INTRODUCTION

The rural economy of Roman Britain may well have been almost wholly based upon arable and pastoral farming, but there is also evidence for many different craftworking and industrial processes being carried out in the countryside (cf. Taylor 2007, 115–17). These range from industries associated with mineral extraction, processing and production (e.g. iron, copper, lead, stone, clay/ceramics, salt, etc.), to a multitude of other crafts (e.g. leatherworking, textile production, basketry etc.) and correlated practices (e.g. woodland management and charcoal production). The scale of most of these operations was relatively minor, often part of a general household-level economy, yet there were also larger, more complex, industries in some regions that would have had major impacts on the economies and social systems of their surrounding settlements. Some of these industries (e.g. Black-Burnished ware pottery, Wealden iron industry, etc.; see below) formed part of wider resource supply networks across the whole of the Roman province, and possibly even beyond, occasionally having explicit or implied associations with the Roman military/state. The degree to which the state dominated industrial production remains uncertain and probably varied over time and space. For the most part, however, the evidence does not suggest the wholesale, official exploitation of all industries, and it is likely that there remained a more complex mix of often smaller scale entrepreneurial operations, run by local landowners as part of an increasing economic diversification seen within parts of Roman Britain.

The analysis of evidence for crafts and industry collated as part of the current project remains at a relatively coarse level, being restricted to the general site-type categories and associated attributes outlined in Table 5.1.

Greater detail on the nature and chronology of the relevant industry or industries within each site is provided, where possible, in the summary fields of the database, so that the scale and development of such activities can be determined across England and Wales from the late Iron Age to the end of the Roman period. The data collected also allow us to examine the various crafts and industries within the context of any associated settlement (farmstead, villa, etc.), where this has been determined, and therefore provide some insight into the social context of, for example, pottery or iron production, and the organisation of such activities within settlements. The ability to conduct such analysis remains one of the great benefits of concentrating on the excavated evidence, though, as will be discussed below, this will not always provide a 'complete' picture of our knowledge of Roman rural industries, with other strands of evidence coming from isolated finds (e.g. lead or copper ingots with Latin inscriptions) or concentrations of industrial material (e.g. slag) found during fieldwalking exercises. The excavated evidence from Roman rural sites will be assessed alongside some of this alternative evidence in the accounts of the various industries presented in this chapter. It must be reiterated, however, that this is far from a comprehensive survey of all Romano-British industry (readers are referred to existing publications below), but will instead concentrate largely on those areas where recent, primarily developer-led, excavations have most advanced our knowledge.

TABLE 5.1: RECORDED AND QUANTIFIED ATTRIBUTES ASSOCIATED WITH ROMAN RURAL CRAFT AND INDUSTRY

<table>
<thead>
<tr>
<th>Craft and industry site-type categories</th>
<th>Other industry attributes recorded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron production (extraction &amp; smelting)</td>
<td>Structure interpreted as a workshop?</td>
</tr>
<tr>
<td>Other metals production (all stages of production and working: lead, copper alloy, tin, pewter, gold, silver)</td>
<td>Presence of kiln?</td>
</tr>
<tr>
<td>Pottery production</td>
<td>Pottery/tile wasters present?</td>
</tr>
<tr>
<td>Tile production</td>
<td>Presence of slag?</td>
</tr>
<tr>
<td>Salt production</td>
<td>Evidence for metalworking? (including smithing)</td>
</tr>
<tr>
<td>Other production (glass, lime, jet, shale, stone)</td>
<td>Evidence for bone/antler working?</td>
</tr>
<tr>
<td>Quarry (clay, limestone, ironstone etc.)</td>
<td>Quantification of tools (punches, awls, bits, etc.)</td>
</tr>
</tbody>
</table>
THE IRON INDUSTRY

Iron production within Roman Britain has received a great deal of attention (e.g. Cleere and Crossley 1985; Clough 1986; Sim and Ridge 2002; Schrüfer-Kolb 2004; Hodgkinson 2008; Bray 2006; 2010). This undoubtedly reflects this metal’s immeasurable importance in all aspects of Romano-British life, used for construction materials (iron nails, joiners dogs etc.), craft and agricultural tools, weapons, wheeled transport, and all manner of domestic objects (cf. Scott 2017, 304–14). The mining, production and smithing of iron has also been argued to have held ritual associations, with Hingley (2006, 217) using ethnographic parallels to suggest that ‘iron production is imbued with beliefs about the social and ritual meaning of the act of creation’ (see Vol. 3 for further discussion).

It has been estimated (based on a population for Roman Britain of 3.6 million; cf. Smith and Fulford 2016, 416) that 5,400 tonnes of iron may have been produced every year in the province, with up to 150,000 people involved in the wider industry (from mining and smelting to artefact production and charcoal production; Sim and Ridge 2002, 23–4). Although still dwarfed by the numbers of people involved directly with agriculture, this nevertheless represents a significant industry within the province, especially within those areas having large tracts of natural iron ore. The organisation of the iron industry in Roman Britain remains ill understood; despite possible imperial ownership, the wider empire never seems to have had any overarching administration for mining and quarrying, with much of the organisational measures being ‘initiated by men-on-the-spot with the occasional intervention of the Roman emperor’ (Hirt 2010).

By the reign of Commodus (A.D. 180–92), some iron mines may have been managed under an equestrian procurator ferrariarum covering various provinces (with duties including ensuring the army was well supplied with iron; ibid.), but there is as yet no specific record of imperial administrative personnel for iron mines in Britain. Aside, perhaps, from some sites in the Weald and the Mendips (see below), most iron production in Roman Britain is likely to have been carried out within a framework of non-official exploitation.

FIGURE 5.1 shows the distribution of all 202 excavated sites with evidence for iron production.
included in the current database. In this sense iron production is taken as meaning all aspects of the ironworking process prior to smithing (i.e. mining, ore roasting and smelting; see Dungworth 2016 and Sim and Ridge 2002, 18-21, for further information on the iron production and smithing processes). Actual evidence for iron ore extraction is relatively uncommon, though shallow, open-cast pits (the typical method for ore extraction in most areas) have occasionally been found in association within iron production sites, especially in the East Midlands, such as the ironstone quarry pits found near to a courtyard villa at Bedford Purlieus Wood, Thornhaugh near Peterborough (Hogg 2010). Aside from a very small number of sites that seem only to have evidence for iron ore extraction (e.g. Lydneypark, Gloucestershire: Scott-Garrett 1959), all iron production sites in the database have some evidence for smelting, usually interpreted on the basis of diagnostic slags. While the quantities of slag recovered are not always at a level to confirm that smelting actually occurred within the excavated area, it suggests that this activity was taking place in the near vicinity. At c. 45 per cent of these iron production sites there was also evidence for a smelting furnace.

Unlike most other metals (copper, lead, tin etc.), sources of iron can be found over wide areas of England and Wales, which accounts for the relatively dispersed distribution of iron production sites. There are, however, three more extensive areas of iron ore with well-known concentrations of Roman ironworking sites: the Weald, the East Midlands and the Forest of Dean (Fig. 5.1). Iron production in these areas has been studied at length, particularly the East Midlands (Condron 1997; Schrüfer-Kolb 2004) and the Weald (Cleere and Crossley 1985; Hodkinson 2008; 2017), with over 200 and 100 ironworking sites identified respectively. The Forest of Dean iron industry has been less comprehensively studied, but there are still c. 100 known sites within a relatively restricted area (Walters 1992, 62–108; 1999).

Relatively few iron production sites in the High Weald have been subject to recent excavation (or at least had the results disseminated), though two investigations on the Low Weald around Ashford have revealed important nucleated sites. At Park Farm East, a later Iron Age to early Roman ‘village’ type settlement had evidence for an iron smelting and smithing area, including a furnace (Powell 2011a), while nearby at Westhawk Farm a roadside settlement developed soon after the conquest, with rectangular plots containing timber buildings, some of which were used for iron smelting and smithing (Booth et al. 2008). It was thought that this settlement was closely connected with the Wealden iron industry, and both went into decline at about the same time, in the mid-third century A.D. (ibid., 395; see below).

As with the Weald, little recent work has been carried out in the core Forest of Dean ironworking area, though large-scale evaluations east of Lydney (c. 1 km west of the River Severn) revealed elements of an extensive late Romano-British settlement most probably primarily concerned with iron production, occurring in defined plots and structures (Barber 2009). A little further afield, much work has been carried at Dymock since 1995, where a roadside settlement above the floodplain of the River LeaDon contained workshops associated with metalworking (iron smelting and copper-alloy working; Catchpole 2007), while many years of investigation within a major industrial roadside settlement at Weston under Penyard (Ariconium), Herefordshire, have now been published (Jackson 2012). More recent archaeological work has been carried out in the East Midlands iron ore zone, including major excavations and evaluations near Weldon, Northamptonshire, revealing an extensive late Iron Age smelting complex (Hall 2006), and concentrations of slag and furnace debris ‘on an industrial scale’ found east of a Roman villa (C. Jones 2011, 26).

Outside of these three key zones, relatively extensive iron ore deposits are known from Exmoor, north Oxfordshire, the Cleveland Hills, South Wales and Cumbria, the latter having some 300 known bloomeries, though few of these have been dated to the Roman period (e.g. Eskmeals Sand-Dunes; Cherry 1966). Smaller outcrops of iron ore are known elsewhere, and were exploited during the Roman period, including those in the Vale of York (Halkon and Millett 1999), North Bristol coalfields (Holbrook 2006, 112–14), the Blackdown Hills in Devon (Griffith and Weddell 1996) and in the Mendips in Somerset, where it was extracted and smelted alongside much larger scale lead production, both probably being under direct state control, at least during the early Roman period (Todd 1995, 41; see Lead production below, p. 192). There are also many areas of bog iron ores (formed in oxygen-poor, waterlogged deposits), which seem likely to have been an important resource for some iron manufacture in areas such as North Wales and the Chilterns (Kelly 1976, 130; Dungworth 2016, 540). The evidence for iron production from most of the Chilterns sites shows it was apparently on a quite restricted scale (e.g. smelting slag from Aston Clinton Bypass Lower Icknield Way Site B; Masefield 2008), though slightly more intensive production was indicated near to a Roman villa at Mantles Green, Amersham (Yeoman and Stewart 1992) and the ill-understood roadside settlement...
at Cow Roast alongside Akeman Street contained significant amounts of smelting slag and furnace debris, which suggested relatively large-scale iron production during the early to mid-Roman period (Hunn 2004).

**CHRONOLOGY OF IRON PRODUCTION**

In many areas of England and Wales iron ore was already well exploited for production prior to the Roman conquest, and there is evidence for the existence of specialist workers and craftsmen, with control probably resting to a large extent in the hands of the local elite (Clough 1986; Bray 2006, 272). The scale of iron usage at this time is hard to determine, but even in the south-east the quantities are thought to have been relatively small compared to the continental Iron Age (Scott pers. comm.), where large volumes of trade iron have been found (Berranger and Fluzin 2011, fig. 1). The problems of dating iron production to the British Iron Age are manifold, with associated datable pottery not always forthcoming (and often broadly dated, even in south-east England; cf. Hodgkinson 2008, 28) and radiocarbon dates being few and far between. Within the current dataset over 40 sites have some evidence for pre-conquest iron production, including slight concentrations in the Weald and in the East Midlands, such as the example at Weldon noted above (FIGS 5.2 and 5.3). Most appear to have been relatively small scale, with single, simple bowl furnaces, though recent excavations at Sadlers End, Sindlesham, Berkshire, revealed considerable quantities of slag (1400 kg recovered, thought to represent around 5 per cent of the total amount) and a number of furnaces dated through radiocarbon and archaeomagnetic methods to the middle to late Iron Age (Lewis et al. 2013).

Although already relatively well established as an ‘industry’, the scale of iron production nevertheless increased dramatically in most areas after the Roman conquest, with growth arguably occurring within the context of quite a different economic system, with production in some areas at least geared much more to the market (Scott pers. comm.). This may initially have been stimulated by the Roman army, with its need for continual supplies of iron (for weapons, tools, building fixtures etc.), which may account for the major expansion of iron production in parts of the Weald, seemingly very soon after the conquest (Cleere and Crossley 1985, 56–7; Hodgkinson 2008, 30–1; 2017, 286) (FIG. 5.3). This rapid growth and the huge scale of some ironworking sites here, along with the close association noted (through stamped tiles) with the *Classis Britannica* fleet based (in Britain) at Dover, has been taken as suggesting direct official involvement by the Roman state in the Wealden iron industry (at least in the eastern Weald), possibly as part of an imperial estate (Hodgkinson 2008, 32–3). As with other hypothesised imperial estates in Britain, there is no direct evidence for this, though some measure of state control over certain large-scale production sites through the *Classis Britannica* seems likely, albeit not necessarily during the early post-conquest period (cf. Millett 2007, 178–9; Hodgkinson 2017, 289). Elsewhere, there have also been more tenuous suggestions of official control of the Forest of Dean iron industry, at least during the early Roman period when there was a similar major expansion of ironworking sites. A high-status building excavated at Blakeney, dated c. A.D. 75 to 150, was argued, somewhat unconvincingly, to be an administration centre for a high-ranking official overseeing the local mining industry (Walters 1992, 77–8).

The continued expansion of iron production into the second and third centuries A.D. is quite evident in all areas (FIG. 5.3), undoubtedly sustained, as Scott has recently argued, by an ‘increased demand for ironwork of all types as a consequence of new patterns of consumption amongst elements of the native British population’ (Scott 2017, 304). These new patterns of
consumption brought with them new economic opportunities in areas where iron production was viable. In a recent study, Bray (2010) noted the price of iron recorded in one of the Vindolanda tablets (90 Roman pounds (29 kg) of iron for 32 denarii; Tabl. Vindol. 183), comparing it with other commodities to suggest a very high relative value, arguing that this represented a distinct opportunity for those with the requisite skills to potentially increase their wealth and social standing. Of course the social and economic organisation of iron (and other metal) production in the Roman province remains largely unknown, so any opportunities for financial or social gain may only have been appreciated by already wealthy landowners (or retired legionary veterans; cf. Verboven 2007), rather than the workers themselves, this perhaps particularly being the case in parts of the Forest of Dean and the West Country during the late Roman period (see below).

The scale of iron production varied significantly over time between different regions, with the Weald in particular suffering a major decline during the later Roman period, suggested by Cleere and Crossley (1985, 85) as being the result of increased insecurity in the Channel, but possibly just linked to the apparent reorganisation of the Clasis Britannica fleet in the mid-third century A.D. (Adler 2013, 17; FIG. 5.3), or else the reduction in military personnel seen in northern Britain during the late Roman period (see Bidwell, Ch. 7). The pattern for the East Midlands ironworking sites is quite different, however, with overall numbers in use barely changing from the first to fourth centuries A.D., though there is some evidence from

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**FIG. 5.3.** Chronological distribution of excavated sites with evidence for iron production
sites such as Laxton Lodge, Northamptonshire (Jackson and Tylecote 1988), for less intensive iron production on sites during the late Roman period. The success and longevity of ironworking in this region has been suggested as being associated with the area’s economic diversity, i.e. that, unlike the Weald, it was not wholly centred around iron, but also lay within the heartland of Romano-British agriculture (see Ch. 4, p. 147), and had a thriving pottery industry in the Nene Valley (Schrüfer-Kolb 2004, 51). The situation in the Forest of Dean during the late Roman period is more mixed. The height of production appears to have been during the second to early third centuries A.D., and thereafter some of the larger nucleated sites to the north of the Forest like Dysmoc and Weston under Penyard (Ariconium) fell into decline (though new ironworking areas at the latter site were still being developed into the fourth century; Jackson 2012).

A site known primarily from fieldwalking near Newent, 13 km north-west of Gloucester, had almost six hectares of concentrated iron slag, and from associated finds appears to have been entirely second century in date (Walters 1992, 83–4). However, a number of new ironworking sites appear to have been founded further south during the late Roman period, both in the central Forest (e.g. Barnfield, Eastbach Court: Walters and Walters 1987) and particularly along its eastern edge (e.g. Millend Lane, Blakeney: Barber and Holbrook 2000; Church Lane, Alvington: Hood 2013). This all suggests a degree of re-alignment of the iron industry in this area at this time, perhaps involving a shift from certain large-scale operations, maybe linked with military supply, to one that was more focused upon local and regional markets. As with the decline of the Wealden iron industry, part of this change may have been caused by the significant reduction in the size of the military in Britain during the late Roman period, including the reduction of the garrison at Caerleon, c. 30 km to the south-west of the Forest of Dean.

Much of the late Roman iron industry in the Forest of Dean area may have been controlled through villa estates such as Woolaston (Fulford and Allen 1992), where late Roman iron production is well attested (see below). Such estates perhaps even facilitated the movement of iron ore to sites further afield, as iron smelting appears to have been carried out for the first time during this period within at least sixteen sites further east across the River Severn, both within the reclaimed alluvial wetlands of the Severn Estuary (Allen and Fulford 1987; 1990), and on the higher ground of the Cotswolds (fig. 5.3). Most of this later ironworking seems to have been on a relatively small scale, and it is possible that some sites were using other, more local, sources of iron ore (Holbrook 2006, 125). There is evidence that at least one of these late Roman sites, Awre on the Severn Estuary, was still operating an earlier ironmaking tradition, with use of bowl furnaces (Allen and Fulford 1990, 323).

The apparent abandonment of the Weald sites during the mid- to later third century A.D. accounts for most of the overall decline in the number of iron production sites in the fourth century shown in fig. 5.2. However, some decline was also observed elsewhere at this time, for example in South Wales, as part of a general decrease in settlement numbers in this area (Smith and Fulford 2016, 414). Iron production in Exmoor is more mixed, although the overall evidence suggests a marked decline by the later third and early fourth centuries A.D., with recent excavations of an ironworking site at Brayford School, High Bray, producing radiocarbon dates suggesting cessation by the mid-third century A.D. (Bampton 2013). The decline of the Exmoor industry has been suggested as being connected with an overall contraction in the markets during the late Roman period, allied with a greater preference for the Forest of Dean and East Midlands industries, which lay closer to the largest group of consumers (Bray 2006, 282).

CONTEXT OF IRON PRODUCTION

Just under 70 per cent of all iron production sites appear to have been associated with particular settlements (farmsteads, villas, roadside settlements etc.), with the remaining 30 per cent being classed as ‘industrial’ sites, either on the basis that no domestic occupation was observed or that any domestic activity appeared closely associated with the industrial activity (figs 5.4 and 5.5). In some cases this may be because the excavation area was limited to the industrial component of a wider settlement, but for the most part these seem to have been specialised industrial zones, either fairly small and well removed from any associated domestic site (perhaps utilised seasonally), or else part of large industrial complexes. Most of the latter sites lay in the three main ironworking regions discussed above such as at Laxton Lodge, Northamptonshire (Jackson and Tylecote 1988; Crew et al. 2008), and Beaufort Park, East Sussex (Brodrick et al. 1988), the latter one of twenty known ‘top level’ sites in the Weald (based on quantity of slag), where most of the iron production took place (Hodgkinson 2008, 32; 2017, 287). However, extensive iron production sites certainly existed in other areas, as for example at North Wootton, where a first to third-century A.D. iron-smelting works covering c. 5 ha lay 4.6 km from the north Norfolk coast, probably utilising bog iron from the local marsh deposits.
These high-intensity iron production sites (along with certain of the ‘industrial roadside settlements’ noted below) are those most likely to have had some kind of official involvement (even if just in terms of private contracts) with the Roman state. The Roman army, mostly based in the North, must have remained a large consumer of iron over the course of its existence in Britain, and supplies from major production sites in the Weald, East Midlands and the Forest of Dean in particular are likely to have been commonplace. Iron production on most of these sites appears to have been most intensive during the early to mid-Roman period, the subsequent changes possibly reflecting the reduced military operations of the late Roman period mentioned above and discussed by Bidwell in Chapter 7. Direct indication of such trade is difficult to establish because of problems in provenancing iron ore sources (cf. Paynter 2006), but may be indirectly suggested through

**FIG. 5.4.** Site types associated with iron production

**FIG. 5.5.** Distribution of site types associated with iron production
ceramic proxies such as Severn Valley pottery (with some production sources relatively close to the Forest of Dean), which was certainly finding its way to the north-west during the second century, and Nene Valley pottery, which was fairly widespread along Hadrian’s Wall in the later Roman period (Tyers 1996, 175, 199; see Bidwell, Ch. 7). It is likely that Wealden iron was transported via the *Classis Britannica* up the east coast and also across the Channel to the headquarters of the fleet at Boulogne, from where the iron may have been shipped direct to the German Limes.

Aside from such ‘industrial’ sites, most evidence for iron production comes from farmsteads (though still only found on 3.5 per cent of such sites), and it is here that the contribution of developer-funded archaeology has made most impact, with c. 75 per cent of these sites only coming to light since the introduction of PPG16 in 1990. Although production on farmsteads was quite prevalent within the East Midlands (as part of the diversified economy noted above), most of these settlements lay outside of the core iron production areas, and are especially notable in parts of the Severn and Avon Vales, suggesting either the utilisation of small local sources of iron ore, or, quite possibly in the case of the Severn and Avon Vales sites, the increasingly widespread use of Forest of Dean iron ore in surrounding settlements, as suggested above. An ‘industrial’ area (alongside late Roman burials) with evidence for small-scale smelting and smithing was revealed on the periphery of a farmstead at Foxes Field, Ebley Road, Stonehouse on the edge of the Severn Vale (Brett 2013), while an evaluation and geophysical survey over 34 ha at Hunts Grove, Hardwicke, in the Severn Vale revealed a complex of mid- to late Roman enclosures either side of a trackway, with dense ironworking slag, almost certainly relating to smelting, deriving from many of the ditches (Wright 2012). Iron production on most of these Severn Valley farmsteads dates to the later Roman period, suggesting that the Forest of Dean orefields (if this was the source of much of the raw material, which remains uncertain: Allen and Fulford 1987, fig. 20; cf. Holbrook 2006, 125) were still very much active at this time (see *Chronology* above).

