

# Iron production in Surrey

JEREMY S HODGKINSON

*This paper discusses iron production in the Iron Age and Roman periods and the Middle Ages, the main expansion based on water power which brought the Weald to national significance in the 16th and 17th centuries, and the secondary working of iron by Surrey mills in the Thames basin into the early 19th century. Finally it suggests priorities for future research.*

## Introduction

With the exception of the Wealden part of the county, there are few sources of iron ore in Surrey, and those that have been exploited have been limited. Nevertheless, iron production has been an economic resource of some importance at several different stages in its history. The reasons for this have changed over the course of time, but the most important periods of production – during the late Middle Ages, the early modern period and the early 19th century – have received their impetus from Surrey's position on the periphery of two, more intensively worked industrial regions. From the late 14th to the 17th centuries, the Weald was an iron production area of national importance, and the parts of this county that lie in that region benefited from the new-found wealth and entrepreneurial zeal of its landowning families. Later, it was the growth of London, whose population, and the commerce generated by it, consumed manufactured goods at an unprecedented rate, which provided the impetus for the growth of processing industries in its rural hinterland.

## The Iron Age and Roman periods (fig 17.1)

Ironworking has probably been carried out at a domestic level in Surrey over much of the last two and a half thousand years. Whether deriving its raw materials from small, local sources, or from larger ones further afield, the forging of iron objects for agricultural use has been a commonplace activity, and the remains of such working need to be noted in as much detail as those of a corn-drying oven or a pottery kiln. However, individually interesting though such sites may be, they only become significant when a pattern in their occurrence begins to emerge, or when they are unique. Both instances can be found in Surrey. Of more significance, however, are the primary production sites and it is important to make clear the difference between primary iron making, and secondary working. With very few exceptions, primary ironworking – that is the smelting of ore to form a bloom of iron – seldom took place far from a source of ore. Secondary working, which may include the consolidation of the bloom and a consequent accumulation of slag, but which

also can include smithing to form marketable iron, can take place far from sources of ore, and is generally less susceptible to regional concentration. Both processes produce fairly distinctive slags, and where they occur smelting slags are usually more plentiful. The important proviso that a small quantity of slag may not denote a proportionate amount of activity should be read in the context of what else is found on a site. It has been shown on Wealden sites that the quantity of slag can be a useful guide to the output and/or longevity of ironworking, and as accurate an estimate of it as possible should be made (Hodgkinson 1999, 68–9). The recognition of slag types is crucial to the correct identification of ironworking sites, and in a number of instances early reports of the discovery of iron slags have unwittingly misrepresented the nature of the processes carried out, with such errors being perpetuated in the literature for many years after. The importance of some sites has, therefore, been overstated, and broad conclusions have sometimes been drawn from too little evidence.

Such is not the case with the ironworking settlement at Brooklands, Weybridge. Dated to the early Iron Age of the 6th or 5th centuries BC, it is a site of great importance for our understanding of the development of the technology of iron making, though less so for the history of iron making in Surrey (Hanworth & Tomalin 1977, 15–23). It is a small site, and even though the amount of slag found there in no way represented the output of the smelting furnaces excavated, production must, nevertheless, have been relatively small too. Although we know nothing of the subsequent use of the iron made there, there are good reasons for suspecting that its products may have been distributed over a wide area. Because of the novelty of iron in a transitional period when few contemporary sites have revealed evidence of the metal, its products may have travelled far, and its location near the confluence of the Thames and the Wey, would have made their distribution that much easier. Sadly, Brooklands is almost unique in the county, with only the farmstead site at Hawk's Hill, Leatherhead, in any way comparable (Hastings 1965, 12). Although slag, which was described as from smelting, was found at Hawk's Hill, no hearths were

discovered, and the broad date range for the site makes it anywhere between contemporary with Brooklands and as much as three centuries later. Also, its location, far removed from the Thames valley, means it would have been unlikely that it shared an ore source with Brooklands, nor does an obvious source spring to mind. Ore sources are a problem in describing ironworking in Surrey. Apart from the Low and High Weald, where sources of ore are reasonably well documented, sources for other sites are somewhat speculative (Worssam 1995, 9–21, 25–30). Doubt has even been cast on the siderite found in the lowest levels of the Bracklesham Beds on St George's Hill, which were identified as the likely source for the Brooklands site (Potter 1977, 22). Analysis by the late Professor Tylecote suggested inconsistencies between the amount of phosphorus in the ore, and in the slag found at Brooklands (Tylecote 1986, 137–9). The lack of abundant sources of ore throughout most of the county clearly accounts for the limited amount of smelting that has taken place.

