTIAL...'
	CHI44	chisel ; type E-6	Rear face of blade	Illegible.
	HOL01	punch ; hole punch ; type 1	Handle	Illegible.
	WXS07	spatula ; wax spatula ; type A	Blade	Illegible.

Table 112 Stamped tools from Roman London.

Roman names are thought to have followed a legally enforced structure, with citizens having a three-part (*tria nomina*) or two part (*duo nomina*) name, composed of a forename (*praenomen*), family name (*nomen*) and personal name (*cognomen*). Non-citizens had only a single name (Hartley and Dickinson, 2008, p. 17). However, whilst makers' stamps usually only show one name, it is often unclear whether this represents a non-citizen's single name or the *cognomen* of a citizen (ibid.). It is also unclear whether these names relate to the people who physically made the stamped objects. Stamps on samian pottery have been interpreted as marks made by out-workers producing piece work for a workshop owner, whose name is on the stamp (Hartley and Dickinson, 2008, p. 23), and it is possible that stamps on metalwork refer to workshop owners rather than individual craftsmen. Stamps are not thought to have continued in use as ‘brand names’ or ‘trade marks’ after the death of the craftsman named on them (Gostenčnik, 2002, p. 228).

Agathangelus

Agathangelus is one of the best understood Roman metalsmiths to have stamped their work, thanks to the work of Gostenčnik (1997, 2002). *Agathangelus* is thought to have been an inventor as well as a bronzesmith, creating new types of tweezer and brush handle (Gostenčnik, 2002, p. 229). These objects may have been used in gilding with gold leaf (Raux, 2015), although this is not certain. These objects were exported widely across Europe, and possibly as far as Spain (Gostenčnik, 2002, fig. 1). *Agathangelus* is thought to have operated in southern Gaul (Gostenčnik, 2002, p. 229), objects stamped with this name from Magdalensberg (Kärnten, Austria) show that the workshop operated from at least the 30s AD, and production had probably ceased by the time of the Pompeiian eruption 40 years later (Gostenčnik, 2002, p. 228). Gostenčnik (2002, p. 231) lists at least 25 examples of stamped *Agathangelus* products, including two small tweezers from London (Gostenčnik, 2002, fig. 9, 2, 5), not included in this study. Several different *Agathangelus* stamps are known. The stamp on BRU07 reads ‘AGATHANGELVS F(ecit)’, with a ligatured T-H. The same stamp can be seen in Vindonissa (Gostenčnik, 2002, fig. 3, 10). BRU07 was dated 65-80 AD, and may therefore have been imported to Britain after or towards the end of *Agathangelus’* life.

Aprilis

The stamp on CHI29 has been read as ‘APRILIS F’ (Collingwood and Wright, 1991, RIB 2428.2), but the stamp is very unclear, and all that can be made out with certainty is ‘A…SF’. Another chisel stamped with the name ‘APRILIS’ comes from Magdalensberg, Austria (Gaitzsch, 1980, p. 264). This site was occupied for only a short period of time, from *c*. 40 BC – AD 50 (Dolenz, 2012). If they were made in the same workshop, this would imply that CHI29 was a Continental import, perhaps produced before the foundation of London itself. That CHI29 may be imported is also implied by its highly unusual Type C-2 form, although CHI31, which is of the same form, was possibly made in London (see p.625).

Hermes/Herma

BRU03 displays a fragmentary stamp reading ‘…ERM…’, which can be expanded to ‘HERMAE’ based on similar stamps seen on an object of the same type from Pompeii (Gostenčnik, 2002, fig. 4, 2). This has been read as the genitive form of *Hermes* or *Herma*, which Gostenčnik (2002, p. 246) interprets as ‘a typical slave’s or freedman’s name’. The name stamp is paired with another stamp, which is poorly preserved but appears to depict a columned building, possibly a temple or shrine. Gostenčnik (2002, p. 247) interprets this as ‘a triangular pediment, with one column on each side and a statue visible between them’, although this is not obvious. This may be the emblem of a company, and possibly continues a Hellenistic or Republican tradition (Gostenčnik, 2002, pp. 246–7). Little is known about the *Hermes* workshop as only two finds are known. The fact that the other example was found in Pompeii suggests that BRU03 (deposited c AD 125-160) was deposited sometime after the workshop had ceased manufacturing.

Martial

Two chisels from London, CHI09 and CHI31, bear stamps with the name *Martial*. It is possible that these tools were made in the same workshop, although this is not certain as both stamps were made with different dies. CHI09’s stamp omits the ‘I’, whilst CHI31’s stamp has a more heavily ligatured M-A. The tools are also of different types. CHI09 is of the comparatively common Type A-4. CHI31 is a unique variant on the rarer type C-2. CHI31 is unique amongst objects of this type in having heavily bevelled edges on the swollen part of the blade. Bevelled edges are characteristic of Type A-4 chisels, however. It would make sense to see these chisels as products of the same workshop, as the skills needed to make both objects are the same. No other tools with this name stamp are known to the author, and it is therefore possible that these tools were manufactured in London.

Titulus

AWL003 has a well preserved stamp, the background of which has been coloured at some stage to make the text stand out. Currently it appears to have been stamped with the name ‘TITVI’, after which there is a separate cell containing a ‘+’ sign. I know of no other maker’s mark which is divided into two cells in this way. In the past, the border between the two cells has been interpreted as a letter, and the stamp has been variously read as ‘TITVLI’ (Wheeler, 1930, p. 76; Gaitzsch, 1980, p. 266) or ‘TITVLI M’ (Collingwood and Wright, 1991, p. 61). Collingwood and Wright (1991, p. 61) read the name as *Titulus*, a variant of the more common name *Titullus*. This name is not featured on any of the tools catalogued by Gaitzsch (1980, pp. 262–73), and it is possible that this represents the name of a London tool maker.

…INI…

AWL010’s stamp is mostly illegible. It appears to have ‘skipped’ when struck, and has left a misaligned fragment of the stamp superimposed over another beneath. The fragment has been read as ‘…INI…’ (Wheeler, 1930, p. 76) but this is not obvious.

Discussion

Although stamps can be found on a wide range of tool types, it is noticeable that the largest number from London come from woodworking tools; bradawls and chisels. Moreover, these are tools associated with fine work, particularly unusual forms of paring chisel. This may indicate the importance of fine carpentry in London, with carpenters investing in fine tools from specialised producers. The other stamped tools from London also appear to relate to fine work. Brushes may be associated with gold leaf working (Raux, 2015), whilst the hole punch HOL01 is of a sort employed to make elaborate openwork footwear, and possibly to decorate metalwork.

Some of these tools are probably imports from Continental Europe. It is interesting to consider that craftsmen could import specialist tools from European producers in the early Roman period. However, it seems likely that others relate to local production. That metalworkers stamping their work were operating in London is shown most clearly by the work of *Basilius*; a knife maker, five of whose stamped products have been found, all in London (Wardle, 2011c, p. 392; Scott, 2017, p. 316).

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