Where evidence exists to determine the actual location of smelting at farmsteads, it is invariably some distance from the core of the settlement, perhaps unsurprising given the polluting nature of the activity and also possibly its special, ritualised status noted earlier, which may have meant it was more suited to ‘liminal’ locations. Examples include an ‘industrial zone’ outside an enclosed farmstead at Bessacarr, Doncaster, South Yorkshire (MAP 2010), a cluster of four smelting furnaces close to a stream 100 m north of an enclosed farmstead at Leda Cottages, Westwell, Kent (Diez 2006), and an iron-smelting area to the north of a complex farmstead at Wavendon Gate, Milton Keynes (Williams et al. 1996). Smelting is somewhat more likely to occur at complex rather than enclosed farmsteads (4.5 as opposed 2.4 per cent of site types), mainly owing to chronological factors, given that the former were relatively more prevalent during the mid- to late Roman period (see Smith et al. 2016). Nevertheless, iron smelting can be seen as one of a number of other attempts at economic diversification within complex farmsteads, at least those within or near to suitable sources of iron ore.

The economic organisation of iron production at farmstead level is hard to gauge. Smelting was a specialised and time-consuming practice, and, as Schrüfer-Kolb has argued (2004, 48), it is unlikely to have been carried out at a purely household level, especially within smaller farmsteads (*contra* Condon 1997, 4–5). There is no real need to engage the concept of ‘itinerant smiths’ (*ibid.*) undertaking occasional smelting in the vicinity of the farmstead, but instead there are likely to have been part-time specialists within these settlements, engaged for most of the year in agricultural practices and periodically smelting iron from local sources for local markets as part of an increasing economic diversification. Bray (2006, 278) has pointed out, in the context of the Exmoor iron industry, that iron production is ideally placed to be undertaken in parallel with farming practices owing to its scheduling flexibility, which can be accommodated within the agricultural cycle.

The increased economic opportunities brought about by the great surge in the use of iron objects during the Roman period have been noted above. It may be in this context that iron production at some farmsteads provided at least part of the mechanism for economic and social advancement, seen in the development of villa buildings. At Holcombe in Devon, for instance, there is extensive evidence for iron production from the late Iron Age onwards (with ore-roasting furnaces thought to belong to this date), which may have been one factor in the development of an increasingly elaborate villa complex during the later Roman period (Pollard 1974). In total, evidence for iron smelting has been found at eighteen excavated villa sites, most within and around the iron ore fields of the East Midlands and the Forest of Dean. At some of these sites it is difficult to gauge the level of production, but on at least ten it appears to have been on a reasonable scale and potentially contributed significantly to the economy of the villa estate. Certain of these villas, Woolaston, Mantles Green, Purlieus Wood and
Weldon, have been mentioned above, while others include Stanion in Northamptonshire, where a possible extensive ironworking area was revealed c. 100–150 m from the main villa (Walker 2012), and at Langton in North Yorkshire, where it was suggested that the villa’s primary economy may have been focused upon iron smelting and smithing (Goodhall 1972).

Nearly all of the remaining 46 sites with evidence for iron production came from nucleated settlements, mostly those defined as roadside settlements, but also some villages, military vici and defended ‘small towns’. As would be expected, most of these sites (except the vici) lay in or fairly close to the three main ironworking regions, particularly around the Forest of Dean and into South Wales and parts of North Somerset. These include well-known iron production sites like Weston under Penyard (Ariconium), which emerged during the second century A.D. around a major road junction, and an extensive mid-to late Roman roadside settlement recently surveyed at Hall End Farm, Wickwar in South Gloucestershire, which contained large numbers of possible ovens/hearth/kilns, and evidence for iron production and other metalworking (Young 2006). Excavations within the defended ‘small town’ at Worcester have also revealed the importance of iron production at this site, with reasonably large quantities of tap and furnace slag from mid/later Roman contexts, seemingly using iron ores brought from the Forest of Dean (Edwards 2004; Cuttler and Buteux 2011), though possibly also by river from a nearer source in the lower Severn Valley (Crabb 2016, 13).

Evidence for iron smelting in nucleated sites outside of the main ironworking areas is suggestive of fairly small-scale enterprises, with little to indicate they were major parts of the site economy. Probable exceptions include the settlements at Cow Roast, Hertfordshire, noted above, and at Wilderspool, Warrington, situated where the north–south Roman road ‘King Street’ meets the east–west road from Chester to Manchester (Rogers and Garner 2007). Here, iron smelting furnaces, bowl furnaces for smithing and other metalworking areas have been found, and it was clear that the site had an important industrial function. Further evidence for iron production was found at other roadside settlements and military vici in the vicinity, including Wigan, Manchester and Northwich, Cheshire, though generally the evidence was more focused on smithing, especially in Manchester, where 33 furnace areas associated with smithing were observed in a relatively small excavation area (G.B.D. Jones 1974).

IRON SMITHING

Smithing is far more commonly identified at most settlement types and in nearly all regions of England and Wales, reflecting the importance of iron as a commodity. However, there are certainly differences noted, which may have some bearing on variations in economic practice and the use of material culture across the province. Evidence for smithing within sites in the current database has relied on the presence of certain diagnostic slags and other elements such as smithing hearth bottoms and hammerscale (flakes derived from ordinary hot working of a piece of iron). No attempts have been made at this scale of analysis to differentiate between primary smithing (hot working of raw iron on a hearth to remove excess slag) and secondary smithing (hot working of iron to create or repair an object), though it is assumed that most evidence away from iron-smelting sites relates to the latter (cf. Keys 2010). However, some caution must be advised in the interpretation of smithing based wholly upon the presence of hearth bottoms (also called ‘slag basins’), which Allen (2012, 78–80) has argued are often more likely to be related to smelting in simple bowl furnaces; this is a particular problem with sites excavated prior to the late 1980s before the widespread recognition of hammerscale.

Figure 5.6 presents the incidence of smithing by site type within the excavated sites of the current project. Perhaps unsurprisingly, most defended ‘small towns’ (c. 80 per cent) have evidence for smithing (notwithstanding the problems of interpretation noted above), some such as Worcester, Alcester, Bath and Godmanchester having specific indications of smithies. In these settlements it is likely that there were full-time, specialist smiths catering for the needs of the resident and surrounding populations, producing the wide variety of tools, fittings and other objects that were increasingly in demand. The same is probably true of the smiths operating in most other nucleated roadside settlements, military vici and villages, where evidence comes from between 62 and 68 per cent of site types. These were the larger population centres that could probably support and maintain permanent smithies. The situation is likely to be somewhat different in the great majority of farmsteads, most of which do not appear to have any evidence for iron smithing. There are, however, striking differences, with c. 56 per cent of complex farmsteads having indications of such metalworking compared with c. 36–38 per cent of other farmsteads. As discussed in Volume 1 (Allen and Smith 2016, 28–33), these settlements are generally more substantial and may have had larger populations, with activities often

\[ \text{Figure 5.6: Incidence of Smithing by Site Type} \]
differentiated within separate zones. Where noted, metalworking (most often smithing) usually seems to have occurred some distance from the main domestic area (e.g. examples on Fig. 5.7), though, unlike smelting, it was usually still incorporated within the main enclosure complex. The apparent increased prevalence of iron smithing within complex farmsteads probably reflects their generally greater economic capacity, with most having a much wider range of tools and other metal objects than other farmstead types. How far smithing on such sites involved creating new objects remains uncertain, but it is likely for the most part that they represent repair and recycling of existing items, possibly by part-time smiths otherwise engaged in agricultural activities, in order to keep the farmstead functioning on a daily basis. The relative paucity of evidence for smithing on enclosed farmsteads in part reflects less intensive use of metal objects on these sites. Such patterns are particularly evident on a regional basis, where farmsteads (mostly of enclosed type) in the North, South-West and Central West regions appear to have less evidence for metal objects (notwithstanding issues of preservation), and also have fewer indications of smithing, evidence occurring on just 25 per cent of sites, as opposed to 35–40 per cent of farmsteads further south and east. There are a number of enclosed farmsteads in north-west Wales that do have evidence for smithing, part of a wider association with metalworking in this region (see below, p. 191), including possible smithies at Hafoty-wnerlas, Din Lligwy, and Cae'r Mynydd (Williams 1923a; Hogg 1975; Griffiths 1959).

Somewhat surprising may be the apparent lack of evidence for smithing at most villa sites, which as, for the most part, the presumed centres of agricultural estates, may be expected to have had regular, if not permanent, smithing facilities. Such facilities certainly seem to have existed on sites where investigation was extensive enough, for example at Bancroft, Buckinghamshire (Williams and Zeepvat 1994) and Ebrington, Gloucestershire (Hood 2009), but in most cases we have very little indication of activities outside of the main villa building. In addition, many of the villa excavations are of some antiquity, and are therefore less likely to have collected data on industrial activities unless it was very extensive. Occasionally there is evidence for smithing within the villa building itself, such as at Thurnham in Kent, where one of the main rooms was converted into a small smithy probably engaged in the recycling of scrap iron, but this appears to relate to a later ‘lower status’ phase of the site, when it was suggested as being subsumed into a larger estate (Lawrence 2006). Similar late Roman ironworking occurred within a partly ruined villa building at Chilgrove, West Sussex (Down 1979), while the re-use of urban public buildings for such activity in the fourth century is well attested, suggested as representing an emphasis on recycling of metals and a need to secure supplies by centralising the work in such buildings (Rogers 2011, 142–3).

Overall, the evidence for smithing on rural sites is fairly substantial, though it was perhaps not quite as universal as has sometimes been proposed (cf. Dungworth 2016, 540). Clearly many larger nucleated centres had considerable capacity for ironworking, often along with other metals and different types of manufacturing (see below). Many smaller farming settlements would have had some provision for limited-scale smithing, especially those more substantial, complex farmsteads, but in other cases the use of metal tools and other objects may have been fairly minimal, with less need or opportunity for such specialist activities on site.
Fig. 5.7. Location of smithing within complex farmsteads at Cotswold Community, Glos/Wilts (Powell et al. 2010) and Yaxley, Peterborough, Cambridgeshire (Phillips 2014)
OTHER METALS

Although iron was by far the most common metal in use across Roman Britain, there is plenty of evidence for non-ferrous metals, especially used for more decorative/personal items such as jewellery and toilet implements, though also for vessels, many of which were probably recycled (see below). Furthermore, Britain was rich with the ores of most of these metals, as was clearly recognised by the Roman state, as evidenced by the well-known extract from Tacitus’s Agricola (I.10), which stated: ‘Britain yields gold, silver, and other metals, to make it worth conquering’.

The distribution of all excavated late Iron Age and Romano-British sites with evidence for non-ferrous metalworking can be seen on Fig. 5.8, showing sites spread throughout the Roman province, but with particular concentrations in parts of Gloucestershire and Somerset. As with iron production, this does not present the ‘complete’ picture, with other sources of evidence including ingots, unstratified deposits of slag and other metalworking debris, and poorly dated mine workings. Most of the evidence presented here, discussed in more detail below, relates to secondary working of these metals (see Bayley 2017, 311, fig. 15.1 for an account of the metalworking cycle), with extraction and primary production sites remaining fairly rare, even in some areas known to have had good supplies of ore. There is, nevertheless, good evidence from certain sites suggesting that, unlike iron, much of the production (especially for precious metals) may have been carefully controlled by the Roman state, using the military to provide security and perhaps to control slave-labour in the mines, at least during the early phases of Roman occupation.

COPPER AND COPPER ALLOYS

After iron, copper-alloy objects form the next most prolific metal artefact found on most Romano-British sites. Typically used for jewellery (brooches, hairpins, finger rings, etc.), toilet objects (tweezers, ligulae, etc.), vessels, coins and decorative fittings (for personal dress, furniture and equine harness), copper alloys were also often used for more specialist objects such as religious figurines and lighting equipment. Copper rarely

FIG. 5.8. Distribution of excavated sites with evidence for non-ferrous metalworking (copper alloy, lead, silver, gold, tin, pewter)
seems to have been used on its own, but instead as an alloy, manufactured through the addition of zinc, tin and/or lead (cf. Dungworth 1997; Bayley 2017, 335–6). Various studies have shown distinct patterns in the use of different alloys (principally bronze and brass) over time and across different object types (ibid.; Bayley and Butcher 2004), though such detail has not been recorded within the present study.

**Figure 5.9** shows the distribution of excavated sites with evidence for copper-alloy working, along with the minimal evidence for copper mining from two sites, at Ogof, Llanymynech in Powys/Shrops. (Timberlake 2003), and Alderley Edge in Cheshire (Timberlake and Prag 2005). The former site also had evidence for copper smelting, dated 162 cal. B.C.–A.D. cal. 53, though as yet there are no copper smelting sites known from Roman Britain, with

![Diagram of distribution of excavated sites with evidence for copper-alloy working and associated settlement context.](image-url)
the only evidence suggesting such activity coming from at least thirty copper ingots, most of which were found in Anglesey (Dungworth 2016, 537). It is likely that much of the evidence for copper mining and smelting in Anglesey, and in other parts of North Wales with good areas of copper ore (Caernarfonshire, Merioneth and Cardigan), were largely destroyed by later mine workings, though they would undoubtedly have formed an important industry within the province (Kelly 1976). Although some association of this industry with the military presence in the area (notably the fort at Segontium and the legionary fortress at Chester) is likely, its nature remains uncertain, especially as none of the stamped copper ingots from Anglesey refers to any military unit or emperor, with most of the stamps seemingly recording personal names (Frere et al. 1990, 34–7). The only other main source of copper in Britain lies in Cornwall and there is no direct evidence here for any exploitation during the Roman period, though three Roman forts in the area may have had some association with the wider range of mineral wealth in the region (see below). The few non-military sites in this area with evidence for copper-alloy working appear to have been engaged in secondary production (i.e. casting), on a relatively small scale (e.g. Duckpool, Morwenstow: Ratcliffe 1995).

Nearly all of the evidence for copper-alloy working within excavated sites shown in Fig. 5.9 derives from secondary production, which accounts for its widespread distribution across the province, most well removed from the principal sources of ore (copper and tin; Fig. 5.9). The evidence for such activity usually comes in the form of fired clay crucibles, moulds and slag, though stone and metal moulds are also occasionally found (cf. Bayley and Butcher 2004, 35–6). It has not been possible to date such metalworking evidence across the province, because in many cases the diagnostic material lies unphased within the site sequence. However, the activity was clearly quite widespread prior to the Roman conquest, with at least 30 examples known, as for example at North Street, Worthing in West Sussex, where an evaluation found evidence for both ferrous and non-ferrous metalworking among late Iron Age/early Roman field systems, including a partial crucible with copper-alloy residue along with a probable kiln bar (Porteus 2010). The apparent increase in evidence for copper-alloy working into the Roman period correlates closely with the overall rise in settlement numbers at this time. Nevertheless, the increasing range and sheer volume of copper-alloy objects found on many Romano-British sites would suggest that extraction and processing of raw materials, and manufacturing of the final product, are likely to have expanded significantly.

In terms of the context of copper-alloy working, very similar patterns emerge to that of iron smithing, being most commonly associated with nucleated settlements, albeit found in far fewer sites (Fig. 5.9). Although the working of these different metals was not always carried out in the same location, there are a number of incidences of ‘industrial zones’ within these sites, such as those revealed during excavations within roadside settlements at Wrox (Atkins 2013b) and Scole (Ashwin and Tester 2014) in East Anglia. Such zones are likely, to have housed groups of specialist craftsmen, but there is rarely any indication that such crafts were being practised on an ‘industrial’ scale (possible exceptions include spoon production at Castleford; see below); instead they appear to provide objects only for inhabitants of the settlement itself and those in the local countryside. The incidence of copper-alloy working appears somewhat less common within the sample of excavated military vici, especially compared with iron smithing. If this pattern is genuine, it suggests that the ‘decorative’ objects produced in such alloys are more likely to have been imported into these sites than produced there.

Copper-alloy working on non-nucleated rural sites remains very scarce, with evidence being found on just over 3 per cent of excavated farmsteads, and just 2.6 per cent of enclosed farmsteads. It is assumed that any copper-alloy objects found on these sites were obtained elsewhere, probably from markets at roadside settlements. Complex farmsteads and in particular villas do have somewhat better evidence (6–8 per cent), probably reflecting the greater incidence of copper-alloy objects on such sites, with increased emphasis on personal display by the inhabitants (e.g. a bowl furnace in the middle courtyard of the villa at Turkdean, Gloucestershire, associated with evidence for copper alloy/lead working: Holbrook 2004). Nevertheless, even here it would seem that these objects were mostly imported into the settlement rather than manufactured on site.

In the majority of cases, there is no specific evidence to indicate what types of object were being made during the copper-alloy working process. Some items would have been manufactured using wrought techniques (hammering), though moulds (mostly of fired clay) for copper-alloy casting have been recovered from at least 80 sites examined in the current project (50 per cent of all sites with evidence for copper-alloy working). For the most part these moulds occur in small fragments so that the nature of the cast object remains unknown, though on occasion the moulds are complete enough to allow the end product to be identified, as shown in Table 5.2.
Brooches are the most common object type identified from production waste, with moulds being recovered at a range of different sites, including those of Colchester-derivative type at the seemingly isolated location at Old Buckenham, Norfolk (Bayley et al. 2001) and moulds for Trumpet brooches from the industrial settlement at Prestatyn in North Wales (Blockley 1989) (see Bayley and Butcher 2004, 35–7, for further evidence for brooch manufacture). Blank moulds for struck Iron Age coins have been found at a number of sites (not just used for copper alloy but also silver and gold), most of them important Iron Age centres classed as oppida. Limited evidence for counterfeit late Roman coin production has also been recovered, including a dump of coin moulds of Carausius found in association with crucible fragments, copper-alloy casting waste and kiln debris by a group of four small kilns at Lyde Road, Yeovil, Somerset (Clelland 2011). Further coin-counterfeiting moulds have found elsewhere in Somerset, notably within some of the briquetage mounds in the Levels (Rippon 1996, 109; cf. Boon 1988 for full discussion on counterfeit coin production in Roman Britain).

Most other diagnostic casting moulds occur in small quantities, often within nucleated or 'specialised' industrial sites, though thousands of spoon mould fragments from the defended small town/vicus at Castleford, West Yorkshire, point to larger scale production (Bayley and Budd 1998). Other moulds from this site include those for enamel-inlaid vessels, another example of which came from a complex farmstead 5 km south of Cirencester at Cotswold Community, though the lack of other evidence for copper-alloy working at this site suggests that the mould may originally have come from the nearby town (Poole 2010a, 144).

In all, the evidence for copper-alloy working from excavated sites is fairly widespread, though concentrated in parts of the Central Belt and North-East regions, along with parts of North Wales and Cheshire where the principal sources of copper ore lay. Most copper-alloy working appears to have been on a fairly small scale, with more extensive activity confined largely to nucleated settlements where specialist craftsmen would have produced a range of mainly personal and decorative items. Such items were rarely found in any number on most smaller rural sites, with the exception of villas and some complex farmsteads, and this goes some way to explain the relative lack of such non-ferrous metalworking on these sites.

### LEAD AND SILVER

Parts of Britain had substantial areas of lead ore (primarily galena), some of which was seemingly extracted and processed during the late Iron Age, but with most evidence falling into the Roman period. Its primary use (especially during the Roman
Age) was as an addition to copper alloys, though post-conquest it was highly important for hydraulic systems for public and military water supplies, baths and fountains, and for certain structural fittings. It was also used as a component of pewter (see below) and on its own for repairs (e.g. lead rivets in pottery), and occasionally for lining coffins in high-status graves. Some galena ores also contain relatively high levels of silver, which can be extracted by a process known as cupellation (cf. Bayley and Eckstein 2006). With the great scarcity of any pure sources of silver in Britain, it is likely that much of the silver sourced within the Roman province was obtained by this method.

A major area of lead ore in Britain that was exploited during the Roman period (and probably also in the late Iron Age, though evidence is more equivocal) is the Mendip Hills in Somerset (cf. Fig. 5.10. Extensive survey of the Roman lead and silver mining settlement at Charterhouse-on-Mendip, Somerset (after Fradley 2009, fig. 4)
Jamieson 2015, 105–20). Here, extensive surveys and limited excavation have revealed major industrial sites at Charterhouse (Smith and Brown 2006; Todd 2007; Fradley 2009) and St Cuthbert’s, P Sidd (R.G.J. Williams 1998). The former site appears to have been spread over 27 ha, with a number of mining rakes (evidence for working of galena and haematite), along with a regular system of lanes dividing a series of compound enclosures, and a possible cemetery and amphitheatre (fig. 5.10). Intensive mining activity appears to have begun fairly soon after the conquest, with active participation by the Roman military, as indicated by two early Roman earthwork enclosures interpreted as military works depots, and a total of 11–13 stamped lead ingots previously found at the site, some with stamps of the emperor and certain military units (Legio II Augusta) (Frere et al. 1990, 42, 50). These ingots can be dated from the mid-first (A.D. 49) to mid-second century A.D. (most being Vespasianic: A.D. 69–79) and point to direct state control at this time, before production was probably devolved into private hands, continuing up until at least the early fourth century A.D.