Hillforts, because of their isolated place in the landscape, and the presumption that such isolation must lend them an air of self-sufficiency, have been prime targets for excavation in the past, and many have yielded evidence of ironworking. None, to date, has produced an example of smelting. This, in itself, is not surprising, given that the geology that formed the commanding positions these sites occupy is unlikely to be composed of the clays from which the necessary ore is derived. Iron forging slag has been found at Hascombe camp, but the significance of iron-bearing carstone, which occurs in the Folkestone Beds of the greensand, and which Winbolt identified as an iron ore, has yet to be established (Winbolt 1932, 89). Reports of iron slag at Dry Hill, Lingfield, despite its Wealden location, are inconclusive despite unfounded assertions that the evidence was pre-Roman (Winbolt & Margary 1933, 80). That such hillforts might have been used as processing and distribution centres for iron, though, seems entirely plausible, especially as most reported ironworking evidence is of forging. The temple site at Farley Heath has attracted some attention because of its presumed link with ironworking. The dedication to Celtic and Roman deities associated with metalworking, which has been attributed to it, cannot be directly associated with such activity in the area (Goodchild 1938, 396).

Inevitably, the Early Iron Age leaves us with more questions than secure facts. Brooklands and Hawk's Hill are isolated geographically and chronologically, and as small, single sites offer us no sense of industry. Similarly in the Late Iron Age and Roman periods, few positively dated sites have been found, and little of the dated material suggests anything more than

small, domestic forging, at most for local, probably agrarian consumption. Three sites discovered more than half a century ago, at Purberry Shot, Ewell, on Stane Street (Lowther 1949, 13), Thorncombe, near Hascombe (SyAS 1949, xxiv), and on Walton Heath (Prest & Parrish 1950, 63), fall into this category. The very small quantities of slag found show all the signs of having been derived from the consolidation of imported blooms and their subsequent smithing. The sources of the blooms concerned are not known, although it may be possible in the future, with developments in slag and ore analysis, to be able to determine this. It is very likely that raw blooms were as much a marketable commodity as forged iron bars, and it is possible that seasonal herding practices, involving the movement of animals into the Weald to graze and forage, may have been the impetus for some small-scale smelting in the Weald before, during and after the Roman period, with the raw products being worked up in the home settlements when the season was over. Such practices may have been carried out to the north and south of the Weald.

Two areas of real interest in relation to iron making in the late Iron Age and early Romano-British period are at Thorpe Lea Nurseries, and in a 3-mile-long area of the Windle brook valley from the Berkshire border down to Lightwater. The recently excavated site at Thorpe Lea Nurseries, near Egham, has produced evidence of iron smelting which differs from that found at Weybridge. Although no hearths were discovered, because excavation was restricted, the evidence from the slag suggested a different tradition of smelting dating from the mid-to-late Iron Age and the Roman periods. Like the Brooklands slags, those from Thorpe Lea appeared to have come from furnaces where the slag was not tapped (ie allowed to run from the furnace) during smelting; but they differed in that they had the appearance of having collected in a wood-filled pit below the furnace – a type not previously recorded in Britain, but known from mainland Europe (R Poulton and D Starley, pers comm).

In the Windle valley, smelting slags have been reported on several sites, and pottery finds suggest that they derive from around 150 BC to the end of the 1st century AD. Excavations at South Farm, Lightwater, have uncovered quantities of slag suggesting modest iron smelting activity (Cole 1991, 10). No furnaces have been located, but the absence of tap slag, not only on this site, but also at other locations along the valley, again points to a different smelting tradition from both Thorpe Lea and the Wealden sites of the same period. Located some 10 miles due west of the outcrop of the Bracklesham Beds at St George's Hill, Weybridge, it is clear that the workings at Lightwater must have relied on a different source of ore, although Cole's suggestion