The apparent intensive exploitation of lead from the Mendips accounts for the concentration of sites with evidence for leadworking in this area, as shown in fig. 5.11. Most of these would seem to be engaged in secondary leadworking (see below), but other extraction and/or smelting sites are suggested at Wint Hill, Banwell (Cottrell et al. 1996) and Vespasian Farm, Green Ore, Wells (Ashworth 1970).

Aside from the Mendips, other major sources of lead ore in Britain can be found in parts of the Pennines, the Peak District, north Wales and Shropshire, though evidence for Roman-period lead production in these areas remains somewhat sparse. Although Roman lead mining is thought to have occurred at Alston Moor in one of the highest parts of the Pennines, excavated evidence from the region is largely confined to a site at Bollihope Common, Weardale, further to the east (Young and Webster 2006). Here, long-term research excavations have revealed an extensive industrial site dating to the second century A.D., including a furnace/forge, and an associated charcoal pit, which appears to be concerned with iron smelting, leadworking and possibly silver extraction.

In the Peak District a lead roasting-hearth was revealed at Lumb Brook, Hazelwood (Leary 1988), while ore grinding and smelting have been suggested at Brough Field, Carsington (Dearne et al. 1995) and Rainster Rocks, Brasington (Makepeace 1998, 127–9). Lead ingots are also known from the Trent-Humber, seemingly coming from Derbyshire. At Pentre Farm, Flint in north-east Wales, a series of early second-century A.D. lead-smelting furnaces were excavated early in the twentieth century, and a number of buildings, including a bathhouse, were subsequently revealed in the vicinity. It has been suggested that they represent an official residence associated with lead mining and extraction in the area (O’Leary et al. 1989). Recent excavations have revealed further evidence for an extensive roadside settlement immediately to the south-east of the previous investigations (Chris Martin pers. comm.), all part of what appears to have been an important industrial complex, perhaps akin to some of the Mendip sites. Another probable nucleated settlement in Flintshire argued to have had some association with the lead industry is located at Ffrith, lying west of the River Cegidog (N. Jones et al. 2004, 13; Wessex Archaeology 2005). This poorly understood settlement may have also had a military connection, as suggested by the quantity of stamped Twentieth Legion tiles recovered, and was active from the late first into the third century A.D., a comparable chronology to that of Pentre Farm.

Sources of galena in Britain are not confined to the main zones noted above, and there is now increasing evidence for the exploitation of other ore fields during the Roman period, particularly in parts of Wales (cf. N. Jones et al. 2004, 12–13). In south Wales, the ill-understood settlement at Lower Machen is thought to have been an early/mid-Roman industrial complex associated with nearby lead mines at Draethen and Risca (Osborne 2006), while a possible Roman lead mine was revealed nearby at Goldsland Wood (Treseder 1978). Recent excavations at Llangynfelyn on the south edge of Dyfi Estuary in west Wales revealed an extensive lead-smelting site radiocarbon dated to the late Iron Age–early Roman period (dates ranging from 90 cal B.C. to cal A.D. 240; Page et al. 2012), while another nearby lead-smelting site at Cwmystwyth was also radiocarbon dated to the early Roman period (Timberlake 2002, 58). Although production at the former site may have started prior to the conquest, it was thought more likely that exploitation began during the early Roman period, probably associated with the nearby Roman fort at Erglodd, which overlooked the site. A modest winged corridor villa in the vicinity at Abermagwr is very rare in this region (see Brindle 2016b) and may have been connected with the lead/silver mining industry, though it appears to be late third/early fourth century in date and there is, as yet, little evidence for late Roman industrial activity in the area.

In all, the evidence for lead extraction, processing and production still remains relatively slight, in part probably because of disturbance by later mines, though our knowledge base has
increased significantly in recent years. It appears to have been conducted at a more intensive level during the early to mid-Roman period, with the possible exception of the Peak District sites, where later Roman production is more evident, albeit on a small scale. Production at places like Charterhouse in the Mendips may have continued until the fourth century (though possibly less intensively than before), but at many of the other sites mentioned above it does not appear to have lasted beyond the third century, and ended considerably sooner in some cases. Why this should be is uncertain, as lead (and silver) was undoubtedly still required in some quantity at this time, as demonstrated by the large number of lead and pewter objects found across the province in late Roman contexts. Furthermore, an indication that British lead was still being exported to the Continent is provided by a late Roman shipwreck off the north coast of Brittany, which had a cargo...
of 271 lead ingots (22 tonnes), some of which were inscribed with the civitates of the Iceni and Brigantes (L’Hour 1987). At least part of the continual requirement for lead may well have been met through greater levels of recycling during the late Roman period (lead being particularly straightforward to work with and therefore easily recycled), as has been suggested for all metals in the early post-Roman period (Fleming 2012). The levels of production in the later first and second centuries in particular may have been such that there was a great deal of lead in circulation that could easily have been recycled as necessary.

Much of the early production in places like the Mendips, Wales and Shropshire (e.g. Pentreheyling fort; White 2013, 142–3) seems to have had close connections with the military, to which can be added a lead-smelting furnace excavated at Carlisle in the vicus of the Roman fort (Miller 2002), possibly using ore from deposits at Alston Moor lying 35 km to the east. This appears to have had a relatively short period of use, starting in the early second century and with archaeomagnetic dating suggesting the final firing to have occurred c. A.D. 135, its use at least partly coinciding with the construction of nearby Hadrian’s Wall. Direct military control over lead production appears to have largely ceased by the mid- to late second century A.D., and probably with that most large-scale exploitation. This correlates with the end of the main phase of major public building in the principal towns of Roman Britain, where lead was presumably required in some quantity. In many ways this is similar to the iron industry discussed above, where there appears to have been a shift from certain large-scale operations, maybe linked with military/urban supply, to smaller production sites that were more focused upon local and regional markets during the later Roman period. Evidence for lead production in the late Roman period is quite scarce, but it was seemingly on a relatively small scale, such as at the Peak District sites noted above, and the lead-smelting debris recovered from the late Roman villa at Great Witcombe near Gloucester (Leach 1998). As with iron production, control of this smaller scale lead ‘industry’ may now have largely been in the hands of private individuals, no doubt one of many new economic opportunities more readily exploited by wealthier members of society.

Over 65 per cent of the sites shown in FIG. 5.11 had no direct association with lead extraction or production and instead represent sites where secondary leadworking took place. These are undoubtedly under-represented, as minor working of lead may leave minimal traces in the archaeological record and small lead droplets and offcuts were not always noted in the data-collection phase of this project. In any case they are often unstratified and therefore undated. Lead ingots were noted at ten sites, five of which had no other evidence for leadworking. As with smithing and copper-alloy working, most of the evidence for leadworking came from nucleated settlements, some deriving from the same ‘industrial’ zones as other metalworking, noted above. The few farms and villas with evidence for leadworking mostly lay in the broad vicinity of the Mendips and Peak District, and, where dating is available, often belong to the later Roman period, when – as just discussed – recycling of metals is likely to have been more prolific. One of these sites, a villa and possible nearby roadside settlement at St Algars Farm, Selwood, Somerset, contained very rare evidence for lead cupellation, with deposits of litharge, the material left behind when lead is oxidised to recover silver (Dungworth et al. 2013). Aside from this site, evidence for secondary silverworking is very limited and nearly all confined to nucleated settlements, with crucibles or moulds containing traces of silver being found at Doncaster, West Yorkshire, Walton le Dale, Lancashire, Dragonby, Lincolnshire, Asthall, Oxfordshire and Scolton on the Norfolk/Suffolk border. The only excavated farmstead (dating to the early Roman period) where such activity is attested, at Langton Hill in Lincolnshire, contained a parting vessel, used in the process to separate silver from gold (Network Archaeology 2006). This remains, as yet, the only incidence of such a vessel outside of major urban centres such as London, Chichester and Exeter (Bayley 1991; 2017, 339–41).

GOLD

The only source of gold in Britain known to have been exploited during the Roman period was at Dolaucothi in Wales, where elements of a Roman fort, vicus and associated gold-mining complex extended over 1 km in a valley on the south-west edge of the Cambrian mountains (Burnham and Burnham 2004). As was typical with gold mines across the empire (Hirt 2010, 35–8), the Roman authorities appear to have assumed active control of Dolaucothi soon after the conquest, with the fort and vicus being established c. A.D. 70, but seemingly abandoned by the mid-second century. There is ceramic evidence for some continued activity near the mines into the third century, though whether this indicates continued exploitation of the gold resource, perhaps in a private or contracted capacity, remains uncertain.

Aside from some droplets of gold (along with silver and copper alloy) from the mid-first-century A.D. religious site at Hallaton, Leicestershire (Score 2011), and the parting vessel from the
farmstead at Langton Hill noted above, there is no other direct evidence for goldworking at any of the excavated rural sites in the current project database. It is certain that goldsmiths did exist in Roman Britain, as indicated by the well-known inscribed stone found in the early nineteenth century at Norton, near to the military *vicius* at Malton in North Yorkshire, which states ‘Prosperity to the genius of this place! O Servulus, enjoy thy goldsmith’s shop in happiness’ (*RIB* 712). However, this industry is likely to have operated on a very small scale, being mostly limited to major towns.

**TIN AND PEWTER**

Substantial deposits of tin ore remain relatively rare throughout much of Europe, and its occurrence as veins within the granites of Cornwall appears to have been well known prior to the Roman conquest, as indicated by references from the likes of Diodorus Siculus (V, 22), and Pliny (*HN* XXXIV, 164) in the first century B.C./A.D. (Gerrard 2000; Ireland 2008, 208, 210). Tin is required as an addition to many copper alloys and in pewter, though its early exploitation, in terms of mining and smelting, remains very hard to find, mainly because centuries of subsequent tin mining have removed all traces (Penhallurick 1986). Evidence for tin smelting during the later Iron Age has been recovered from a hillfort at Chun Castle, Penwith, in the form of a furnace with traces of tin slag and a large cake of tin slag associated with one of the roundhouses (Leeds 1931).

Although the lack of known early Roman tin-smelting sites in Cornwall has been suggested as being due to the availability of Spanish tin (cf. Fulford 2004, 318), official early Roman interest in the tin industry is strongly suggested by the discovery of three forts close to areas of tin ore (as well as copper, iron, silver and lead deposits), at Nanstallon, Calstock and Restormel. The former two appear to have been occupied for a relatively brief period only (c. A.D. 50 to 80), though the significant scale of the fort of Calstock (over 2 ha compared to 0.72 and 0.42 ha for the other forts), which also contained some evidence for mining and processing, is notable (Smart 2014). The smallest fort at Restormel may have continued in use until the early fourth century, perhaps maintaining some level of control of the rich mineral wealth of the region (Hartgroves and Smith 2008). There are very few excavated, non-military sites of the Roman period in Cornwall with associations with the tin industry, though tin smelting is thought to have occurred within the ‘round’ farmstead at St Mawgan-in-Pydar and the ‘village’ at Carvossa (also thought to have had military associations), and stamped tin ingots have been found at sites across the region. It was suggested in Volume 1 (Brindle 2016d, 358) that the expansion of settlement away from coastal areas of Cornwall during the second century may have been associated with increased (imperial?) interest in the mineral resources in Cornwall, with the principal tin lodes being found in the same area in which the new second-century sites were located. Cornwall’s only known villa building, at Magor Farm, Illogan (dated second–third century A.D.), has also been suggested as being the residence of an official or private contractor associated with control of the tin industry, though on little direct evidence (Mattingly 2006, 407).

The development of the Cornish tin industry through the course of the Roman period in Britain is hard to ascertain, though its importance for the manufacture of pewter (an alloy of mostly tin and lead) would indicate continual production on some level. A tin ingot was recovered from a fourth-century context in the ‘round’ at Trethurgy (Quinnell 2004), while small-scale tin working was identified further afield at the late Roman farmstead at Kenn Moor in Somerset (Rippon 2000). Lee (2009) has argued that the major expansion of pewter production during the third and fourth centuries A.D. was due to the much greater accessibility of tin at this time, certainly suggesting that this industry continued, however it may have been organised.

Pewter was mostly used for vessels (plates, cups, dishes), which are often found in what appear to have been ritual deposits, pointing to a special significance for this alloy (see Vol. 3). Most manufacturing sites, usually indicated by the presence of stone moulds, tin-alloy ingots or waste pewter, have been located in the West Country, with a particular concentration around Bath, though they are also to be found in some areas further east and north-east (Beagrie 1989, 181–90, fig. 4). The objects themselves have been suggested as being primarily associated with higher status rural sites (villas) and towns (Lee 2009), and the evidence collected within the current project would certainly support this, with over 60 per cent of all pewter objects coming from these site types. Furthermore, nearly all of the classifiable farmsteads on which pewter vessels did occur were of complex type, including Kilverstone in Norfolk, where a stack of twelve plates was recovered (Garrow et al. 2006) and Lower Cambourne in Cambridgeshire, where three vessels (two plates and a dish) were found placed together in a pit (Wright et al. 2009a).

The apparent focus of pewter production in areas of the West Country can be seen as part of the wider emphasis on (mostly) small-scale metal production and working in this region, which is
particularly pronounced in the late Roman period. This appears to have been part of an economic diversification that may have been one factor in the creation of substantial pockets of wealth at this time, seen through the development of increasingly elaborate villa complexes. How far all these industries continued into the early post-Roman period remains uncertain, but it is unlikely that they all simply ceased to be by A.D. 400 and Gerrard (2013, 110) has argued, in terms of pewter production at least, for continuation well after the ‘end’ of Roman Britain.

ARTEFACT PRODUCTION: STONE, JET AND GLASS

By Tom Brindle and Alexander Smith

In much of central and southern Britain metal objects form a sizeable proportion of the small finds assemblages from excavated Iron Age and particularly Roman-period sites, although other types of material were also widely utilised for a range of artefacts. Furthermore, many of these non-metal objects actually dominate assemblages in areas further north and west where metalwork is relatively scarce, though this may partly be for reasons of differential preservation. This section briefly explores the excavated evidence for stone, jet and glass artefact production within the context of rural Roman Britain.

STONE

Objects made of stone are frequently recovered from Roman rural sites, typically in the form of quernstones, whetstones and spindlewhorls. Quernstones, for example, have been recorded on 34 per cent of all excavated rural settlements in the project’s database (1246 sites), this rising to almost 40 per cent of sites in the North region, where, outside of the military vici, artefacts of other materials are relatively rare. The evidence for the manufacture of stone objects is, however, slight, being found in only 62 sites (2 per cent of records on the database), usually in the form of unfinished objects or waste.

Clearly there were some areas where the manufacture of stone objects was an important economic concern in the Iron Age and Roman periods. In south Dorset for example, particularly the Isle of Purbeck, many sites have produced evidence for working the local Kimmeridge shale, part of a wider suite of industries in this area, which also included pottery and salt production (Allen et al. 2007; see below, p. 204). Kimmeridge shale is a distinctive, oil-rich shale known as ‘blackstone’ which, in south Dorset, occurs in a band less than a metre thick, in part of the Upper Jurassic Kimmeridge Clay formation (Allason-Jones and Jones 2001, 236). Its hardness makes it relatively easy to work, and by polishing with beeswax it can achieve a high gloss, making it suitable for manufacture into decorative objects, particularly armlets (Calkin 1953), but also a range of other items including beads, dishes and furniture parts (Denford 2000).

Objects that seem to have been made of Kimmeridge shale (though see Jet below for problems of identification) have been found on almost 400 excavated sites across England and Wales, from Cornwall to North Wales and Northumberland, pointing to the importance of this industry to the Dorset coast region, with trade perhaps associated with the Dorset Black-Burnished ware pottery industry, whose products were almost equally as widespread (see below, pp. 203–4). At some sites, shale working appears to have been a primary element of the economy, such as at Rope Lake Hole, Corfe Castle, where shale production began in the early Iron Age and extended until the third and possibly into the fourth century A.D. (Sunter and Woodward 1987). Here, armlets were the principal artefact being manufactured, and massive dumps of shale were recovered with fragments from various stages of the production process identified. As outlined above, shale working seems to have been part of a complex range of industries centred on this area, with production at some sites, such as Hamworthy (Jarvis 1993; Coles and Pine 2009) and Ower (Sunter and Woodward 1987), occurring alongside pottery manufacture (facilitated by the presence of the local Kimmeridge clay), salt production and ironworking. There is also evidence for unworked shale being exported for working far from its source in south-east Dorset, with shale waste, especially lathe cores, being found in towns such as Silchester, Cirencester and Worcester (Allen et al. 2007, 175).

In addition to shale, Purbeck marble was an important mineral resource for the Purbeck region, with evidence for its working (alongside shale working, mosaic tesserae manufacture and pottery production) from Norden, Corfe Castle (Sunter and Woodward 1987; see Construction industry below, p. 207). As with shale, the importance of this industry to the region is attested by the widespread distribution of objects and structural components of Purbeck marble, found at sites across the south of England, principally at towns, roadside settlements and villas. Much of the monumental architecture and many inscriptions at Silchester and Colchester, for instance, employed Purbeck Marble (Boon 1957; 1974; Crummy 1984), and it was widely used for fashioning artefacts (e.g. pestles and mortars found at Colchester; Crummy 1983).
Elsewhere, evidence for stone working is somewhat more dispersed, although there are geological outcrops that are known to have been well exploited for whetstone and quernstone manufacture (see Ch. 7, p. 352). Peacock (2013, 132) has argued that quern quarries in particular are likely to have been controlled by individuals, groups or authorities on the basis that they were vital for human subsistence. Archaeological evidence for Iron Age/Roman quern quarries is limited, although Shaffrey (2006) has identified from petrological analysis three main sources of Old Red Sandstone (ORS; Forest of Dean, Bristol and the Mendips) that was extensively used for quern production; products have been found across large parts of South Wales and central and southern England. The unusually large number of mostly ORS querns and millstones from the complex farmstead at Cleveland Farm, Ashton Keynes, Wiltshire, has been used to suggest that this was a distribution site for these objects (ibid., 70), which may provide some hint as to the organisation of the industry.

As just stated, excavated evidence for quernstone quarries/manufacturing sites is fairly limited, though they have been identified at The Pits Copse, Lodsworth, West Sussex (Peacock 1987), East Wear Bay, Folkestone, Kent (Keller 1989; Parfitt 2012; 2013) and Longwalls Lane, Blackbrook, Derbyshire (Palfreyman and Ebbins 2011). Earlier investigations at Pen Pits in Somerset also revealed evidence for Upper Greensand quern production (Crawford 1953), while quern roughouts were recovered at Woolaston villa in the Forest of Dean (Fulford and Allen 1992, 178), not too far from a likely ORS quarry (Shaffrey pers. comm.). Possible quarries for Puddingstone have been found in Hertfordshire (Lovell and Tubb 2006), while some evidence for quern production in this stone has recently been recovered from excavations at Junction 8 of the M1 road scheme (Shaffrey 2012). Puddingstone, together with Greensand, are the only suitable rocks for quern manufacture in eastern England, and this probably accounts for their relatively widespread distribution here, though there is also much evidence for lava querns imported from Mayen in Germany (Peacock 2013, 131).

Aside from querns the most commonly encountered stone objects on excavated sites comprise whetstones (used to sharpen edge-tools) and spindlewhorls (used to spin wool), and, although direct evidence is often lacking, it is likely that many of these artefacts were produced on a small scale for use at individual sites (though see evidence for large-scale whetstone manufacture and distribution, Ch. 7). At farmsteads in much of the South-West, Wales and the North regions, there were strong, long-lived traditions of using stone objects as tools, these often forming sizeable components of the artefact assemblages, with local pebbles used for a range of purposes, for instance, as whetstones, hammerstones and polishing stones. In Cornwall, local elvan and greisen rocks were used in the manufacture of a distinctive range of artefacts, including the large stone mortaria often referred to as ‘Trethurgy bowls’ and the smaller Cornish mortars (Quinnell 1993; 2004). Evidence for site-based manufacture has been identified from several excavations in Cornwall, including Nancemere Fields (Higgins 2009), Trethurgy (Quinnell 2004) and Castle Gotha (Saunders and Harris 1982).

JET

 Artefacts such as armlets, beads, pendants and pins stipulated as being made from jet have been recorded at c. 180 excavated Roman rural sites in England and Wales, most of these lying in parts of the Central Belt, East and North-East regions (cf. Eckardt 2014, 120–3, fig. 4.13). However, how many of these were made of ‘true’ jet remains uncertain, as work by Allason-Jones and Jones (2001) have demonstrated that many of the ‘jet’ objects from across Roman Britain and further afield were actually made from a wide variety of materials including coal, cannel coal and certain types of shale. The only major source of ‘true’ jet in Britain lies at Whitby in North Yorkshire, and this was clearly well exploited alongside other ‘jet-like’ material, at least from the late second century A.D., when there was a growing fashion for shiny, black jewellery (ibid.; Allason-Jones 2003). Small-scale ‘jet’-working has been recorded at just three rural farmsteads in the current dataset, at Crankeley Lane (YAT 1993) and Roxby Site 2 (Inman et al. 1985) in North Yorkshire, and Street House, Loftus, in Cleveland (Sherlock and Vyner 2013). However, larger scale manufacture of objects made from jet and jet-like materials are known from Roman York (RCHME 1962, 141–4) and from the fort at South Shields on Hadrian’s Wall (Allason-Jones and Jones 2001). At the latter site, reflected light microscopy analysis suggested that craftsman had access to a wide variety of source material, including local outcrops of coal as well as material from Yorkshire, Derbyshire, Midlothian in Scotland and possibly even from as far afield as Spain (ibid., 242).