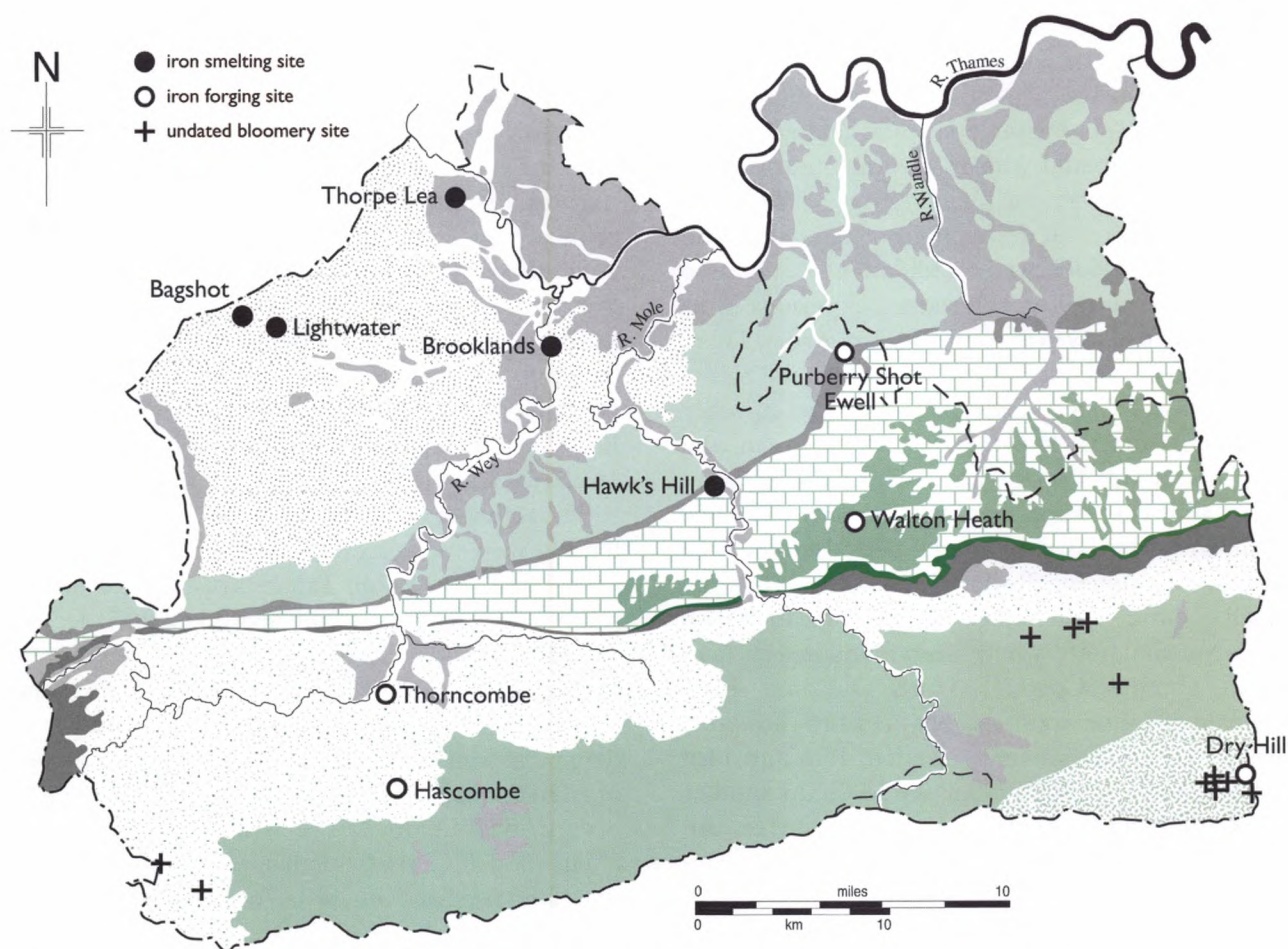


Fig 17.1 Iron Age and Romano-British iron production sites. For key to geological background see map on page x.

that the source for the workings along the Windle brook is haematite nodules occurring in the surface gravels exposed by the brook has not been substantiated (G H Cole, pers comm). Marshy conditions, where much of the evidence for ironworking in the Bagshot area has been noted, may indicate extraction of ore along its banks, and, if this is the case, exhaustion of this source may have prevented exploitation for a longer time in the Roman period. The presence of Roman material at Wickham Bushes, just over the Berkshire border, suggests that the Windle brook sites may be part of a larger group (Corney & Gaffney 1985). The almost haphazard discovery of single iron smelting sites of at least three distinct traditions in different geological locations within the county points to a need to establish to what extent these sites really exist in isolation, or whether they represent the first examples of greater concentrations of industrial activity.