GLASS

Glass manufacture does not appear to have been an especially widespread rural industry, with evidence for production from just thirteen sites within the current project’s database. However, as glass furnaces were very small and the waste from
the production process was usually recycled, there is often little diagnostic material with which to positively identify this activity (Price 2003, 81). Even so, it is likely that most glass vessels found in Britain were either imported or made at one of the production sites that have been identified at some of the major urban and military settlements in Britain (ibid., 85, 87), notably from London (Shepherd 2015). Indeed, of the limited evidence for glass production on the database, several sites were either military vici (Middlewich, Cheshire; Castleford, West Yorkshire), small towns with military origins (Carlisle; potentially Worcester) or roadside settlements with otherwise strong military associations (Widerspool, Warrington, Cheshire; Great Bulmore, Newport, South Wales). At these sites the glass workshops often appear alongside other industries such as metalworking, within specific ‘industrial zones’, as discussed above.

Evidence for glass production outside of nucleated settlements is particularly meagre, and is often equivocal. For example, a glass rod fragment from a roundhouse at the farmstead at Roxby Site 2, North Yorkshire, provides some suggestion of glassworking (Inman et al. 1985), though it is unclear what may have been produced (Price 2003, 90). At Didcot West (Great Western Park) in Oxfordshire a glass rod and beads of the same colour represented the principal evidence from an excavated villa complex (Haden et al. 2014). At Parc Bryn Cegin, Llandygai, Gwynedd, a large number of beads and glass vessel fragments were suggested to represent evidence for bead manufacture (Kenney 2008), an interpretation that was also put forward for similar material at Cefn Cywmd, Rhosstrchwfa, Gwynedd (Cutler et al. 2012), although neither site produced convincing industrial waste. Glassmaking has been inferred from the analysis of microscopic residues within Lay Hill slag dump next to Chesters Villa, Woolaston, in the Forest of Dean (notable for its association with ironworking; see above, p. 183) with indications that glass products from this site reached at least as far as Worcester (Allen and Fulford 1987; 279–80).

Finally, evidence from the Iron Age sites at Hengistbury Head in Dorset and Meare Lake Village in Somerset is suggestive of glassworking. At Hengistbury, raw blocks of glass were imported from the Continent, while the number of beads and bracelets recovered has been suggested as evidence for their manufacture at the site (Henderson 1987). Similarly, at Meare Lake Village hundreds of beads and other glass objects were recovered, while the presence of an unfinished bead suggests on-site production (Henderson 1981). However, neither site produced direct evidence for glass production in the form of furnaces or industrial waste.

**POTTERY PRODUCTION**

Pottery remains the most consistently recovered and most prolific artefact type in nearly all excavated Roman settlements across England and Wales, with a number of site assemblages extending over 100,000 sherds. Although there are large amounts of imported pottery (especially Gallic finewares such as samian), the great majority of most rural site assemblages consisted of material produced within the province, either from local kilns or from one of the larger industries that developed from soon after the Claudian conquest. The intricacies and complex developments of these industries have been accounted for at length in various studies (e.g. Swan 1984; Tyers 1996; Evans 2016), and it is not the place here to provide any similar in-depth analyses of changing ceramic technologies, forms and fabrics. Instead, a summary account will be presented of the development and context of pottery production within excavated rural sites, as well as some consideration of its place within the wider rural economy of Roman Britain. More detailed accounts of pottery supply and movement in certain regions of the Roman province are presented in Chapter 7.

The distribution of all 265 excavated rural sites with evidence for pottery production is shown in Fig. 5.12, c. 63 per cent of the reports on these sites post-dating PPG16 in 1990. This is far from the comprehensive survey of over 1500 late Iron Age and Roman pottery kilns previously presented by Swan (1984; http://romankilns.net/), though the spatial patterns of both datasets are quite similar. In many ways the distribution of production sites reflects the overall concentration of pottery assemblages recovered from excavated sites (see Smith and Fulford 2016, fig. 12.10), being very heavily biased towards the south and east. This is largely due to pre-conquest traditions of pottery use. Most of Upland Wales and the Marches and the western part of the North region (notably Cumbria; Peacock 2016) were largely aceramic in the Iron Age, and on the whole remained so during the Roman period. Imports from further south (especially Dorset Black-Burnished ware (BB1) in parts of Wales) and from across the Channel (e.g. samian and amphora) have been found at Roman rural sites in these areas, occasionally in reasonable quantity such as at Cefn Graenog II in Gwynedd, where most of the 650 pottery sherds comprised BB1 (Fasham et al. 1998). However, very few production sites existed in these areas, and nearly all of these were linked to the military in some way (see below). An exception is the recently excavated late Iron Age/early Roman farmstead at Pegswood Moor, Morpeth, on the Northumberland coastal plain,
which produced one of the largest assemblages of native tradition pottery from the project’s North region (242 sherds) and had evidence for pottery production on site (Proctor 2009).

Most of the regions further south and east had very long traditions of continuous pottery use, stretching back to the Neolithic. The proliferation of Roman pottery production sites in these areas reflects this tradition, allied with the fact that it seems likely that these regions had higher populations and a wealth of market centres, seen in the high number of nucleated settlements. There are also substantial outcrops of primary clays (clays remaining in place of formation) in parts of central, southern and eastern Britain, which were of utmost importance in the establishment and maintenance of specialist ceramic industries (e.g. those near Verulamium, Hertfordshire, Oxford and Mancetter/Hartshill, Warwickshire; Swan 1984, 6).

CHRONOLOGY OF RURAL POTTERY PRODUCTION

The chronology of pottery production on excavated rural sites is presented in FIG. 5.13 and shown geographically in FIG. 5.14. The late Iron Age saw significant transformations from previous ceramic traditions, especially in the east and south-east with the introduction of wheelmade, predominantly grog-tempered wares, yet there remains relatively little evidence for production, thought to be because of the short-lived nature of kilns at this time (Swan 1984, 53; Tyers 1996, 52). Many of the excavated production sites are located in parts of the east Midlands and most kilns date to the very late Iron Age or early Roman period, such as the small in situ updraught kiln in an enclosure within a complex farmstead at Broughton, Milton Keynes (Atkins et al. 2014, 78–9). Much of this production would have been on a very small scale, conducted at a household level on farmsteads (see below), although some of the later, larger, Roman ceramic industries may have started prior to the conquest, as suggested at Alice Holt in Hampshire (Lyne 2012). The Dorset Black-Burnished ware industry, which was to become a major ‘provincial player’ during the Roman period, is also known to have had Iron Age origins, with excavated evidence from a number of sites (Lyne 2002), while Timby (1990) has argued for a late Iron Age start for the Severn Valley ware industry (see Timby, Ch. 7).
Our evidence for pottery production during the early Roman period expands significantly, not only reflecting the adoption of new, more archaeologically visible kilns, but also undoubtedly signifying increased levels of production, as indicated by the quantities of pottery recovered from Roman-period sites. In the south-east, the decade A.D. 60–70 saw what has been described as a ‘major revolution in ceramic use’ (Evans 2016, 513), when small-scale, grog-tempered pottery production largely ceases and new, more permanent kiln sites arise in places like Horningsea in Cambridgeshire and in North Kent, as well as in close proximity to urban centres such as Colchester and Verulamium. The reason for this shift in the organisation of production has been explained through the imposition of regular Roman provincial administration in the aftermath of the Boudiccan Revolt (ibid.), and in part correlates with other changes in settlement and...
landscape patterns in parts of the south and east (Smith and Fulford 2016, 408–10). With the exception of those early kilns associated with military sites to the north and north-west (e.g. Middlewich, Cheshire: Williams and Reid 2008), most evidence for pottery production of this date at rural sites is to be found in central and eastern parts of the province, with particular concentrations in parts of the East Midlands and East Anglia (see Rippon, Ch. 7). This continues into the early second century a.d., when the number of sites involved in pottery production appears to reach its height. Many of these remained fairly small-scale production sites making local coarse wares (often the ubiquitous greywares), but the larger-scale industries continued to develop, with Dorset Black-Burnished ware (BB1) products in particular reaching far afield, much, seemingly, on the back of military contracts (Tyers 1996, 67; Allen and Fulford 1996; see Bidwell, Ch. 7), and influencing similar, wheel-turned styles produced around the Thames Estuary (BB2).

At almost half of all sites with early Roman pottery production, the kilns had ceased to be used by the mid-Roman period (defined as mid-second to mid-third century a.d.), though the decline in numbers was far less marked within most of the large-scale pottery industries that tended to have greater longevity (see Context and organisation below). This pattern of decreasing numbers of production sites but with greater scales of production continued into the late Roman period, when relatively few major industries in places such as Oxfordshire and the Nene Valley came to dominate fineware pottery in particular across large areas of the Roman diocese, or at least those areas engaged with ceramic use. The coarse-ware products of these industries were rather less widely distributed, and it is likely that for the most part such ceramics continued to be sourced more regionally and locally (though see Rippon, Ch. 7, for an account of the coarse-ware industries of East of England).

CONTEXT AND ORGANISATION OF POTTERY PRODUCTION

Establishing the nature of the wider contexts around pottery production sites is crucial for any understanding of the role of the industry within the Roman province. This has been touched upon in a number of studies, though the emphasis has usually focused on the context of production sites within the major industries discussed above, such as Oxfordshire (Young 1977, 3–13), New Forest (Fulford 1975, 7–23), Alice Holt/Farnham in Surrey and Hampshire (Lyne and Jeffries 1979, 13–19; Lyne 2012) and Crambeck in North Yorkshire (Wilson 1989).

Around 50 per cent of all excavated sites with evidence for pottery production within the current dataset have been categorised as primarily ‘industrial’ in nature. As discussed above in relation to iron production, this term covers a range of different contexts, though many are clearly components within the larger ceramic industries, such as the fourth-century pottery workshop and kilns excavated at Stibbington in Cambridgeshire, which is argued to have been one of the last known production centres of the Nene Valley pottery industry, seemingly continuing into the early fifth century a.d. (Upex et al. 2008).

Another, recently excavated, late Roman kiln at Groom’s Farm, Frith End Quarry, Hampshire, was part of the Alice Holt industry (Cooke and Powell 2014). Fairly typical for such ‘industry’ sites, the excavations at Groom’s Farm revealed minimal evidence for any associated domestic activity, despite investigations being relatively substantial (covering 1.3 ha). The occupation deposits comprised spreads of midden material in the vicinity of the kiln. Huge area excavations carried out over thirteen years at Bestwall Quarry, Wareham, Dorset, revealed 32 kilns and two dryers of the Black-Burnished ware (BB1) industry, all dating to the third and fourth centuries a.d. Here, more contemporary features were revealed, with nine structures (including six cellared buildings) thought to be workshops and possible domestic dwellings (Ladle 2012). Ceramic industries on this scale are likely to have had a permanent workforce living close to the manufacturing sites, though production itself may still have been largely seasonal, owing to the climatic conditions (Tyers 1996, 47). To some extent, however, this could be mitigated by use of indoor kilns and heated drying sheds, as recently suggested by Lyne (2012, 136) for the Alice Holt industry. In addition, there are other related activities that people involved in the industry could still undertake in different seasons of the year, including clay quarrying and clay preparation, coppicing and charcoal production (see below, p. 233).

The wider organisation of these pottery industries remains ill understood. Peacock (1982) used ethnographic parallels to determine eight modes of production for the pottery industry, ranging from ‘household’ production, through market-orientated workshops, to military/state production. There have been a number of criticisms of this model (e.g. Tyers 1996, 35–6; Greene 2005, 40–2), in particular that it remains divorced from the context of the wider Roman economy as understood from literary and epigraphic sources (Green 1986). Nevertheless, a simplified version of the scheme, with varying scales of ‘household’,
and ‘workshop’ production, as developed by Rice (1987), seems appropriate in terms of the archaeological evidence for Romano-British pottery manufacture. In this case, most of the ‘industry’ production sites noted above would belong to the broad mode of ‘workshop production’, although what remains uncertain is the extent to which the different sites represent groups of independent, familial-based potworks, or were part of more cohesive industries, controlled (in production and/or marketing) by a wealthy few (Fulford 1975, 12; Lyne and Jeffries 1979, 14).

The Dorset pottery industry (BB1) appears to have gained a lucrative supply relationship with the army from soon after the conquest right up into the late Roman period (Allen and Fulford 1996), perhaps in association with other Purbeck industries such as salt and shale production. It is likely that certain individuals or groups would have profited greatly from such arrangements, along with supply to a growing civilian market, perhaps indicated by the numbers of extensive villas developing in the surrounding region, especially during the late Roman period (Allen 2016a, 92). Elsewhere, during the early Roman period in particular, there is evidence for specialist potters moving between production centres, pointing to a certain degree of independent enterprise (cf. Swan 1984, 98–101; Johnson et al. 2012). However, it is possible that much of the ‘export’ production may still have been controlled to some extent through small numbers of wealthy native entrepreneurs, at least during the late Roman period when the major industries were most dominant in terms of pottery supply. A bathhouse and another hypocausted building at Hale Road, Farnham, Surrey, have previously been argued to be associated with the local pottery industry (a house for the ‘manager’ or ‘overseer’ of the potters; Lowther 1955), though the evidence is equivocal, and it is in essence just a mid- to late Roman villa, whose economic basis remains uncertain.

Despite coming to dominate pottery supply across much of Roman Britain, excavated sites associated with the major industries account for a relatively small proportion of our total evidence for pottery production and do not account for all of the ‘industrial’ site types. Some other sites in this category would seem to have been isolated kilns with no link to any wider industry and no other confirmed association with any settlement. One such site, at Land East of Moorfield Road, Duxford, Cambridgeshire, had six pottery kilns located among field and trackway ditches, thought to be on the edge of an unidentified settlement (Woolhouse 2014). The kilns (dated mid- to late first century A.D.) look to have specialised in flagon production and it was suggested that the potters were itinerant workmen from Gaul, perhaps producing specialised ‘funerary’ pottery (ibid.; Anderson et al. 2016).

**Figure 5.15** presents the contexts for the remaining 122 sites in the database with evidence for pottery production, in terms of their prevalence at different settlement types. As with evidence for secondary metalworking, it is the nucleated sites that are far more likely to have pottery kilns, presumably because of their likely role as market centres (see Brindle, Ch. 6). This included one of the most northerly non-military, roadside settlements known in the province, at East Park, Sedgefield in County Durham, where small-scale excavations revealed at least one later second–early third-century A.D. kiln (Hale 2010). The limited evidence for pottery production on military *vici* is all early Roman in date, with most ceramics presumably being imported to military sites in use after this date, as indicated by the presence of products of the BB1, BB2 and Yorkshire Crambeck industries.

Evidence for pottery production on farmsteads is quite scarce in all areas except for parts of the East Midlands, where half of all such sites are located (Fig. 5.16). The relative prevalence of iron production on farmsteads in the East Midlands has already been noted above, seen to have been part of a diversified economy; pottery production on such sites is undoubtedly another facet of this, part of what has been described as a ‘complex industrial agglomeration’ in this area (Fulford 2006, 609). Schrüfer-Kolb (2004, 48–9) attested to a general link between iron smelting and pottery manufacture in the East Midlands, and some farmsteads do have evidence for both activities, seemingly contemporaneous (e.g. Syresham Area G, Northamptonshire: Mudd 2007). It is on complex farmsteads that our evidence for pottery production is most evident, with these sites generally favouring low-lying river valley locations that were preferred locations for kilns owing to the presence of secondary clays and readily available sand temper (Swan 1984, 3).

In most cases it appears that pottery production on farmsteads was not a long-term enterprise, with the kilns at seventeen sites only being in use during the mid- to late first century A.D., many being more specifically dated to the pre-Flavian period (c. A.D. 43–68). It has been argued that such pottery production related more to later Iron Age traditions, with the potters utilising ‘pre-existing social structures of communal gatherings where they could produce and distribute their wares at the same time to a local population’ (Gibson and Lucas 2002, 117; see discussion by Rippon, Ch. 7). The productive capacity at some...
farmsteads could be quite considerable at this time, as indicated by the eleven pre-Flavian kilns arranged around the periphery of each of two farmsteads at Greenhouse Farm and Addenbrooke’s, near Cambridge (ibid.; Evans 2008; Phillips 2013; FIG. 5.17). The latter site had a further kiln noted in a field system to the south, and must surely have supplied ceramic needs beyond the immediate settlement, perhaps operating in the context of the traditional ‘communal gatherings’ just noted. Most pottery production on farmsteads, however, appears to have been on a much smaller scale, with 1–2 kilns, in what would seem to have been a strictly ‘household level’ industry (see discussion of organisation above, p. 203).

The early Roman emphasis on pottery production at farmsteads is shown on FIG. 5.18, in
FIG. 5.17. Site plans of Cambridgeshire farmsteads at Hutchison Site, Addenbrooke’s (Evans 2008) and Greenhouse Farm (Gibson and Lucas 2002) showing early Roman pottery kilns

FIG. 5.18. Proportion of all pottery production by major site type over time
relation to nucleated settlements and ‘industrial’ sites, the latter, as discussed above, including all sites for which there is no associated domestic occupation, or else those where activity appears clearly focused upon the industrial activity. This graph illustrates the increasing dominance of the major ceramic industries over time (these making up the majority of the ‘industrial’ sites), with production on nucleated settlements remaining steady and evidence for manufacture on farmsteads declining to very small levels by the late Roman period. This appears almost diametrically opposite to the pattern seen in the iron industry noted above, where the late Roman period is characterised by smaller scale production, more widely spread across different site types (i.e. not just major production centres), at least within the Central Belt region. The apparent increased centralisation of the pottery industry into a small number of ‘major players’ during the late Roman period, may at least partially account for its apparent total collapse during the first half of the fifth century, no longer able to be sustained by the rapidly declining economic and transportation infrastructure.

Overall, the evidence for pottery manufacture in Roman Britain is substantial, with ceramics clearly being of major importance in many regions, not only for utilitarian food-preparation, eating and drinking, but also as a signifier of identity and social status, and on occasion being imbued with ritual symbolism, as seen in many grave goods and structured deposits (see Vol. 3). Yet as a component of the wider Romano-British economy, pottery production is unlikely ever to have been that significant beyond a local scale, especially when compared with agriculture (cf. Gerrard 2016, 853). Fulford’s estimation of the manpower involved with the late Roman New Forest pottery industry suggested a maximum of 42 people (Fulford 1975, 12), and although other industries (e.g. Oxfordshire, BB1 and Nene Valley) may have been much more extensive, it is unlikely that they ever employed significant parts of the population, even taking into account ‘subsidiary industries’ (e.g. coppicing, clay extraction, etc.), with which, as stated above, may have been conducted at different seasons of the year.

CONSTRUCTION INDUSTRIES

The range of materials used in the construction of Romano-British buildings has already been touched upon in Volume 1 (Smith 2016b, 51–4). Although most structures in rural contexts were still built of timber and/or mass walling (e.g. turf/ cob), as they had been in the Iron Age, many innovative construction methods were employed during the Roman period (cf. Perring 2002, 80–110; Goodburn 1992, 197), and there was an increasing tendency towards rectilinear building forms, at least in much of central, eastern and southern areas. Partly in conjunction with this change in form was an increase in the use of stone within buildings, albeit often only for foundations and dwarf walls for so-called half-timber structures, with the earliest mortared masonry structures appearing in the south-east fairly soon after the Claudian conquest. Throughout the second and third centuries the number and extent of masonry-footed buildings increased significantly, particularly within nucleated roadside settlements and larger towns, though it would still seem that full masonry-walled structures were largely confined to public buildings and elite houses (Perring 2002, 36–40; Pearson 2006, 16–31). In the countryside, the increasingly elaborate masonry buildings that are defined as villas also increased in number and extent, reaching their height in the late Roman period, while, particularly in the Central Belt region, there is evidence for a broad continuum of other masonry buildings at farmsteads, including aisled halls. Overall, the increasing use of masonry in all forms of construction (including houses, public buildings, town walls, metalled roads, etc.), alongside use of other materials such ceramic tile, brick, mortar and plaster, and window glass, necessitated the creation of construction industries engaged in the extraction and production of building materials. This section will examine the evidence for some of these industries within the context of excavated rural sites.

STONE QUARRYING

The massive scale of building and road construction entailing use of aggregates in the Roman province, particularly during the second century A.D. with major rural and urban expansion, was such that huge volumes of stone would have needed to be quarried. For major building projects, such as Hadrian’s Wall and its associated forts, there are well-known quarries such as that at Barcombe Hill (McGuire 2011, 18–20), which were probably large-scale enterprises under direct military control, while it has been suggested that the larger Romano-British towns, as significant consumers of stone, may have owned and operated their own quarries (Pearson 2006, 44; e.g. quarries underlying the amphitheatre at Cirencester: Holbrook 1998, 147). Recent research on the Ragstone quarries of the Medway Valley in Kent has indicated that these were a major source of building stone in the south-east, including London (Elliott 2017).

Hayward (2009) has suggested a more complex and dynamic picture of stone procurement,
least for parts of southern Britain, with certain freestones (easily worked, sedimentary rock) utilised for funerary monuments and monumental architecture in towns such as Colchester being derived from distant sources in Britain (exceeding 200 km), and some even being imported from the Continent. It was further observed that from the start of the second century A.D., quarrying of stone from the Bathonian escarpment of the Cotswolds had developed into a large, centralised operation, supplying free-stone to public building projects throughout southern England (ibid., 103).

Geological analysis of mosaic tesserae from a number of early Roman sites across southern Britain indicated a relatively small range of materials, mostly derived from the Kimmeridge Clay Formation of the Dorset coast (Allen and Fulford 2004). There was limited evidence for tesserae manufacture in the vicinity, at Corfe Castle, though finds from Fishbourne in Sussex revealed that at least some raw materials were exported some distance (probably alongside Purbeck marble; see above p. 198), to be manufactured where required (ibid., 31–2). Aside from such specialist geological materials, the norm seems to have been for smaller scale quarrying, with roads and rural masonry buildings generally utilising local sources of stone whenever possible.

A total of 193 excavated sites within the project dataset had evidence noted for quarrying, though, as with the mining of metals, many more sites must have been lost through continuous aggregate extraction over the years. The excavated quarries included clay extraction pits for pottery and tile manufacture, ironstone quarries associated with ferrous metal production (see above, p. 180) and specific types of stone quarries used for artefact production, such as The Pits Copse, Lodsworth, West Sussex (Greensand for quern manufacture; Peacock 1987) and Longwalls Lane, Blackbrook, Derbyshire (Millstone Grit for quern manufacture; Palfreyman and Ebbins 2011) (see above, p. 199). The remaining quarries were mostly for limestone, sandstone, chalk and gravel, and were probably dug to extract aggregates used in varying forms of construction. Some clearly seem to have been used for road construction, such as the gravel and limestone quarries encountered at various points along Roman Ermin Street in Gloucestershire and Wiltshire during road-scheme excavations (Mudd et al. 1999). Other small-scale limestone quarries at places like Kingscote, Gloucestershire, and Wilcote, Oxfordshire, were probably used for local building construction, while a sub-circular 7 m diameter pit at Ipplepen, South Devon, was interpreted as a slate quarry, used to supply roofing slates to nearby Exeter during the late Roman period (Farnell 2010).

At least 27 chalk quarries have been recorded, many of which were probably dug for material used to improve the agricultural capacity of local soils (producing agricultural lime in small clamps or kiln pits; Dix 1979, 262; see Ch. 2), including those found within field systems at Nunton in Wiltshire (Clelland and Harding 2010) and Ridgeway Hill in Dorset (Brown et al. 2014). Other quarries may have been for the extraction of chalk used to make quicklime in larger lime kilns, which was used for a variety of purposes, including in the construction industry for mortars and plasters.

MORTARS AND PLASTERS: LIME KILNS

Considering the large numbers of mortared and plastered buildings found in Roman Britain there are very few excavated examples of lime kilns. Sources of calcium carbonate (typically chalk or limestone) needed to be calcined in the carefully controlled environment of such kilns, in a process that could take several weeks, including the cooling period (Dix 1979). The resultant quicklime produced may have been used in the tanning industry (removing the hair from skins), or for pharmaceuticals, though for the most part it is thought to have been slaked (hydrated) and utilised for plaster or stucco work, as well as a base (when mixed with sand and water) for mortar, used in masonry wall bonding or for opus signinum surfaces often found in bathhouses.

Just sixteen excavated sites with evidence for lime kilns are included in the project database (Table 5.3), though another possible example was found at the fort at Loughor in South Wales (Ling and Ling 1973), and a few others have been noted at larger urban centres (e.g. Dorchester, Dorset: Durham and Fulford 2014). Additionally, a lime slurry pit (for providing lime for plastering) was revealed beneath the floor of one building at Old Durham (Wright and Gillam 1953), and the presence of a white coating on limestone samples from an industrial settlement at Longwalls Lane, Blackbrook, Derbyshire, was suggested as being related to lime production (Palfreyman and Ebbins 2011).

Only a single nucleated site contained evidence for lime production – the walled town at Dorchester-on-Thames in Oxfordshire – and even this was problematic, comprising twelve hearths and ovens, some containing traces of lime. These were not ‘classic’ lime kilns and were suggested to be kiln pits for agricultural lime (Rowley and Brown 1981, 18), though their location within the town walls makes such an interpretation less plausible (Booth pers. comm.). The general lack of lime kilns used for construction/industrial purposes within nucleated settlements remains
somewhat surprising given the expected higher levels of mortared buildings at such places, along with the evidence for tanning and other industrial activities noted above. This is in contrast to their presence in medieval towns and in Roman nucleated sites on the near-continent, such as Famars near Valenciennes (Clotuche 2013, 42; in press).

Villas make up over 60 per cent of all rural sites with evidence for lime kilns, these probably being short-lived structures used in the construction and/or major refurbishments of the villa complexes. The status of one of these, at Tremadog in north-west Wales, remains uncertain, the site being identified as a villa only on the basis of a nearby bathhouse and corndryer. The lime kiln, dated late third to early fourth century A.D., was of considerable size (4.5 m diameter) and would have required the importation of raw materials from some distance, as no local sources of suitable limestone or chalk were available, attesting to the importance of the settlement. It was suggested that the kiln may have supplied several buildings in the vicinity (Parry 2013, 29). The only excavated farmstead with evidence for lime kilns remains that at Hardwick Park, Wellingborough in Northamptonshire, where three poorly dated examples were found. There was no evidence for any buildings on site that may have utilised such material, and so it may be that the occupants of this complex farmstead were involved in supplying quicklime for mortar and plaster to the many villas and nucleated settlements in the area – yet another example of the economic diversification apparent in this region.

**Table 5.3: Excavated rural sites where Roman lime kilns have been interpreted**

<table>
<thead>
<tr>
<th>Site name</th>
<th>County</th>
<th>Site type</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardington Mill, Bedford</td>
<td>Bedfordshire</td>
<td>‘industry’</td>
<td>White 1977</td>
</tr>
<tr>
<td>Mantles Green, Amersham</td>
<td>Buckinghamshire</td>
<td>villa</td>
<td>Yeoman and Stewart 1992</td>
</tr>
<tr>
<td>Old Penrith Fort</td>
<td>Cumbria</td>
<td>vicus</td>
<td>Austen 1991</td>
</tr>
<tr>
<td>Brantingham villa</td>
<td>East Riding</td>
<td>villa</td>
<td>Liversidge et al. 1973</td>
</tr>
<tr>
<td>Tremadog</td>
<td>Gwynedd</td>
<td>villa?</td>
<td>Parry 2013</td>
</tr>
<tr>
<td>Northfleet villa</td>
<td>Kent</td>
<td>villa</td>
<td>Andrews et al. 2011</td>
</tr>
<tr>
<td>Low Pleasant, Quernmore</td>
<td>Lancashire</td>
<td>‘industry’/military</td>
<td>Leather and Webster 1988</td>
</tr>
<tr>
<td>Hardwick Park, Wellingborough,</td>
<td>Northamptonshire</td>
<td>farm</td>
<td>Foster et al. 1977</td>
</tr>
<tr>
<td>Ringstead</td>
<td>Northamptonshire</td>
<td>villa</td>
<td>Jackson 1980</td>
</tr>
<tr>
<td>Wekeley</td>
<td>Northamptonshire</td>
<td>villa</td>
<td>Jackson and Dix 1988</td>
</tr>
<tr>
<td>Dorchester-on-Thames, Beech House Hotel</td>
<td>Oxfordshire</td>
<td>defended town</td>
<td>Rowley and Brown 1981</td>
</tr>
<tr>
<td>Chew Park</td>
<td>Somerset</td>
<td>farm/villa</td>
<td>Rahtz and Greenfield 1977</td>
</tr>
<tr>
<td>Manor Farm, Castle Cary</td>
<td>Somerset</td>
<td>‘industry’</td>
<td>Leach and Ellis 2003</td>
</tr>
<tr>
<td>Cocks Farm, Abinger Hamer</td>
<td>Surrey</td>
<td>villa</td>
<td>Dyer 1997</td>
</tr>
<tr>
<td>Wellhead, Westbury</td>
<td>Wiltshire</td>
<td>villa</td>
<td>Rogers and Roddham 1991</td>
</tr>
<tr>
<td>Bays Meadow villa, Droitwich</td>
<td>Worcestershire</td>
<td>villa</td>
<td>Barfield 2006</td>
</tr>
</tbody>
</table>

**CERAMIC BRICK AND TILE PRODUCTION**

The use of ceramic brick and tile as a construction material remains unknown in Britain prior to the Roman period, yet within 50 years of the conquest it was starting to be widespread in certain buildings in the newly developing urban centres and military sites, as well as in the early villas being built in parts of the south-east (cf. Brodribb 1987, 2; Mills 2013, 454). A wide range of ceramic building products soon became required, including bricks, floor tiles, roof tiles ( tegulae and imbrices), and specialist hollow tiles (box-flue and voussoir) for use within bathhouses and heated rooms. The initial skills required for brick and tile making are likely to have been brought over with the army, but fairly soon specialist tile-production sites emerged across parts of the province. The organisation of this ‘industry’ remains fairly ill-understood, and we are still largely reliant on the work undertaken by Peacock (1979) and Darvill and McWhirr (1984), who drew upon ethnographic and recent parallels to suggest different modes of production (see discussion of similar work for pottery production above, p. 203). At the time of these studies the number of excavated tile kilns remained very low, and, although many new examples have subsequently come to light (26 at rural sites since 1990), they are still relatively scarce considering the scale of production needed to fulfil the construction demands of the province.

**Figure 5.19** presents a distribution of all 54 excavated rural tile-production sites known from Roman Britain, against a backdrop of all quantified ceramic building material (CBM) from excavated sites. Unfortunately not all sites had quantified...
data, but nevertheless the major concentration of building material is approximately coterminous with the main group of tile kilns, in central and southern parts of the province. The band of tile kilns further to the north-west was mostly associated with the military, located either at *vici* or other sites probably contracted for army supply (see below). A lack of excavated tile kilns in much of the north-east is more puzzling considering the volume of tile recovered from some excavated sites (e.g. over 800 kg from Burnby Lane, Hayton, East Riding: Halkon *et al.* 2015), though there are some indications that tile production was occurring in rural contexts in this region (e.g. dense concentration of Roman tile thought to indicate a tile kiln at Whitwell-on-the-Hill, North Yorkshire; NMR SE 76 NW 53).

**Chronology, context and organisation of brick and tile production**

The earliest excavated rural tile kilns from the Roman province generally date from the later first century A.D., though Neronian (A.D. 54–68) stamped tiles are known, for example at Little London near Silchester in Hampshire (Greenaway 1981). Nevertheless, it is in the second century when production reaches its height, with almost 30 known kiln sites (FIG. 5.20). This undoubtedly reflects the general expansion of urban and rural settlement, and supply to the Roman military, particularly in the northern frontier zone, where many stone-founded and tiled-roofed buildings were constructed at this time, often replacing earlier timber structures. During the later Roman period there is a reduction in the number of sites engaged with brick and tile production, with perhaps a shift from numerous small-scale local producers to a smaller number of tileries with larger-scale distribution, such as at Harrold in Bedfordshire, whose products were still reaching London until the mid-fourth century A.D. (Betts 2017, 379). New kilns were still being constructed right until the very end of the Roman period, as recently demonstrated by an unusual double-flued example found at St Martin’s Place, c. 400 m from the north bank of the Thames close to Roman London, which was archaeomagnetically dated to between A.D. 400 and 450 (Telfer 2009).

The overall late Roman decline in brick- and tile-production sites can be explained in part because of a shift to other forms of construction.

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**FIG. 5.19.** Excavated Roman sites with evidence for tile production in relation to all quantified tile assemblages (kg)
material (e.g. predominantly stone-tiled roofs in late Roman villas), and almost certainly due to a greater incidence of recycling of existing materials (Brodribb 1987, 141; Betts 2017, 377; Warry forthcoming). Possible evidence for the economic worth of such recycled material can be seen within a complex farmstead at Cotswold Community, 5 km south of Cirencester, where a substantial dump of previously used voussoir tile was found, mostly within a late Roman well (Poole 2010b, 165). It was tentatively suggested that these tiles, which are likely to have come from a bathhouse, were picked up from a demolished building in the nearby Roman town, either by official arrangement or in a more ‘enterprising’ spirit by local farmers, who may have been motivated by its possible economic value (ibid.).

The organisation of the Romano-British tile industry has been suggested as being multi-layered, with at least five different coeval forms ranging from small-scale industry to large-scale production (Darvill and McWhirr 1984, 247), while itinerant tile-makers are also likely to have played a significant role, particularly for more specialist products (e.g. Mills 2013, 461–2). At least twenty (37 per cent) of the excavated tile production sites in the current dataset are likely to belong to the ‘rural brickyards’ category (within the ‘industrial’ site type in Fig. 5.20), comprising small scale, seasonal, private production centres comprising 1–2 kilns, with the tile makers otherwise engaged with agricultural activities. Such sites are, however, very rarely directly associated with farmsteads, and four were also engaged in pottery production, an association found across 30 per cent of all tile production sites. Other ‘industrial’ sites with evidence for brick and tile manufacture include four that seem to have been part of ‘clustered industries’, these comprising the well-known tile kilns at Minety in Wiltshire, along with others associated with some of the major pottery industries discussed above, at Alice Holt (Hampshire), Hadham (Hertfordshire) and Harrold (Bedfordshire). These are likely to have produced a wide range of products, some of which were exported far afield, as shown at Minety, where the provision of recognised stamps (dated early to mid-second century A.D.) has indicated that although the main emphasis of supply was centred on Cirencester, c. 10 per cent of products were found over 40 km from source (Darvill and McWhirr 1984, 252). More recent work on the stamped tiles from Gloucestershire has been conducted by Warry (forthcoming), who noted that tile from municipal kilns (notably tiles stamped with the names of the annual magistrates from Gloucester civic tile-works at St Oswald’s Priory) was used exclusively for public building works in towns and tiles made by private tile-makers (even within the same tilery) were used within much wider territories. Furthermore, he argued that some tile would have been stored and distributed by Roman builders’ merchants away from production sites, with one such site being suggested as the villa at Hucclecote, c. 5 km east of Gloucester (ibid.). Such places also seemingly

![Chronology and context of tile production](image-url)
acted as re-cycling centres for used tile, which, as indicated above, would have become increasingly important within the construction industry (ibid.). A further element of the tile supply-network in the wider Gloucestershire/Wiltshire area was discovered at Neigh Bridge, Somerford Keynes, between Minety and Cirencester, where an aisled building was associated with regular stacks of apparently unused tile and suggested as a tile depot (Miles et al. 2007, 272).

The remaining tile-production sites falling under the ‘industrial’ category comprise those where there may have been some degree of municipal or military control, even if just in terms of contracted industries (loosely grouped under Darvill and McWhirr’s ‘Military/municipal production’ category). These include sites in relative proximity to major towns, such as the St Martin’s example discussed above, along with those with more certain military connections, demonstrated through the stamped tiles, with each legion and some auxiliary cohorts having their own stamp (cf. Warry 2010). Some tile production within military *vici* is also attested (e.g. possible tile kiln at Castell Collen, Llandrindod Wells, Powys: Hkinson 2012), although their general scarcity suggests that it was more usual to import tile from military-run kilns lying further afield (e.g. Brampton, Cumbria, 1.5 km from the nearest fort: Hogg 1965), or from external suppliers, as indicated by a die of the Legio XX that referred directly to a contractor (Warry 2010, 136).

Away from specialist ‘industrial’ sites, evidence for tile production is fairly meagre. There are, however, at least nine villas that would appear to have had provision for making their own tiles (Darvill and McWhirr’s ‘Estate production’ or ‘Peripatetic [itinerant] production’ categories), including a well-constructed kiln built near to a recently excavated villa at Itter Crescent near Peterborough (Henley et al. 2012). This was re-built at least once, indicating its use in two different phases of building at the site, with some products perhaps being exported beyond the villa estate in a separate economic enterprise. This seems to have been the case at the villa at Plaxtol in Kent, where specialist voussoir tiles, stamped by the tile-maker Cabriabanus, were produced in the mid-second century a.d. and used not only in the adjacent villa and bathhouse but also in at least three other sites in Kent and London (Davies 2004; 2009).

Overall, it is clear that brick and tile production was an important element within the wider construction industry, especially within the early to mid-Roman period. While certain villas, military sites and roadside settlements appear to have had some manufacturing capacity, it seems, on present evidence, that most settlements were supplied from established rural ‘industrial’ sites, possibly alongside specialist itinerant tile-makers, though these operated at greatly varying scales and no doubt through very mixed contractual arrangements.

**SALT PRODUCTION**

As with most ancient economies, salt was of great importance to the economy of Roman Britain, used primarily for the preservation of foodstuffs, in food preparation and possibly in other activities such as tanning and in the dyeing of textiles (Kinory 2012, 105; see below). Its significance was such that in central parts of the Roman Empire the production of salt remained mostly under state control, although the organisation of the industry in Britain remains largely unknown (Shottter 2005, 43). The two major sources of salt are from coastal sea water and natural brine springs inland, both of which were exploited in Britain. Although there were many individual variations, surviving evidence indicates that the typical process for salt extraction in late Iron Age and Roman Britain was the open-pan method. Here, the saltwater was either transferred straight to a vessel over a hearth (often a lead pan during the late Roman period) and evaporated to create salt crystals, or else first settled in tanks to allow some natural evaporation (and thus concentrate the brine) and then poured (or filtered) into the evaporation vessel. The salt crystals were then dried and packed in containers ready for transport (cf. Fielding 2005; Biddulph et al. 2012, 13, figs 1.1 and 6.58).

Major salt-production areas of Roman date comprise the coastal zones of the East Anglian Fens, south Essex/north Kent, parts of the south coast of England (particularly Dorset) and the Somerset Levels, while inland brine sources were well exploited at Droitwich in Worcestershire and in parts of Cheshire (fig. 5.21). Academic attention has traditionally focused upon the eastern salt-producing areas of the Fens (Gurney 1982; Lane and Morris 2001) and the Essex ‘red hills’, identified by mounds of debris from long-term salt production (Fawn et al. 1990; Sealey 1995), though more recent work on salt production in southern England (Hathaway 2013; Biddulph 2017) and Cheshire (Nevell and Fielding 2005) has somewhat redressed this imbalance. In all areas except Droitwich, salt production was polyfocal, with hundreds of salterns identified (though mostly unexcavated) in the coastal zones. Droitwich is unusual in that it appears to have been a single, centralised salt-extraction centre, with production occurring on a substantial scale.
from the late Iron Age onwards (Woodiwiss 1992). Until fairly recently the other main inland salt-production area in Cheshire was also thought to belong to the ‘Droitwich model’, with a single centre at Northwich. However, extensive archaeological work has now revealed major areas of salt production in nearby nucleated settlements at Nantwich and Middlewich, while a significant new discovery in Cheshire was the smaller Iron Age and Roman salt-production site at Railway Farm in the Wheelock Valley (Nevell and Fielding 2005, 66–7).

**FIGURE 5.21.** Excavated Roman sites with evidence for salt production in relation to sites with evidence of briquetage

CHRONOLOGY, CONTEXT AND ORGANISATION OF SALT PRODUCTION

Previous studies have demonstrated the major regional and chronological variations in salt production over the course of the late Iron Age and Roman periods, with Hathaway (2013) demonstrating how producers adapted to changes in the supply and consumption of salt within this timescale. Despite only using evidence from a selection of excavated sites, the chronological patterns observed in the current study broadly
correspond with these more detailed analyses of regional salt production. In particular it is shown that, overall, there is significant evidence for salt production during the late Iron Age, and that numbers of sites increased to a high point in the late first to second century A.D., whereupon there was a pronounced decline in numbers during the later Roman period (fig. 5.22).

This general pattern obscures major regional differences as shown in FIG. 5.22. The late Iron Age and early Roman period appears to be the highpoint of salt production for much of the south English coast, and – during the early Roman period in particular – for the Kent and Essex sites, although as Biddulph has recently pointed out (2016, 222), a programme of pottery re-assessment and radiocarbon dating is needed for the Essex Red hills. In many ways this chronology corresponds with the overall height of rural settlement numbers in these areas, and thus it could represent an inward-driven (i.e. without external influence from the Roman state) economic response to a growing population. The Fenland salt-production sites reach their peak in terms of numbers during the second and third centuries A.D., again largely following general rural settlement patterns, though this does disguise well-noted differences, with the Lincolnshire sites reaching their numerical height in the early Roman period and the southern and eastern Fen sites becoming more prominent during the mid-Roman period, perhaps under some stimulus from the Roman state (cf. Lane and Morris 2001, 398; Jackson and Potter 1996, 687). Such patterns may be more apparent than real, however, as it has been suggested that the saltworkers of the western Fen edge sites may have shifted further east, deeper into the Fens, during the early Roman period owing to climatic reasons (i.e. Fen edge drying up), but that evidence for this was covered up by late Roman and post-Roman flooding and silting (Lane 2005, 54). The final major coastal salt-producing area, in the Somerset Levels, has too few datable sites in the project dataset for any major chronological patterns to be detected, although there is some evidence that production in the North Somerset Levels had more of an early Roman emphasis (Cox and Holbrook 2009). However, the work of Hathaway (2013), compiling dating evidence from a larger number of salterns, would suggest that the dominant period of salt-production in this area overall occurred during the mid- to late Roman period, when it may have become one of the major producers, coinciding with the floruit of late Roman settlement in the west of England.

The two main inland salt-production centres, in Droitwich and Cheshire, have both revealed evidence for salt production at some level from the late Iron Age to the late Roman period. Many different excavations within Droitwich have shown evidence for salt production, one, at Dodderhill seemingly limited to the late Iron Age, terminating at around the same time that a fort was established...
in the mid-first century A.D. (McAvoy 2006). Excavations elsewhere revealed numerous brine tanks and large quantities of briquetage, though there are indications of a decline, or at least relocation of the industry, from the early second century (Woodwiss 1992). There is relatively little evidence for salt production in Droitwich during the late Roman period, though the later third century was the *floruit* of the adjacent Bays Meadow villa complex, which – assuming that it was associated with this industry – suggests continued exploitation of some kind (Barfield 2006).