Although south-eastern Surrey lies on the northern periphery of the main ironworking area of the Weald in the late Iron Age and Romano-British period, no sites in that part of the county have, as yet, been dated to the period. However, four sites on Upper Stonehurst Farm, Lingfield, while undated at present, may be satellites of the major Roman ironworking site at Great Cansiron, over the Sussex

border (Cleere & Crossley 1995, 292, 299). Nor has the Low Weald of southern Surrey, an area exploited for its iron in the late medieval, as well as in the 16th and 17th centuries, yielded any evidence of iron making in the Roman period. The few farm or villa sites, the tile kiln at Cranleigh, and the limited number of isolated finds that have been made there, however, suggest that evidence of the period, rather than being absent altogether, has simply not come to light (Goodchild 1937).

Turning to London, the role of Southwark, as a centre for the processing of raw materials imported from the rural hinterland of the capital, seems to have been established in Roman times, and its long association with the iron industry dates from the same period. With roads converging on the borough from several points near the south coast, and having passed through areas of iron production, it is perhaps inevitable that evidence should have been found there of the secondary working of iron. Excavations on the site of the former Courage brewery, close to the early bridge across the Thames, have shown a dense concentration of iron and bronze smithing, as well as several buildings and other features, from the late 1st century through to the 4th century AD; an unusually long sequence of metalworking activity (Westman 1998, 63).



**The Middle Ages** (fig 17.2)

Until recently, our knowledge of iron making in Surrey in the medieval period has been confined to a small amount of documentary and archaeological evidence. Compared with most other historic and prehistoric periods, the Middle Ages have been under-represented in descriptions of the industry in the county, yet evidence is accumulating that points to it being one of the more productive periods in its history, particularly in its south-eastern corner. There is a dearth of evidence of iron making in the Saxon period in the Weald, and this is mirrored in other parts of Surrey. However, fieldwalking in the Outwood area of Burstow and Horne parishes, as yet untested by excavation, has begun to show evidence of activity from as early as the period around the Norman Conquest (Robin Tanner, pers comm). Small quantities of bloomery slag in association with Saxo-Norman pottery have been found in Ten Acre Wood, abutting Cogmans Lane, Outwood. Elsewhere in the same wood, slag has been noticed with a surface scatter of pottery of the late 13th and 14th centuries (*Wealden Iron* 1998, 2 ser 18, 2). In another part of Outwood, a single fragment of probable 13th century pottery was found embedded with a concentration of bloomery slag during a sampling excavation by the Wealden Iron Research Group.

Other discoveries of iron cinder, at Woolborough Farm, Horley, and in nearby Hathersham Lane may be of a similar period (Robin Tanner, pers comm). To the north of the village, bloomery cinder has been found on the edge of Nutfield parish in a field where a scatter of pottery dated to no later than the 14th century may be associated with it (*Wealden Iron* 2000, 2 ser 20, 3). At this last site, the utilization of iron ore from beds in the Weald Clay, which outcrop less than a mile south of the Lower Greensand, draws parallels between this and three other, undated sites, two in Bletchingley and one at the northern extremity of Burstow parish (Worssam & Herbert 2000, 14–17; *Wealden Iron* 2001, 2 ser 21, 3).

The activities of a single, energetic field walker can tend to skew the perceived distribution of archaeological finds, but Robin Tanner's discoveries add to, rather than stand apart from, existing knowledge. As far back as 1809, Manning & Bray (2, 255) drew attention to a deed of 1396 by which the prior and convent of Christ Church, Canterbury, reserved the digging of iron in Charlwood, as part of their manor of Merstham. Probably, this same source of ore had been worked by the earl of Arundel when he held Charlwood of Christ Church in 1362. Ten years after that, John Neel and others had been fined for digging ore from the highway in Horley parish – adjacent to