Salt production appears to have been sustained more consistently in the Cheshire sites, being an important feature of the military *vicus* /roadside settlement at Middlewich, along with other industries such as iron, lead and bronze working, leatherworking, pottery production and window-glass manufacture (Garner and Reid 2012). However, even here there is evidence for a reduction in activity during the later Roman period, while at nearby Nantwich occupation is thought to have largely ceased around the mid-third century, although there was a final phase of brine collection during the late third/fourth century, when wicker-lined pits may represent successive episodes of brine collection on a more modest scale (Arrowsmith and Power 2012).

The chronological patterns just outlined suggest that there were major changes in salt production and supply mechanisms over time, yet the organisation of the salt ‘industry’ remains ill understood. Unfortunately, the lack of diagnostic briquetage transportation vessels of the Roman period means that the distribution networks of salt exported from the different production areas is largely conjecture, though see Willis (2016) for the distribution of briquetage salt containers of the late Iron Age and early Roman period in northeast England. It has been suggested that some of the common Dorset BB1 pottery jars found across the country may have started life as salt packaging (Cool 2006, 58; Gerrard 2008; see also Biddulph 2017, 227–9).

Somewhat more can be ventured about differing modes of salt production. Lane and Morris (2001, 394–8) utilised production models derived from studies of pottery and tile manufacture to suggest similar modes of ‘household production’, ‘individual workshop’, ‘workshop industry’, ‘estate production’ and ‘military’ production, with most Roman sites falling into the ‘individual workshop’ category. Within this mode relatively small-scale saltmaking would have formed the main economic activity for individuals, though it is unlikely to have ever been a full-time occupation as the salt-production season is known from medieval documents to have run from approximately June to September (Keen 1988, 142–3). Just 14 of the 71 excavated salt-production sites in the current study lie within the context of what has been interpreted as a farmstead, indicating that, in these examples, agriculture is likely to have been the major economic activity. At a further 40 sites there was no evidence for any significant associated settlement in the immediate vicinity, although most did produce some evidence for limited domestic activity in the form of animal bone and pottery, as would befit sites that were occupied or utilised seasonally, perhaps used as additional economic enterprises on wider agricultural estates. A significant late Roman salt production site at Stanford Wharf, Essex, on the Thames Estuary also revealed evidence for fish sauce/paste production in the form of a mass of small fish bones from a single deposit, and it was suggested that such activity could have extended the economic season on this site into the autumn or early winter (Biddulph et al. 2012, 171; Biddulph 2017, 226). Small-scale excavations at Scotney Court, Kent, also revealed evidence for a coastal salt-production site with numerous bones from haddock and halibut, mostly from a single pit, suggesting specialist processing; many included knife-filleting marks that suggest they were strung for salting and drying (Barber 1998). Maltby (2006) has identified a link between pig-processing and salt production at sites in south Dorset (see Ch. 3), as seems likely in Roman-era Armorica, and all these examples illustrate the potential economic diversity of some salt-production sites.

There is, as yet, only limited and indirect evidence for state or military control over any aspect of salt production in Roman Britain, and most of this relates to the two main inland sources of brine. The saltwater springs at Droitwich and in Cheshire were clearly well exploited during the late Iron Age, and therefore the early construction of forts at all sites except Nantwich (though one is suspected here; Connelly and Power 2005, 40) may well have been to exert some control over salt production in the form of a mass of small fish bones from a single deposit, and it was suggested that such activity could have extended the economic season on this site into the autumn or early winter (Biddulph et al. 2012, 171; Biddulph 2017, 226). Small-scale excavations at Scotney Court, Kent, also revealed evidence for a coastal salt-production site with numerous bones from haddock and halibut, mostly from a single pit, suggesting specialist processing; many included knife-filleting marks that suggest they were strung for salting and drying (Barber 1998). Maltby (2006) has identified a link between pig-processing and salt production at sites in south Dorset (see Ch. 3), as seems likely in Roman-era Armorica, and all these examples illustrate the potential economic diversity of some salt-production sites.

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Within the coastal salt-production areas the evidence is more mixed, and the sheer diversity of sites has led Hathaway (2013) to conclude that
there was little evidence for any formal state control, at least during the early Roman period. Nevertheless, during the late Roman period, while the number of salt-making sites was greatly reduced, there were a few where production seems to have been on a considerable scale, inciting arguments for some kind of military or state influence. At Blackborough End, Middleton, in the Norfolk Fens, there was a large, late third to fourth-century saltern mound of briquetage and pottery, 0.18 ha in size and 0.6 m high, with evidence for hearths, settling tanks and probable lead pans (Crowson 2001). The scale of production, formality of the site’s layout, and its location where salt could easily be transported by river out to the Wash and any number of military or urban sites led to suggestions that it fell under the ‘military production’ mode (Lane and Morris 2001, 398). Similarly, the late Roman phase of salt making at Stanford Wharf, Essex, noted above, was also on a relatively large scale with hearths, lead tanks and buildings (Biddulph et al. 2012).

An enigmatic building on this site was interpreted as a possible signal tower, with its military connections strengthened by a spearhead found in one of the structure’s replacement postholes (ibid., 175). As with Middleton, the site was well placed for water-borne traffic, which would have enabled salt to be transported quickly and easily into the heart of Roman London or further afield.

Sites such as Stanford Wharf and Middleton suggest that, while the state might not have had a direct role in salt production in Roman Britain, there were contingencies in place to ensure that the military and larger urban centres were kept well supplied with this important commodity.

**ANIMAL PRODUCTS**

By Martyn Allen

As seen in Chapter 3, animals were an integral part of food production in late Iron Age and Roman Britain, providing much of the population with meat and dairy. After their slaughter, however, animal carcasses can also be utilised for a range of materials. This section focuses on the evidence for the exploitation of bone, antler, hides, and horn.

**BONE AND ANTLER-WORKING**

Bone and antler were widely exploited as raw materials for a range of objects, including dress and personal items (e.g. combs and hair pins), tools for textile processing and leatherworking (e.g. awls and needles), recreational objects (e.g. gaming counters and dice), and other household items (e.g. spoons). While many bone items were utilitarian in nature, others were finely manufactured, involving considerable time and expertise. The hundreds of intricate and highly detailed bone veneers recovered from funerary biers and graves at Brougham, Cumbria, stand as an example of the exceptional levels of skill of some craftspeople (Cool 2004). Crummy (2001) has suggested that some specialist bone-workers may have been fairly mobile, moving between different settlements to ply their trade and to sell their products. The scale of production, however, is difficult to assess. Large-scale boneworking requires a regular supply of animal carcasses, which were probably only available in larger settlements. Comparatively substantial deposits of bone and antler-working waste have been identified in towns, but are less common at rural sites (e.g. Maltby 2010, 218–19; Rees et al. 2008, 64–6).

Direct evidence for boneworking is indicated by fragments of off-cuts and unfinished items. The distribution of rural sites with boneworking evidence is concentrated in southern and eastern England, and closely mirrors the distribution of sites with animal bone assemblages (Fig. 5.23). It is hard to gauge the relative importance of boneworking in different parts of the province, because the distribution of finds is so clearly biased by preservation conditions and by the concentration of excavated sites in these areas. Dating and contextual information of worked bone and antler artefacts is provided in some finds reports, particularly those of Greep who studied large collections from Castleford and Caerleon (Greep 1986; 1998). Crummy’s detailed report on the finds from Colchester not only covered finished artefacts but also unfinished items and working waste, which allows for a much better understanding of the manufacturing process (Crummy 1983, 149–60; see also Crummy 1981). These reports demonstrate the array of different types of bone artefacts being manufactured at some sites, ranging from rough-outs of decorative, household items to splintered long bones, presumably for needles, awls, and possibly pins. Saws were most commonly used to cut bone and antler, while lathes were also used to turn objects while they were being cut (Crummy 1983, 150, 158).

Away from major towns, boneworking waste has been identified at over 25 per cent of defended small towns and villages, 20 per cent of roadside settlements, 15 per cent of military *vici*, and at less than 5 per cent of farmsteads (Fig. 5.24). Complex farmsteads are twice as likely to produce boneworking waste as enclosed farmsteads, reflecting the greater economic diversification often associated with this type of rural settlement (see Allen and Smith 2016, 28–33). The frequency of boneworking activities identified at nucleated
settlements possibly reflects higher numbers of craft-workers and better access to raw materials. Antler-working has also been recorded at most types of site, though it is particularly rare outside of defended small towns and villages. As a proportion of sites with evidence for boneworking, antler waste is more commonly found at defended small towns and villas. Higher proportions of deer bones resulting from hunting are often found at villas, which may have provided further raw material for working (M.G. Allen 2014). Unlike other bones, however, the exploitation of antler does not require animals to be slaughtered, as male deer annually shed their antlers at the end of the mating season. In most cases, it is difficult to tell whether worked antler derived from hunted...
animals or shed specimens. Greep (2015) has recently published details of a late Roman antler workshop at the fort at South Shields that provides information about the manufacturing process. The antler used there was exclusively from red deer and, notably, both shed antler and antler from hunted animals were exploited, perhaps suggesting that manufacturing was not necessarily restricted to a particular season.

At most rural sites boneworking is often represented by only a few waste scraps, reflecting fairly non-intensive activity. Bone tools are durable and probably did not need to be frequently replaced. Nevertheless, larger waste deposits at Balsbury Camp, Hampshire, and Gussage All Saints, Dorset, suggest that boneworking may have been a regular activity at these sites in the late Iron Age (Wainwright 1979; Wainwright and Davies 1995), while some Roman sites also provide evidence of more intensive working. Concentrations of cut and broken bone in mid-Roman deposits located close to buildings in the roadside settlement at Higham Ferrers, Northamptonshire, indicate the presence of a small workshop (Lawrence and Smith 2009). Numerous unfinished bone and antler objects were recovered alongside a large number of bone artefacts at Frocester villa, Gloucestershire. These included an abundance of hair pins, armlets, spoons, a whistle, a bone inlay, and a possible weaving tablet, many of which were probably manufactured on site (Price 2000, 97–102). Specialised production occurred at some rural settlements, as suggested by unfinished bone pins at Gatcombe, North Somerset (Branigan 1977), and Strood Hall, Essex (Timby et al. 2007a), spoons at Woodcuts, Dorset (Pitt-Rivers 1887), and gaming counters at Stanwick, Northamptonshire (English Heritage n.d.). Similar manufacturing evidence was also found at the probable villa at Reader’s Estate, Chalk, Kent, where a considerable quantity of bone and antler pins, along with antler rough-outs, were recovered from the cellar (Johnston 1972).

HORN-WORKING

It is difficult to gauge the scale of the horn-working industry in Roman Britain owing to the relative lack of finished horn artefacts. These are very seldom found on Roman sites because horn is composed of keratin, which is rarely preserved in archaeological deposits. Even in waterlogged features, which favour the preservation of organic materials, horn does not survive well (though see Berg 1999, 244, plate 31). A finely made, horn comb recovered from heavily saturated conditions in the southern gardens at Fishbourne is an outstanding example (Cunliffe et al. 1996). The best evidence for the manufacturing of horn derives from concentrations of bone horncores from cattle, sheep or goats. Horn is removed from the bony core either by drying, or by soaking in boiling water for several hours or cold solution for several weeks or months (MacGregor 1985, 65–6; 1991, 370–1). Horns that show further signs of chopping or sawing after being removed from the skull are likely to represent horn-working activities rather than hide preparation, where horns may have been left attached to the skin (MacGregor 1985, 66; see below, p. 219).

It is reasonable to assume that horn-working would have been most commonly practiced in towns. Carcass processing was relatively intensive in urban settlements, where butchers would have been able to provide horn-workers with regular access to raw materials. At Exeter, Maltby (1979, 86) reported an abundance of cattle cranial fragments in fourth-century ditches, but a relative lack of cattle horncores. This implies that horns were being deliberately removed during primary butchery and probably sent elsewhere for working. At Victoria Road East in Winchester, a large pit (F814) produced numerous cattle horncores with cut marks showing that the horn sheaths had been removed (Maltby 2010, 63–6, 251–2). Further deposits from this site suggest that horn-working and hide production may have been a feature of this area of the town (see below). In Lincoln, accumulations of cattle and sheep horncores were found deposited just to the south of the town wall, indicative of waste from specialist working (Dobney et al. 1996, 29, fig. 30b). Concentrations of cattle horncores have also been encountered at other nucleated settlements, such as at Alcester, Hockley Chemical Works, Warwickshire (Mudd and Booth 2001), Staines, former Central Trading Estate, Surrey (McKinley 2004), Enfield, Lincoln Road, Greater London (Gentry et al. 1977), and the military vicus at Chester-le-Street, Co. Durham (Proctor 2006).

In contrast, concentrations of horncores are rarely found at farmsteads. Evidence for horn processing in the late Iron Age is found at Brighton Hill South, Hampshire, where a large quantity of cattle horncores was recovered from pits and ditches, many with cut and chop marks (Maltby 1995). At Gussage All Saints, Dorset, sheep horncores had been sawn from skulls (Harcourt 1979), while butchery marks from skinning and horn removal were also evident in late Iron Age phases at Owslebury, Hampshire (Maltby 1987), and Whitcombe, Dorset (Buckland-Wright 1990). Evidence for horn-working is equally rare in the Roman period, although there are a few exceptions. At Orpington,
Greater London, excavation of a short section of ditch produced 135 cattle horncores, around 20 per cent of which had been chopped through with a cleaver (Hart 1984). The deposit contained few other animal remains and clearly represents extensive horn processing.

HIDES AND LEATHER PRODUCTION

Evidence for the exploitation of hides can be quite ambiguous. Depending on the method of skinning, hide processing can be represented by bones left attached to skins by butchers, seen archaeologically as deposits of faunal remains dominated by skull fragments and foot bones. However, concentrations of horncores can also be attributed to this activity, making it difficult to distinguish from horn-working (Serjeantson 1989). As with horn-working, it is likely that hides were more intensively exploited in towns and other large settlements, and it is possible that hide processing and horn-working occurred in close proximity. This is indicated at Victoria Road East, Winchester, where a massive deposit of chopped horncores (see above), and numerous cattle and sheep metapodials and skull fragments were placed in a single pit (Maltby 2010, 63–6, 251–2). Similarly, excavations to the south of the colonia at Lincoln, at 181–3 High Street, produced marked concentrations of horncores and metapodials (Dobney et al. 1996, 29, fig. 30a). Locating tanneries and horn workshops outside towns may have been common owing to the unpleasant smell given off during processing. Of course, waste from tanneries and horn-workers may have been collected and deposited in external areas, along with general refuse from the town.

Skinning waste from sheep and goats can be found on a number of farmsteads. Pit deposits with concentrations of skull and foot bones, many with skinning marks, have been excavated at Tolpuddle Ball, Dorset (Hearne and Birbeck 1999, 222), Poundbury Farm, Dorset (Grimm 2011), Alington Avenue, Dorset (Maltby 2002), Oakridge, Hampshire (Maltby 1994b), Langdale Hale, Cambridgeshire (Higbee 2013, 124, fig. 2.61, 127), Wattle Syke, West Yorkshire (Richardson 2013, 235), and Swaythorpe Farm, Kilham, East Yorkshire (Gidney 1998). Sheep slaughtered between six and twelve months were a feature of the skinning deposit at Langdale Hale, which contained the bones from at least 26 animals, while a similar emphasis on yearling lambs was evident at Poundbury Farm. Lambskins were probably more highly valued than hides from adult sheep, considering the expense of slaughtering livestock at such a young age.

The large-scale processing of hides into leather may have been an important innovation of the Roman period, and analysis of material from military sites suggests that goatskin was particularly favoured by the army (Van Driel Murray et al. 1993, 56–7). At Castleford, West Yorkshire, goatskin leather was used to manufacture tents, shield covers, saddle covers, and bindings, while cattle hides were used for shoe manufacturing (Van Driel Murray 1998, 334). Such a quantity of leather would have required large numbers of goats, though the relative lack of goat bones in the faunal assemblage perhaps suggests that goatskin was imported (Berg 1999, 226). This is also implied by several orders for goatskins in the Vindolanda tablets (e.g. Tab. Vindol. II, 309).

Tanning requires hides to be immersed to loosen hair and to treat the skin, and in the medieval period this was done with urine, wood ash or lime (Cherry 1991, 296). The methods used in Roman Britain are not known, though excavations at Middlewich, Cheshire, produced quantities of preserved leather from brine pits (Williams and Reid 2008). As discussed above (p. 215), salt production was a major part of the economy of this site, and the animal bone evidence suggests that joints of meat were being salted (see Ch. 3). It seems likely that leather production and meat preservation were both undertaken here to supply the army.

The scale of the leather-production industry in Roman Britain is uncertain, though leather objects are widespread, tending to survive in waterlogged features such as wells and waterholes, owing to the hide being chemically treated, which delays biological and microbial deterioration (Wayne Smith 2014). Shoes are the most commonly recovered leather object (FIG. 5.25), with several different types being manufactured (e.g. Crummy 2011, 49–50; Keily 2011). These tend to be found more often in nucleated settlements, especially defended small towns, partly because of the greater number of wells and the larger human population, but also perhaps because of differences in the use of footwear. The relatively high incidence of leather shoes in wells has previously been recognised, with those for the left foot suggested as being deliberately selected for structured deposition as part of a rite of termination (Van Driel-Murray 1999, 136; see Vol. 3).

Other leather finds are occasionally found in towns and at military vici, such as shield covers and horse gear, though these rarely appear at farmsteads or villas; indirect evidence for leather items, particularly clothing, is, however, often indicated by studs and fasteners. Leather manufacturing is evidenced by tools, such as awls, punches and slickers (though some of these
tools may have been used for other activities), and by waste from leather off-cuts. Such tools are found on most site types, but are more commonly recovered from nucleated settlements (FIG. 5.26). In contrast, leather off-cuts are almost exclusively restricted to towns, defended ‘small towns’, military vici, and roadside settlements. As with the boneworking industry, leather production and manufacturing is likely to have been predominantly centralised, partly due to the location of craft specialists and the availability of raw materials.
TEXTILE PRODUCTION

By Tom Brindle and Lisa Lodwick

The textile industry has been suggested as being a leading sector of the Romano-British economy by the late third century A.D., primarily on the basis that the only British products named in the Edict of Diocletian comprised woollen capes (Birrus Britannicus) and rugs (Tapete Britannicum) (Wild 2002, 1; see Ch. 3, p. 141). Evidence for textile and clothing production in Roman Britain is based on sculptural evidence (e.g. Carroll 2012), documentary evidence (Bowman 2003), preserved textiles and archaeobotanical evidence. In addition there are rare references in Roman literary sources, notably in the Notitia Dignitatum, which refers to a post of procurator of a textile establishment at Venta (procurator gynaeii (in Britannia) Ventensis), usually taken as meaning Winchester (Clarke 1979, 369), although the interpretation and activities undertaken are debated (Booth et al. 2010, 527–8; Wild 1967).

Unfortunately, given the limited information provided by most of these strands of evidence, our understanding of the organisation of the rural textile industry remains quite poor (cf. Fulford 1989a, 190). Nevertheless, Wild has argued that the villa estate was the most likely context for the organisation of textile production (see discussion of villas as markets in Ch. 6), based largely on sculptural evidence from northern Gaul, with farmsteads only producing textiles at a subsistence level (Wild 2002, 28). Furthermore, Wild also suggested that given the military requirements for textile products, around half of all households in Britain may have contributed towards fulfilling the army’s annual textile needs, based upon previous population estimates for the Roman province (Millett 1990, 184).

Developer-funded excavations have contributed little in the way of preserved textiles or sculptural evidence, but have provided a rich dataset of material culture (spindlewhorls, loomweights, wool combs), faunal and archaeobotanical remains, against which textile production can be evaluated. This section will use this evidence to discuss the use of different fibres, alongside developments in spinning and weaving practices.

FIBRES

Wool

Sheep’s wool was the major textile fibre in use within Roman Britain (Wild 2002, 1), and its production, from livestock husbandry through to shearing, processing and manufacture, would have formed a significant component of the rural economy, at least in certain parts of the province. Evidence for wool production is derived primarily from an examination of sheep mortality profiles, with higher proportions of sub-adult and adult livestock interpreted as an emphasis on the production of secondary products, including wool. Sheep mortality profiles are generally quite consistent throughout the Roman period, with few sheep kept alive until full adulthood. However, as discussed in Chapter 3 (pp. 114–16), there is a great deal of inter-site variability, and some sheep age profiles have indicated that wool production was more prevalent at certain larger towns (e.g. Winchester: Maltby 2014, 4), along with a number of roadside settlements (e.g. Grandford, Cambridgeshire: Stallibrass 1982) and several farmsteads (e.g. Claydon Pike in the Gloucestershire Upper Thames Valley: Sykes 2007, 152–3). The overall impression from these sites is that wool production was more intensive during the later Roman period, though this was not necessarily a widespread phenomenon (see Ch. 3, pp. 116, 141).

The material culture evidence for the early stages of wool production (as opposed to the subsequent processing of fibre through spinning and weaving, discussed below) comes principally in the form of iron spring shears for shearing sheep and wool combs, to secure longer fibres for finer yarns (Wild 2003, 79–80). Sets or parts of sets of shears were recovered from 114 sites on the project database. Shears could have had a range of functions (Wild 1970, 23), including in hide/leatherworking, glass manufacture (Manning 2011, 70) and, for the smallest sets, for personal grooming (Jackson 2011, 265). However, while small sets of shears that are unlikely to have been used for sheep shearing are sometimes found, those recovered from rural sites are typically of Manning’s medium-sized type (Manning 1985, 34), which would have been used for shearing as well as for other tasks during wool and other fibre processing (Rees 2011, 109).

The geographic distribution of excavated sites with shears is strongly focused on the south and east of the province, with few sets of shears recovered from the north and west (FIG. 5.27). While this may partially reflect differential preservation of iron, it is arguably more likely to be linked with differences in the methods used for gathering wool, as well as the scale of production. The relative absence of shears in the north and west may indicate continuation of traditional practices of plucking rather than shearing wool at farmsteads where textile production was arranged at a household level (Wild 2002, 5). The increased incidence of shears in the south and east, on the other hand, is likely to represent intensified wool production, with shears facilitating rapid recovery...
of the whole fleece (*ibid*). Indeed, the social distribution of shears also suggests an emphasis on surplus wool production, focused as it is on villages (12 per cent of all sites), roadside settlements (11 per cent) and villas (8 per cent), with less than 2 per cent of farmsteads having produced shears. This distribution raises questions regarding the organisation of shearing and other processes associated with textile production, and may suggest that some flocks were annually mustered for shearing at central locations. This suggestion is perhaps supported by the larger numbers of shears sometimes recovered from defended ‘small towns’, including five sets from Alchester, Oxfordshire, although of course this may also represent the role these sites played as markets for these sorts of iron tools, as well as the fact that shears could also have been used for cutting cloth (Manning 1985, 34).

Wool combs are relatively infrequent finds at rural sites, largely because they are fragile objects that do not survive well. Identifying the broken teeth from these objects can be difficult, and it is also hard to distinguish the teeth from those of flax heckles (Crummy pers. comm.). They are restricted to just eighteen sites in the project database, focused on the Central Belt and East project regions. Manning (1966; 1972; 1985) and others (e.g. Crummy 2010) have previously noted an East Anglian emphasis on the distribution of wool combs, suggesting that this may represent a focus on wool production for this region. The wool combs recorded on the project database are less clearly focused on nucleated settlements and villas than shears, only being identified at the roadside settlements at Great Dunmow, Essex, and Stanwick, Northamptonshire, and the villas at Ironmongers Piece, Marshfield, South Gloucestershire and Gorhambury, Hertfordshire. They appear to occur slightly more widely at farmsteads, having been identified at eleven sites, although Manning has previously identified additional examples in museum collections recovered from the roadside settlements at Icklingham, Suffolk, and Ewell, Surrey, and the villa at Ixworth, Suffolk, as well as from towns including Caistor-by-Norwich, Great Chesterford and London (Manning 1972, 335). This suggests that such objects may have been more widespread at nucleated sites than the project data suggest.

Fulling, the preparation of woollen cloth through scouring and milling, has been identified elsewhere...
in the Roman world on the archaeological grounds of basins and fulling stalls, such as at Pompeii, Ostia and Rome (Flohr 2013). Frere suggested the tanks and hypocausts at Darenth villa, Kent, were associated with fulling or dyeing (Frere 1987, 291), but the presence of corndrying ovens offers another explanation for these structures, in the brewing process (see Ch. 2, p. 62).

**Flax**

Wild considered flax as a significant cloth fibre in Roman Britain, although it was still thought to have been a relatively modest element of the textile industry (Wild 2002, 1, 6-7). *Linum usitatissimum* L. (flax) is an annual herbaceous plant cultivated for linen textiles, linseed oil and linseeds (Zohary et al. 2012). It is often described as an intensive crop, requiring fertile and moist soils (Valamoti 2011), and its presence in Roman Britain has often been associated with crop rotation (M. Jones 1981, 113). In order to produce linen fibres from flax plants, the harvested plants are riddled to removed flax capsules, soaked under water or left out in fields, before being dried, broken up, and scutched to remove the straw and shives (Andersen and Karg 2011). The resultant fibres can then be spun into threads (Leuzinger 2002) and whether it was an oil or textile crop in Britain has often been associated with oil, and small seeds with textiles (Herbig and Maier 2011). Unfortunately, flax measurements have rarely been recorded from Roman Britain, though a recent study from Silchester produced a wide range of seed sizes, indicating a multi-use flax crop (Lodwick 2016). The majority of records of flax consist of rare seeds or capsules in only a few samples. For instance, at Ford Airfield, Yapton, West Sussex, flax seeds were minor occurrences in one out of fifteen late Iron Age samples and two out of sixteen early Roman samples (Hinton 2004). Exceptions include samples from ditches at a roadside settlement at Renny Lodge, Newport Pagnell, Buckinghamshire, where rich charred samples contained seeds, capsules and stems of flax, with a distinctive weed flora including *Chenopodium album* (fat-hen), *Atriplex sp.* (orache) and *Spergula arvensis* (corn spurrey). This exceptional find was interpreted as evidence for oil cultivation owing to the presence of mature seeds (C. Stevens 2009).

At Kingsborough Farm, Eastchurch, Kent, hundreds of flax capsule fragments were recovered from an early to mid-Roman ditch within a field system, again interpreted as evidence for linseed oil production as the capsules were all mature (S. Stevens 2009). Beyond these sites, the Thames Valley provides the best studied region. Good evidence for flax retting is provided by mid–late Iron Age retting pits with relatively high densities of flax seeds and capsules at Lower Bolney Farm (Campbell 1992) and Old Shifford Farm in Oxfordshire (Hey 1995) (fig. 5.29). Elsewhere in the Thames Valley, only occasional charred and waterlogged seeds and capsules occur, such as at Claydon Pike, Reading Business Park, Mount Farm, Barton Court Farm and Yarnoton (Robinson 2007; Moore and Jennings 1992; Lambrick 2010; Jones and Robinson 1986; Greig et al. 2004). Within Romano-British urban contexts, flax seeds and capsules often occur in samples containing fodder and hay (Lodwick 2016; Monckton 1999).

Agricultural tools specifically associated with linen fibre processing are exceptionally rare. At Ickham in Kent, seventeen iron spikes were identified as heckles, used to separate flax fibres (Bennett et al. 2010), and a flax heckle was also identified at Wanborough (*Durocornovium*) in Wiltshire (Anderson et al. 2001). Equally rare are features identified as retting pits. Beyond Old Shifford Farm and Lower Bolney Farm, two square pits located within a system of enclosures and platforms at Kenn Moor on the North Somerset Level were suggested as retting pits (Rippon 2000, 92), and a single charred *Linum sp.* seed was recovered from a nearby enclosure around a corndryer (fig. 5.29). A possible retting pit on the edge of the Lea Valley floodplain at
FIG. 5.28. Frequency of records of flax by period, site type and distribution
Newham consisted of large wooden stakes and possible surviving wattle (Payne and Spurr 2009). The lack of identified retting structures may be due to the location of this noxious activity at the edge of settlements or, alternatively, dew retting may have been taking place. Perhaps the more likely argument is that linen production was a rare activity, occurring only at the household level, and hence leaving little archaeological evidence. It is certainly the case that flax production for textiles was never on a par with wool.

**Minor textiles and dye plants**

Wild (2002, 7–8) suggested several other textile plants that may have been used in Roman Britain. *Cannabis sativa* L. (hemp) was introduced to Britain in the Roman period (Tomlinson and Hall 1996), but records are largely restricted to military and urban sites (Van der Veen et al. 2008). Cannabis-type pollen (hemp or hop) was recorded from a Roman ditch at Deeping Bypass, Cambridgeshire, suggested as evidence for hemp retting (Wiltshire 2000), and waterlogged hemp seeds have also been recorded from late fourth-century deposits within a cubicle of a bathhouse, alongside other food plants at Bucknolse Roman villa, Dorset (Light and Ellis 2009). Other occasional materials have been recorded, such as a coarse grass rope from Droitwich, Worcestershire (Hurst 1997), a hazel withy rope at Brockley Hill north of London (Goodburn 2008, 136) and goat hair, tree bast and hairmoss (Wild 2002, 7).

Equally limited archaeobotanical evidence is available for dye plants, in stark contrast to that available from the medieval period (e.g. Walton Rogers 1997). *Isatis tinctoria* L. (woad) has only been recorded from late Iron Age deposits at Dragonby, Lincolnshire (Van der Veen et al. 1993). *Reseda luteola* L. (weld) is also rare, again found at Dragonby, but also London and York. The occurrence of a charred seed of *Reseda luteola* from Monkton, Isle of Thanet, and at Weeting, Norfolk (Murphy 1996) is consistent with the other calcareous arable weed seeds present (Pelling 2008). In contrast to the lack of archaeobotanical remains for dye plants, a range of dyes have been identified through examination of textiles, including *Rubia tinctorum* L. (madder), of which no Roman archaeobotanical remains from Britain are known (Wild 2002, 7). Evidence for the use of...
madder, bedstraw and woad has also been identified through the analysis of textiles (Walton Rogers 1993; Taylor 1983). Further evidence for dyes comes from the coastal metal-production site at Duckpool in north-east Cornwall, where the presence of many Nucella lapillus (dog whelk) shells with uniform breakage pattern was interpreted as evidence for the extraction of purple dye, referred to as Tyrian purple (Light 1995). Wild considered that mordants or dye fixants were in use in Roman Britain (Wild 2002, 8) but there is no direct evidence.

The limited evidence for dye plants is matched by that for dyeing installations. In Pompeii, dyeing workshops have been identified through the presence of furnaces, cauldrons and basins (Flohr 2013), but no such convincing evidence has been recorded from Roman Britain. At Silchester, circular furnaces recorded in Insulae X and XI were initially interpreted as dyeing vats, but reinterpreted as brewing structures (Boon 1957, 286–7). At Wilderspool, Cheshire, three large clay-lined tanks, two with a drainage channel, were recorded at the Lousher Lane site, but with no supporting evidence for textile activity other than a number of spindlewhorls and loomweights (Hinchliffe and Williams 1992, 115, 119; Rogers and Garner 2007, 49).

SPINNING

After flax and wool were gathered and prepared for processing, fibres required spinning to form thread before they could then be woven into cloth using a loom. Abundant artefactual evidence for the spinning and weaving of fibres survive, chiefly in the form of spindlewhorls and loomweights, although a range of other objects likely to be associated with textile production are also found.

The spinning of fibres was undertaken using a drop spindle, as well as a distaff, probably, which held the prepared fibres (Wild 2002, 8). As most spindles and distaffs were made of wood they seldom survive, although occasional examples have been recovered where preservation is exceptional (e.g. a possible wooden spindle from Upwich, Droitwich; Hurst 1997). Far more common are the spindlewhorls (discs or spherical objects with a perforation for the spindle, made from a range of different materials), used as a weight to control the spin of the spindle. Indeed, spindlewhorls are among the most common types of object recovered at sites across the province. The representation of wool and spinning equipment on female tombstones (RIB 1065; Wild 2003, 77; Crummy 2010, 76; Cool 2011, 309) and the placement of spindles in (usually) female graves indicate that spinning was predominantly undertaken by women and girls. For instance, spindlewhorls were recovered from a second-century A.D. female inhumation grave at Ely, Cambridgeshire (Crummy 2010), a likely late Roman female inhumation from Boscombe Down, Amesbury, Wiltshire (Gibson and Manning 2005), and a first to second-century cremation pit from Old Down Farm, East Meon, Hampshire (Whinney and Walker 1980), while at the late Roman Lankhills Cemetery at Winchester (an urban, not rural, cemetery), spindlewhorls were identified in several female graves (Cool 2010, 274–6). The placement of such equipment as grave goods suggests that wool-working was regarded as a symbolic virtuous, womanly pursuit (e.g. Wild 2002, 8; Hersch 2010).

The broad geographical and social distribution of spindlewhorls indicates that the spinning of wool was a widespread domestic activity undertaken at the level of the individual household (Wild 2002, 9). The quantities found vary considerably, with roadside settlements, villages and villas usually better represented than farmsteads (fig. 5.30), and this difference may chiefly reflect the varied scale of these settlements and the number of individual households present. A number of Iron Age sites, particularly some villages and hillforts, have yielded exceptionally

![FIG. 5.30. Frequency of spindlewhorls shown by site type](image)
rich evidence for textile production, including Glastonbury and Meare Lake Villages in Somerset, each of which yielded around 200 spindlewhorls, along with many other objects associated with textile production such as weaving combs and loomweights. These sites were originally interpreted as Iron Age textile-production centres (Bulleid and Gray 1911; 1917; 1948; 1953; 1966), although it has more recently been suggested that it is the long duration of occupation and excellent preservation at these sites (the result of waterlogged conditions and the formation of peat) that sets them apart, and that the occupants of these sites may only have been engaged in domestic-scale textile production (Tuohy 2004). The frequent presence of loomweights at Iron Age rural sites (see below) is also evidence for general levels of self-sufficiency.

In general terms there appears to be something of a reduction in the use of spindlewhorls between the Iron Age and the mid-Roman period, and viewed by presence/absence at farmsteads there is a decline in the proportion of farmsteads with spindlewhorls from 27 per cent of sites occupied in the mid–late Iron Age to 18 per cent at those occupied during the second half of the second century A.D., with a slight increase in the later Roman period (Fig. 5.31). The reason for this pattern is not certain. It is possibly associated with a relative reduction in the scale of domestic textile production at some sites during the early Roman period, which may correspond with increased centralisation of the textile industry, the wider availability of ready-woven cloth, and an increasing preference among those who could afford them for dyed fabrics and new styles of clothes that could not easily be reproduced domestically. However, it is also possible that the phenomenon is methodological, with the data perhaps skewed by the erratic reporting of spindlewhorls made from recycled pot sherds, which are sometimes examined by pottery rather than small finds specialists, and are not necessarily always noted in the pot reports (Crummy pers. comm.). Whether or not the pattern is genuine, spindlewhorls certainly remain a common object type throughout the Roman period, and it is likely that much of the clothing requirements of many rural sites continued to be met at the domestic level.

The poor survival of textiles themselves makes it difficult to identify any major textile-production sites with certainty, although a small number of sites, particularly some villas, have yielded especially large numbers of spindlewhorls (and other textile equipment) alongside faunal assemblages that suggest an emphasis on wool and fabric production (e.g. Tarrant Hinton, Dorset: Graham 2006; Ironmonger’s Piece, South Gloucestershire: Blockley 1985); it is possible that such sites housed groups of quasillariae, slave women skilled in spinning (Wild 2002, 9; Hersch 2010, 124). Even if this were the case, it is not clear whether such sites would have produced spun wool or woven cloth for the wider market; epigraphic and literary references indicate that rich households in Italy had slaves who produced clothes for domestic use, as well as slave lanificae (wool-workers) on rural estates who produced clothes for the familia rustica (A.H.M. Jones 1960, 184). How much these Italian references can be applied to Britain is uncertain, although it seems plausible that cloth production was one element within a broad economic base for many villa estates.

There is, however, not always a straightforward correlation between the presence of faunal assemblages that appear indicative of wool production and the evidence from material culture. For instance, some roadside settlements have animal bone assemblages that may suggest a focus on wool production, but have yielded surprisingly little finds evidence for textile production, despite

![Fig. 5.31. Frequency of spindlewhorls at farmsteads over time](image-url)
having large finds assemblages overall (e.g. Birdlip, Gloucestershire: Mudd et al. 1999; Asthall, Oxfordshire: Cook 1955; Booth 1997). The variation suggests that the organisation of the textile industry was complex and operated across a range of scales. Although wool may have been an important by-product for some sites where sheep/goat are particularly well represented, these same sites need not necessarily have been engaged in large-scale processing of wool, with fleeces at some sites perhaps distributed to major centres for spinning, weaving, fulling and dyeing.

It may be of significance that farmsteads in some regions, such as the South-West and Upland Wales, appear far more likely to produce spindlewhorls than those in other areas (Fig. 5.32). For example, the Roman-period settlement at Trethurgy, Cornwall (Quinnell 2004), yielded twelve spindlewhorls, and while the excavator considered this a small number for the area excavated, it is considerably greater than for Roman-period farmsteads in most other areas (where the average is less than two per site). We must be wary of over-interpretation, as spindlewhorls can be made from a range of different materials, and it may be that the stone and ceramic spindlewhorls favoured in these areas survive better than those made from other materials elsewhere (e.g. the bone spindlewhorls placed in the grave at Ely, Cambridgeshire: Crummy 2010). However, the apparent distinctions may indicate that the occupants of farmsteads in these areas were more reliant on the production of home-spun textiles than those in areas where nucleated settlements with markets were more widespread, and ready-woven fabrics more widely available.

WEAVING AND SEWING

Weaving

After having been spun, wool was ready for weaving on the loom. As they were timber constructions looms rarely survive, and there are still no firmly identified examples from Iron Age or Roman Britain, although two fragments of possible loom-frames were recovered from a farmstead at Walesland Rath, Dyfed (Wainwright 1971a). Other artefacts associated with the weaving process include weaving combs, pin-beaters, weaving tablets and loomweights. Bone ‘weaving combs’ – tools often believed to have been used to manipulate thread while it was being woven on the loom – are occasionally found at rural sites, although they are not especially common, having been identified at just 33 sites on the database. These artefacts have long been recognised as an Iron Age rather than Roman type of object (e.g. Tuohy 1992, 385), and there is indeed an overwhelming emphasis on sites occupied during the Iron Age, with very few examples recovered from sites with solely Roman-period occupation. The identification of them as weaving tools, however, has attracted debate (Tuohy 1990; Ryder 1991; Wild 2002, 11). It is possible that they had functions in textile processing other than weaving, and some may have been entirely unrelated to textile production. Bone pin-beaters, used to push threads down during weaving and clear knots, have been identified at a number of rural settlements, but in many cases their identification is also questionable; such objects may have performed a range of functions not necessarily related to weaving. Weaving tablets, used for producing decorative or corded bands and borders, are also occasionally found.
Of the c. 20 examples recorded on the database almost all were retrieved from villas, roadside settlements or other nucleated settlements, and they are seldom recovered from farmsteads. Extant examples are typically of bone, although many were presumably also of wood, limiting their survival.

Far more common are loomweights, usually ceramic, used with the warp-weighted vertical loom to keep the thread taut. Typical loomweights of Iron Age or early Roman date are triangular in form, though their function as such has been disputed, with Poole (1995) arguing that many are more likely to be associated with ovens or kilns as lining or pedestals. However, at least some of these objects have suspension holes with evidence for thread wear (Wilhelmi 1977, 180–4; Martin 1988, 63; Major 1998, 106), and almost certainly therefore functioned as loomweights.

There is a widely recognised decline in the use of loomweights following the Roman conquest (Wild 2002, 10–11), and it is possible that this reflects increased centralisation of textile production during the Roman period, although nucleated settlements are also generally poorly represented by loomweights after the first century a.D. If the overall decline in loomweights was simply the result of centralised processing, we ought reasonably to see them occur more frequently at roadside settlements and towns. It is therefore likely that during the early Roman period in Britain there was a technological change in the type of loom being used, with the displacement of the traditional warp-weighted loom by the two-beam vertical loom, which did not require loomweights (Wild 2002, 11), and was regarded by Seneca (writing in Rome in the mid-first century a.D.) as a more refined instrument (ibid., 11; Wild 1970, 69). Although there is still no direct evidence for the two-beam loom from Britain, it was being used in Gaul (Roche-Bernard 1993, 80–2; 90–1; Walton Rogers 1997, 1759–61; 2001, 160–1). Roman towns, ports and roadside settlements typically developed during the latter first and early second century a.D., and as it is at these sites where we might expect to see the swiftest adoption of new technology, it may be at these places, as well as at villas, where weaving using the new type of loom began to be undertaken most widely.

Although loomweights appear to have gone out of use at most sites in many parts of Britain from around the time of the first century a.D., the recovery of possible loomweights from some Roman-period sites in the north and west suggest that the warp-weighted loom may have continued in use for longer. Loomweights were recovered from the farmstead at Forcegarth Pasture South, Co. Durham (Fairless and Coggins 1986), for instance, along with possible examples from the Cornish sites at Reawla, Gwinear (Appleton-Fox 1992), Kilhallon, Tywardreath (Carlyon 1982; 1999) and Nancemere Fields (Higgins 2009); all of these sites appear to have originated during the second century a.D.

Sewing

Garments were in most cases woven as single-piece items and required only minimal sewing prior to being worn (Wild 2003, 92). The social distribution pattern for sewing needles for the most part follows that of spindles, occurring most widely at roadside settlements (32 per cent) and villas (20 per cent), with relatively few recovered from farmsteads (6 per cent). Where they have been found in large numbers, the sites often also produce substantial numbers of spindles and they are frequently villas (e.g. Yewden Buckinghamshire: Eyers 2011; Gorshambury, Hertfordshire: Neal et al. 1990; Frocester Court, Gloucestershire: Price 2000; Kingscote, Gloucestershire: Timby 1998); this might at first glance represent further evidence for textile production being an important element of the economies at some villas. However, Roman needles are found in a range of different types and sizes, and not all would have been used for the manufacture or repair of textiles. Small iron needles were used for sewing leather, whereas large bone, antler, ivory and even precious metal needles have been shown convincingly to have been more appropriate for sewing together elaborate women’s hairstyles than for sewing textiles (Stephens 2008). This may help account for the large number of needles at some villas, especially as hairpins are also especially well represented at villas compared with other rural sites. It is notable that a spindle formed part of the contents of the exceptional ‘beauty case of Cumae’, and spun thread would also be required for the creation of elaborate sewn hairstyles (ibid., 123). Objects that might appear at first sight to be directly associated with the production of textiles might in some cases therefore be representative of other activities entirely.