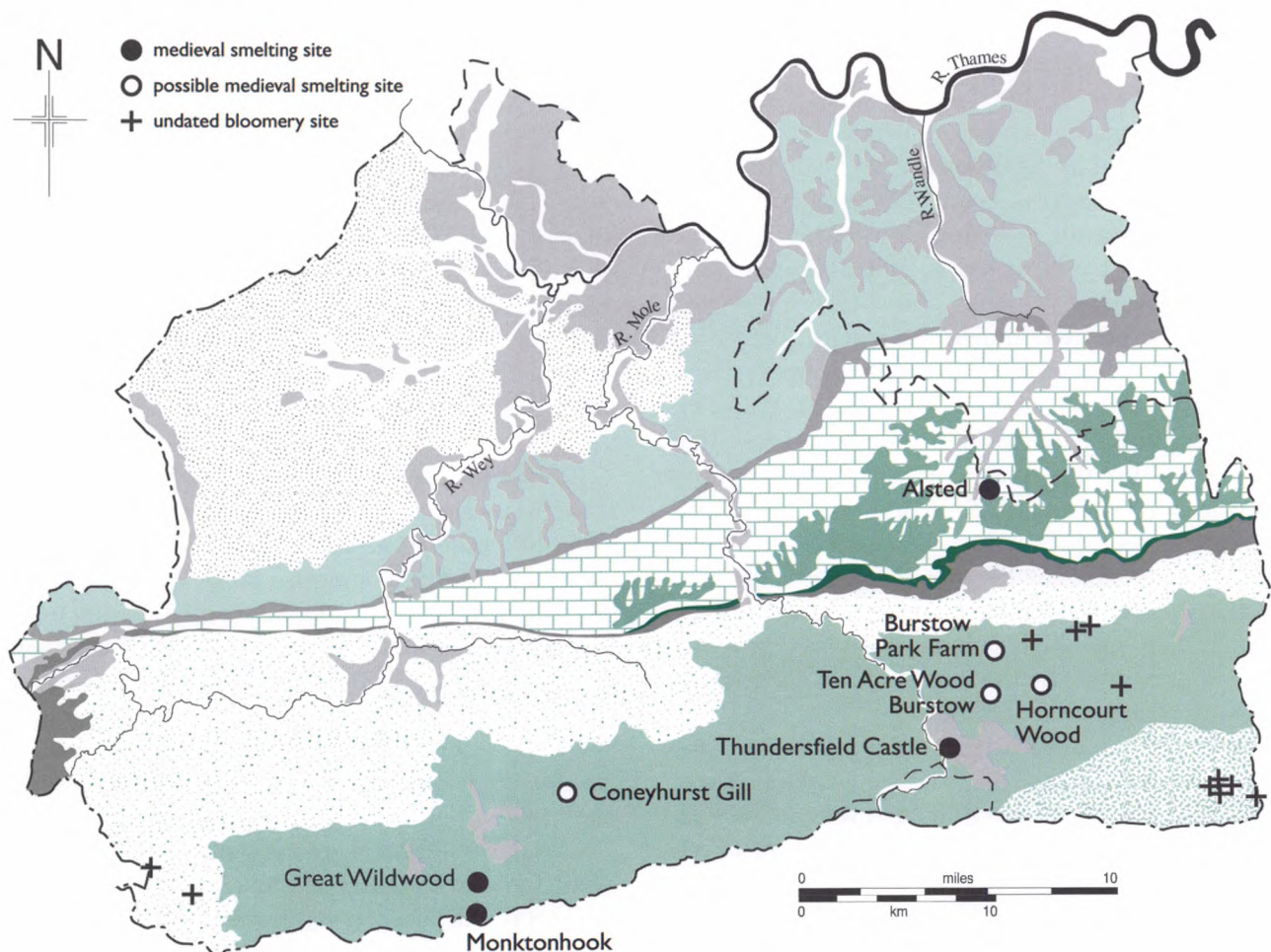


Fig 17.2 Medieval iron production sites. For key to geological background see map on page x.