PRESERVED TEXTILES

Given the rarity with which preserved textiles are recovered, recent developer-funded work has made a very limited contribution to the corpus presented by Wild (1970; 2002). Finds are generally limited to burials (e.g. Lankhills, Winchester: Walton Rogers 2010) and sites with waterlogged occupation deposits (e.g. Vindolanda: Cork et al. 1997). Of Wild’s (2002, 13) corpus of
over a thousand textile fragments, the vast majority have been recovered from urban and military sites, and very few derive from rural settlements. From Hadrian’s Wall, the most common cloth was wool spun in a 2/2 diamond twill, while finds from Colchester include a 2/2 diamond twill and weakly z-spun yarns (ibid., 14–18). Of these, linen textiles are rare, recovered only from Carlisle, Colchester and Corbridge, although this may be due to differences in preservation between linen and wool fabrics (ibid., 18). Beyond textiles, a carbonised flax rope, possibly a net, based on the presence of reef knots, was identified from Great Casterton Villa, Rutland (Corder 1951), while rope fragments of flax/hemp were recovered from Chew Park, Somerset (Rahtz and Greenfield 1977).

THE TEXTILE INDUSTRY: A BRIEF APPRAISAL

An appreciation of the scale and organisation of the Romano-British textile-processing industry is mostly derived from material culture evidence, though for wool production in particular it is important to take account of the animal bone evidence (Ch. 3, p. 141). The presence of shears, for example, suggests that wool collection was focused at nucleated settlements in the south and east, correlating with high proportions of sheep at roadside settlements in Lincolnshire, Northants and Cambridgeshire. The distribution of spindlewhorls could suggest that the spinning of fibres became more centralised over time within towns, villages and villas. In contrast, textile production in the South-West and Upland Wales regions appear to have continued at a subsistence level, with spindlewhorls being more frequently recovered at Roman-period farmsteads. Evidence for weaving fibres and sewing equally points towards increasing centralisation in parts of the south and east, probably linked with a wider commercialisation of textiles, although some products may have been produced for settlements’ own inhabitants, or even as a leisure activity. Crucially, the role of larger urban centres in textile production must also be considered. Complementary evidence from plant remains has shown that flax was relatively more common within nucleated settlements and complex farmsteads than in other rural sites. However, current evidence indicates that this plant was mainly cultivated for oil rather than textiles. Given the intensity of archaeobotanical analysis in rural Roman Britain, the lack of evidence for other textile crops and dye plants shows these were very limited aspects of the textile industry.

WOODWORKING, FUEL AND WOODLAND MANAGEMENT

By Lisa Lodwick

As a fuel, wood was vital for numerous craft and industrial activities in rural Roman Britain, though its main fuel use in this northern province was for domestic cooking and heating. The iron and construction industries in particular have been argued to have placed significant pressure on woodland resources in Britain (Fulford 1989a, 188). Wood also served as a raw material for creating a range of objects such as baskets, barrels, furniture, vessels, tools, sculpture, ships and other water craft (Pugsley 2003). The selection of wood type (i.e. species and age) and the management of woodland resources have been studied in Roman Britain primarily through the analysis of waterlogged and charred wood from archaeological sites. While wood and charcoal have been recovered from excavated sites for as long a time as plant macrofossils (seeds, cereals), the analysis of charcoal beyond that needed for radiocarbon dating is a relatively limited practice, although Historic England’s regional reviews provide rare pieces of synthesis (Murphy 2001, 16–18; Smith 2002, 27–32; Huntley 2010, 20–30). The availability of charcoal data is sporadic, and the quality of data is variable owing to differences in preservation environments.

Evidence for the character of woodland is also provided by off-site palaeoenvironmental records, especially pollen, which so far have not shown any major change in the extent and character of woodland in Roman Britain (Dark 1999). Pollen sequences are, however, largely restricted to the north and west of Britain (ibid.), albeit with increasing numbers available from the southern region (Rippon et al. 2015, 59). Currently, the only quantitative evidence we have for woodland use is derived from a writing tablet from Roman London, which records how, in A.D. 117, a 5-acre area of woodland in Kent was sold for the relatively modest sum of 40 denarii (Tomlin 1996). No quantitative data on wood and charcoal remains were collected as part of the Roman Rural Settlement Project beyond observations from specialists. Here, evidence is reviewed for woodworking, fuel wood and woodland management, while some assessment is made of other fuel types.

WOODWORKING

The prevalence of timber structures across nearly all parts of late Iron Age and Roman Britain has been highlighted in Volume 1 (Smith 2016b, 51), typically revealed by postholes and beam slots, occasionally with charred timber still in situ.
Likewise, wooden objects, including vessels and furniture, are likely to have been commonplace, though issues of preservation ensure that we only have relatively small numbers of surviving artefacts (Pugsley 2003). Nevertheless, given the probable scale of wood usage at this time, it seems highly likely that carpentry at various skill levels would have been a common activity in rural settlements. Specific evidence for woodworking is derived from tool marks on waterlogged wood, wooden artefacts and the tools themselves. Although a variety of new carpentry techniques was introduced after the conquest (Goodburn 1992, 197), the basic range of woodworking tools in use in Roman Britain largely continued from the Iron Age, with the addition of the plane (Manning 2011), and more specialist tools such as the cooper’s croze for making barrels (e.g. from Claydon Pike in the Upper Thames Valley: Miles et al. 2007, 191). Such tools are encountered most frequently at nucleated sites, such as the roadside settlement at Ickham, Kent, where the finds assemblage included wedges, drill bits, gouges, saws and knives (Bennett et al. 2010, 293). The villa at Ingleby Barwick, Stockton-on-Tees, Co. Durham, produced a metalwork hoard that included nine tools linked to carpentry (Hunter 2013, 111–20). The distribution by site type of two specific carpentry tools, saws and gouges, is shown in FIG. 5.33. Both occur most frequently at roadside settlements and villages, suggesting that carpentry workshops were part of the suite of industries that appear to cluster at these nucleated centres.

Some assemblages of waterlogged wood can provide more detailed information on the nature and processes of woodworking. For example, at Stonea Grange in the Cambridgeshire Fens, there is evidence to suggest whole trees were brought to the site, based on the presence of oak galls and acorns (Cartwright 1996), while similar examples exist at Bancroft villa in Buckinghamshire, where all types of wood were recorded including sapwood, heartwood, round wood and twiggy debris (Gale 1994). Examples of carpentry techniques include the details of axe blows, as evidenced by wood chips and offcuts at Brockley Hill, north of London (Goodburn 2008, 137) and indications of planks being sawn consecutively from both ends at Great Holts Farm, Essex (Darrah 2003). Some wooden objects were produced by lathe-turning, as indicated by cups and plates at Dalton Parlours, West Yorkshire (Morris 1990). Evidence for the production of smaller wooden objects is difficult to identify in the archaeological record, given the small size of off-cuts, although based on boxwood-comb typology, Pugsley (2003) has argued that such combs were being produced in some quantity in parts of southern Britain. The manufacture of baskets, such as the possible wickerwork fish trap at Claydon Pike in Gloucestershire (Miles et al. 2007, 175), is another rarely evidenced rural activity, although the presence of withy bundles of Salix sp. (willow) at Stonea Grange (Cartwright 1996) indicates that a wide range of woodland resources were in use.

FUEL WOOD

It is generally considered that fuel wood was sourced locally owing to the high cost of transportation (Shackleton and Prins 1992). Broadly speaking the range of taxa recorded as charcoal continues from the Iron Age into the Roman period, with Quercus sp. (oak) the most frequent wood type, but also Fraxinus excelsior (ash), Corylus (hazel), Maloideae (pear/apple/hawthorn), Saliaeaceae (willow/poplar) and a wide range of other taxa recorded (Dark 2000; Murphy 2001; Smith 2002; Huntley 2010).

FIG. 5.33. Frequency of carpentry tools at key site types.
Domestic and agricultural use
A wide variety of fuel wood was used in domestic and agricultural contexts, with, for example, at least 22 types of woody plants being recorded as charcoal within excavations at Springhead roadside settlement in Kent (Barnett 2011). Fuel used in corn dryers ranges from *Quercus* sp. (oak) at Cotswold Community in the Upper Thames Valley (Challinor 2010), to *Fraxinus* sp. (ash) at Parvwell, Peterborough (Challinor 2007). Similarly, the use of fuel in bathhouse hypocausts ranges from oak being the dominant fuel at Groundwell Ridge, Wiltshire (McParland et al. 2009), to a diverse pattern at mid–late Roman Springhead, with the probable *frigidarium* producing *Acer campestre* (field maple), *Betula pendula/pubescens* (birch), *Corylus avellana* (hazel), *Prunus spinosa* (blackthorn), and other rooms producing *oak*, *field maple*, *birch*, *hazel* and ash; it is thought that the selection of wood was driven by the desire to create distinctive smells (Barnett 2011).

Fuel wood and industry: ironworking and pottery production
Oak is generally considered as the best fuel for all forms of ironworking, owing to the high burn temperature it produces (Edlin 1949, 160; Cleere and Crossley 1985, 37). At Thurnham villa, Kent, charcoal recovered from a room associated with iron smithing was dominated by oak heartwood, while a much wider range of taxa were recovered from domestic contexts elsewhere in the villa (Challinor 2006). At Chesters villa, Woolaston, in the Forest of Dean, oak was the most abundant taxa in samples from the ironworking building and furnaces (Figueiral 1992). Oak charcoal was common in ironworking features at the roadside settlement at Westhawk Farm, Kent, though the range of roundwood sizes suggest that local woodland management was not intensive (Challinor 2008; see below).

The pottery industries would also have required large quantities of wood fuel, with experiments indicating 150 kg of wood was required for a single kiln firing (Bryant 1973; Dark 2000, 120–1). However, in contrast to iron production, several studies of charcoal assemblages from pottery kilns indicate that a range of wood types were used. At Alice Holt, Hampshire, the northern flue of a kiln contained charcoal of mature oak, alder and hazel, while the southern flue contained young oak round wood (Barnett 2012). Oak and *Ulex/Cytisus* (gorse/broom) were the dominant fuel woods used at Bestwall Quarry, Dorset, where Black-Burnished ware pottery was produced (Gale 2012).

![Graph](https://example.com/graph.png)

FIG. 5.34. Proportion of oak, hazel and other taxa in selected charcoal samples from (a) metalworking and (b) non-metalworking contexts in Kent
A mid/late third-century A.D. kiln at Blackbird Leys, Oxfordshire, contained heavily fragmented charcoal with a range of taxa including ash, oak, Ulmus (elm) and Corylus (hazel), and no evidence for systematic woodland management (Challinor 2003). The presence of extensive woodland to provide fuel has been argued as an important factor in the wider location of the Oxfordshire potteries (Booth et al. 2007, 307), although a pollen sequence from Sidlings Copse shows that woodland was relatively sparse in at least parts of the local region by the beginning of the Roman period (Day 1993).

Evidence from sites in Kent confirms the use of oak for ironworking, with a more varied selection of wood species for other uses. Figure 5.34 shows the proportion of wood charcoal by taxa from ironworking and non-ironworking contexts at Westhawk Farm, Thornham villa and Springhead. Oak contributes on average 82 per cent of the charcoal in ironworking contexts, while non-ironworking contexts only average 60 per cent oak. Based on these data, it appears that oak was specifically selected for metalworking.

WOODLAND MANAGEMENT AND CHARCOAL PRODUCTION

There is little doubt that the use of fuel wood for domestic, agricultural and industrial purposes, as well as the volumes of timber required for construction and other wood products, would have necessitated extensive exploitation of woodland resources. Key questions therefore arise as to whether wood or pre-prepared charcoal was in use, and whether woodland was managed through coppicing or pollarding in order to provide a sustainable resource. It is generally considered that metalworking required charcoal fuel to reach the high temperatures required (Cleere and Crossley 1985, 36). Charcoal may have also been used for cooking with braziers or gridirons (Cool 2006, 51–3), though evidence for the purposeful production of charcoal is rare in Roman Britain. The conversion of wood to charcoal is an intensive process, with around 6–7 tonnes of wood producing 1 tonne of charcoal (Gale 1999). Charcoal production typically occurs in shallow pits (Edlin 1949, 160–5), which are hard to identify archaeologically. Only one potential charcoal production site is known of, at Beechwood Parc, Truro, where exceptionally large quantities of charcoal, including many roundwood twigs, were recovered from a rectangular timber structure containing a hearth (Chadwick 2012). The presence of alder-dominated samples may also indicate the use of charcoal fuel, as fired alder charcoal produces a high temperature (Gale and Cutler 2000, 34).

The management of woodland for wood supply is conducted through coppicing (cutting the tree near the ground level) or pollarding (cutting the tree 2–3 m above ground level) which prompts the growth of new stems from the stool or bolling (Rackham 1980). Roman authors were knowledgeable about woodland management techniques (Meiggs 1982; Dark 2000, 121–2), but some consider coppicing to have been rare in parts of the Roman Britain (e.g. Upper Thames Valley: Booth et al. 2007, 307). Measurements of average ring growth and tree-ring curvature can be used to identify coppicing or pollarding (Marguerie and Hunot 2007), but there are numerous issues with environmental factors other than woodland management contributing to ring growth, as well as taphonomic factors of charcoal shrinkage and fragmentation. Where large assemblages of charcoal roundwood fragments have been measured, the consistency in roundwood diameter has sometimes indicated consistent woodland management practices, for instance the presence of predominantly 7–8 year-old oak roundwood branches at Chesters villa, Woolaston in the Forest of Dean (Figuerial 1992). In contrast, an iron-smelting site nearby at Blakeney, Gloucestershire, produced evidence for the selection of young wood, brushwood and narrow roundwood for metalworking (Gale 2000). Much more reliable indications of woodland management derive from large assemblages of waterlogged wood, although unlike urban centres such as London or York (Dark 2000, 121–2), the recovery of such material at rural settlements is rare. A large assemblage of waterlogged wood was recovered from the nucleated settlement at Stonea Grange in the Fens, incorporating many roundwood pieces of ash, oak and hazel, interpreted as evidence for woodland management (Cartwright 1996). Elsewhere, a well associated with an enclosed farmstead at Farmoor, Oxfordshire, had a wattle lining constructed from straight poles of oak, considered to have grown from coppiced trees (Lambrick and Robinson 1979, 81), and pieces of wood with remains of a coppice heel have been identified at Bancroft villa (Gale 1994) and Wavendon Gate (Gale 1996) in Buckinghamshire. Generally, when substantial assemblages of waterlogged wood have been examined, there is consistent evidence for woodland management, and this practice is likely to have been widespread in Roman Britain (Dark 2000, 122).

Overall, it is clear that wood was a vital, primary material in rural Roman Britain, but until further data are collected, wood selection and woodland management practices can only be tentatively evaluated. Oak was specifically selected for ironworking, but in other contexts a broader range of trees were utilised. No major changes have been
observed by specialists in the use of wood as fuel or construction material over time, though where substantial assemblages of waterlogged wood are available for study there is clear evidence for coppicing. This evidence suggests that demand for wood did not outstrip supply during the Roman period. However, the use of coal did increase in the later fourth century A.D. and the distribution of coal away from the coal fields increased over time (Dearne and Branigan 1995, 75–7). Further work is required in order to evaluate whether woodland was sustainably managed in order to supply domestic and industrial requirements, or whether demand outstripped supply.

OTHER FUEL SOURCES

Woodland management and charcoal production were clearly important aspects of the Roman economy, though other organic materials were also used as fuel. Lamps, largely restricted to urban, military and villa populations, were fuelled with oil, tallow or wax (Eckardt 2002, 15). Coal fields were also exploited from the first century A.D. onwards in Britain, initially by the military, with its use becoming more widespread across central parts of the province by the second century A.D. Coal was used in hypocaust furnaces, hearths, iron forges and corndryers (Dearne and Branigan 1995). A total of 75 sites in the project database were noted as having coal. These sites are focused around the south-west of the Central Belt, including the south coast of Wales, with more scattered finds in the north-east (fig. 5.35). The absence of coal from sites in the south-east of England confirms previous observations made by Dearne and Branigan (1995, 79). Analysis of the provenance of coal has demonstrated that the majority of sites were using local sources (Smith 1997). Further sources of fuel include cereal chaff, as used in corndryers (see Ch. 2) and peat, as indicated by the extent of Roman Fenland peat cuttings (Hall and Coles 1994, 117–19), and burnt lumps of peat found in Roman contexts on the North Somerset Levels (Rippon 2006).

CONCLUSIONS

The economy of Roman Britain clearly incorporated many different industries on a variety of different scales, mostly operating within a rural context, though inextricably linked with urban and military populations. Given the wealth of
material evidence, it would be easy to over-state the relative importance of these industries within the province, yet it must be reiterated that it was first and foremost an agricultural society, with the vast majority of the population occupied full time in farming and related practices (Fulford 2004, 312; Gerrard 2014, 3). This understood, the evidence for craftworking and industrial activities outlined in this chapter contributes greatly to our understanding of a rural economy increasingly recognised as being very regionally and socially diverse.

How different crafts and industries were organised and developed throughout the province is an underlying theme tackled in much of the analysis above, yet in the general absence of literary records, the specifics remain largely obscure. Instead, our understanding relies upon the scale and context of archaeological evidence, including structures (kilns, hearths, workshops etc.), material culture (tools), industrial residues (slag, bone-working waste etc.) and environmental evidence (plant and animal remains). This evidence suggests that many industrial and craftworking practices were carried out at a relatively small ‘household’ scale, some, such as textile production, perhaps associated with specific social groups, and most probably structured by the agricultural calendar (i.e. practices ‘fitted in’ with farming schedules). Seasonality of production remained important, with the movement of workers to engage in, for example, ceramic or salt production, at specific times of the year, probably in many cases following longstanding socio-economic traditions. Nevertheless, there are many indications that expansion of the Roman Empire had a significant effect upon certain industries in Britain, with larger scale operations and increasing numbers of skilled craftsmen, working within a new economic reality. The military certainly acted as a major stimulus, particularly towards the metallic industries, with direct control over lead and precious metals, and no doubt having a strong influence over certain iron and copper operations, as well as some salt-working centres. In most cases, such direct military/state intervention appears to have waned somewhat towards the later Roman period, part of wider military, economic and social changes at this time (cf. Bidwell, Ch. 7), which saw a lessening of imported goods, and, in some areas, an increase in private enterprise and a polarisation of wealth (Fulford 2004, 324).

Aside from the military, the growth of urban centres and the imposition of taxation must also have provided a stimulus for increased industrial output, though it is likely that supply and demand would have fluctuated markedly (see Discussion, Ch. 8). Certain ‘complex industrial agglomerations’ arose, in particular on the south Dorset coast, and also to some extent in parts of the East Midlands and the Severn Estuary, where multiple industries developed including pottery, stone-working, salt-extraction and metalworking (Fulford 2006, 609). In other areas, the industries were less diverse (e.g. Wealden iron, Oxfordshire potteries), though their products could still reach far and wide across the province and even beyond. Highly skilled craft-workers, such as flue-tile makers or mosaicists, arose to fulfil the niche demands of military, urban and high-status rural markets, with some known to have come from other parts of the empire.

Many of the excavated sites with evidence for industrial activity, including extraction and processing of metals, salt-working, pottery or tile production, appear to have been located away from, or on the periphery of, domestic rural settlements. In parts of the south and east, some of these rural ‘industrial’ sites may well have been associated with larger private estates, the greater parts of which were probably devoted to farming. Such increased economic diversification is certainly seen at some (mostly complex) farmsteads and particularly at villas, which may have evidence for activities such as metalworking, pottery production, tile production, textile production and bone/antler-working. It remains difficult to gauge the economic scale of such activities, with some (e.g. smithing, woodworking) no doubt limited to supplying the needs of the settlement on an ad hoc basis, and others operating at higher levels for commercial benefit.

Nucleated settlements (villages, roadside settlements, military vici and defended ‘small towns’) played a key role in the development and expansion of craft activities throughout much of the province. Such sites clearly had greater provision for smithing and other metalworking, glassworking, bone-working, leatherworking, textile production and other crafts, and sometimes appear to have had ‘industrial zones’ in certain parts of the settlement. There is a consistent pattern of greater industrial diversity and intensity, though most settlements do not appear to be involved in manufacturing on any large scale; they were more often just collections of specialised craft-workers, with their livelihoods able to be sustained by populations of the settlement and surrounding countryside. However, there is evidence that such industries that were traditionally practised in the home (notably textile production) may have become more centralised within nucleated settlements (along with some villas), in much the same way as large-scale grain processing (see Ch. 2, pp. 83–5). Such a situation was far from uniform, however, being largely restricted to parts of central, southern and eastern Britain. Further
north and west, it appears such crafts remained at a household level, with military vicī – the main nucleated settlements in these areas – being far more inward-driven, largely catering for the needs of the soldiers and their dependants only.

There were clearly major changes in craft and industrial practices over the course of the Roman period. In the third and fourth centuries A.D., iron production appears more concentrated in the Central Belt region, with a shift from certain large-scale operations, maybe linked with military supply, to one that was more focused upon local and regional markets. A similar shift towards smaller scale private enterprise appears to have been the case with other metal production (notably gold, silver and lead), probably correlating with an increase in metal recycling. Other industries seem to have followed different trajectories. The number of salt-production sites, for example, was greatly reduced during the late Roman period, although there were a few sites of this date where production was on a considerable scale, perhaps under military or state influence. Fineware pottery manufacture became concentrated in a small number of major industries from the mid-third century A.D., largely making up for the lack of continental imports at this time. These larger scale, centralised industries – pottery, textiles and to some extent salt production – appear to have flourished throughout much of the late Roman period, much of it probably on the back of state supply networks and the provision of urban markets. However, it was also these industries that would have suffered most from the rapidly changing economic circumstances of the early fifth century A.D., with the cessation of coin supply and the collapse of centralised military control. Smaller scale industry and craftworking, meanwhile, may have continued to operate on similar levels for some generations to come.