Charlwood – in the manor of Banstead. Elsewhere in Horley, although this time on property of the de Clares of Bletchingley, the existence of ironworking at Thundersfield in the same period must signify that such evidence is not isolated (Hart & Winbolt 1937, 146–50). In Sussex, recent excavations in Crawley, less than 5 miles south of Horley, have revealed substantial ironworking – both smelting and forging – dating from the late 14th and early 15th centuries, with corroborative documentary records of iron makers from tax returns in the 1370s (Cooke 2001). And about 4 miles to the south-west lies the documented 14th century site at Roffey (Straker 1931, 442). This cluster of sites, forming an arc from Horne in the east, through Burstow, Horley, Charlwood, Roffey and Crawley, forces the conclusion that this north Sussex/south Surrey border area was of real importance in the production of iron in the late medieval period, with marketing and distribution possibly centred on the town of Crawley, where a fair had been established in 1202. It may also be significant that Burstow was granted the right to hold a market and fair in 1246, so both could have served areas which may have extended to a radius of 5 or 6 miles, more distant fairs being at East Grinstead, Horsham, and Reigate (Gwynne 1990, 37).

There is also a tenuous link between iron ore digging in the Charlwood area in the 14th century and the 13th/14th century ironworking site at Alsted manor, on the North Downs ridge in the northern part of Merstham parish. Both were in the same primary manor of Merstham, although the tenants of the separate sub-manors of Alsted and Charlwood were different. Iron smelting and primary forging, together with other, non-ferrous, metalworking were being carried out in the mid-to-late 13th century at Alsted, with forging only carried on more than a century later, in a purpose-built building, after the abandonment of the manor house (Ketteringham 1976, 22–32). The evidence of the quantity of cinder suggests that iron smelting was both of short duration and of limited scale. It is possible that the single acquisition of a quantity of ore, probably from a Wealden source, might account for this, but that a direct link with ore from Charlwood is too tenuous to be supported. The ownership links that the de Passele family had with other ironworking areas of the Weald, notably the Parrock district of Hartfield parish, in Sussex, are the most plausible source of raw blooms which the 14th century forge at Alsted would use as a raw material (Ketteringham 1976, 66–7). The Parrock area has been specifically identified with ironworking during the same period (Tebbutt 1975, 146–51).

This, however, is not the only area in which ironworking is postulated in Surrey in the Middle Ages. Further to the west lies an enigmatic site. In the 1960s,

the late Tony Clark carried out a brief excavation of what he interpreted as a water-powered iron-forging site in Coneyhurst Gill, Ewhurst (Clark 1961). Some slag – possibly bloomery slag – was also noted by the Wealden Iron Research Group, but opinions about the site are inconclusive, and it merits further investigation. (*Wealden Iron* 1975, 8, 12; Judie English, pers comm). Forging slags are often indistinguishable from bloomery slags, the processes that produce them being very similar, and it is other features of the sites where they are found that are usually used to set them apart. Whatever the circumstances in which the site at Ewhurst was used, no known documentary evidence and precious little archaeological evidence means that the site remains a mystery. Less than 4 miles to the south-west, late 12th and early 13th century pottery has been found in association with bloomery slag in Great Wildwood and at Monktonhook, both in Alfold (English 2002). With no others known in the area, these sites seem somewhat isolated. A connection may exist with the discovery of iron slag and pottery of a similar date at Loxwood in Sussex, less than 3 miles to the south (*Wealden Iron* 1998, 2 ser 18, 4).

### **Water-powered iron smelting and forging in the Surrey Weald** (fig 17.3)

Turning to the post-medieval period, iron production based on the newly imported technology of blast furnace and finery forge developed initially in the High Weald of eastern Sussex. Early growth was slow, but accelerated in the second half of the 16th century, and by 1574, when the Privy Council ordered a survey of all the ironworks in the region, some 50 furnaces and a more or less equal number of forges had been established (Straker 1931, 53–9). Expansion of the industry had been confined to Sussex until 1548, when a list of ironworks was attached to a complaint by the authorities of some of the Channel ports that ironworks were depriving them of timber (Cleere & Crossley 1995, 123). Within the next decade, however, the ironworks at Leigh, Cranleigh and Abinger had been established, with furnaces or forges at Dunsfold, Chiddingfold and near Lingfield by 1570 (Cleere & Crossley 1995, 309–67, 382–93). The limitations on the growth of the industry in Surrey in this period were largely geographical. Furnaces could only be built within a reasonable distance of adequate sources of ore, and these were confined to the outcrops of the Hastings Beds and the Weald Clay. Forges were not so restricted, but nevertheless needed to be within an economic carriage distance of one or more of the furnaces. For both types of sites, the principal factor determining location was the presence of a reliable supply of water. This presented problems on the low-lying relief of the Weald Clay in the



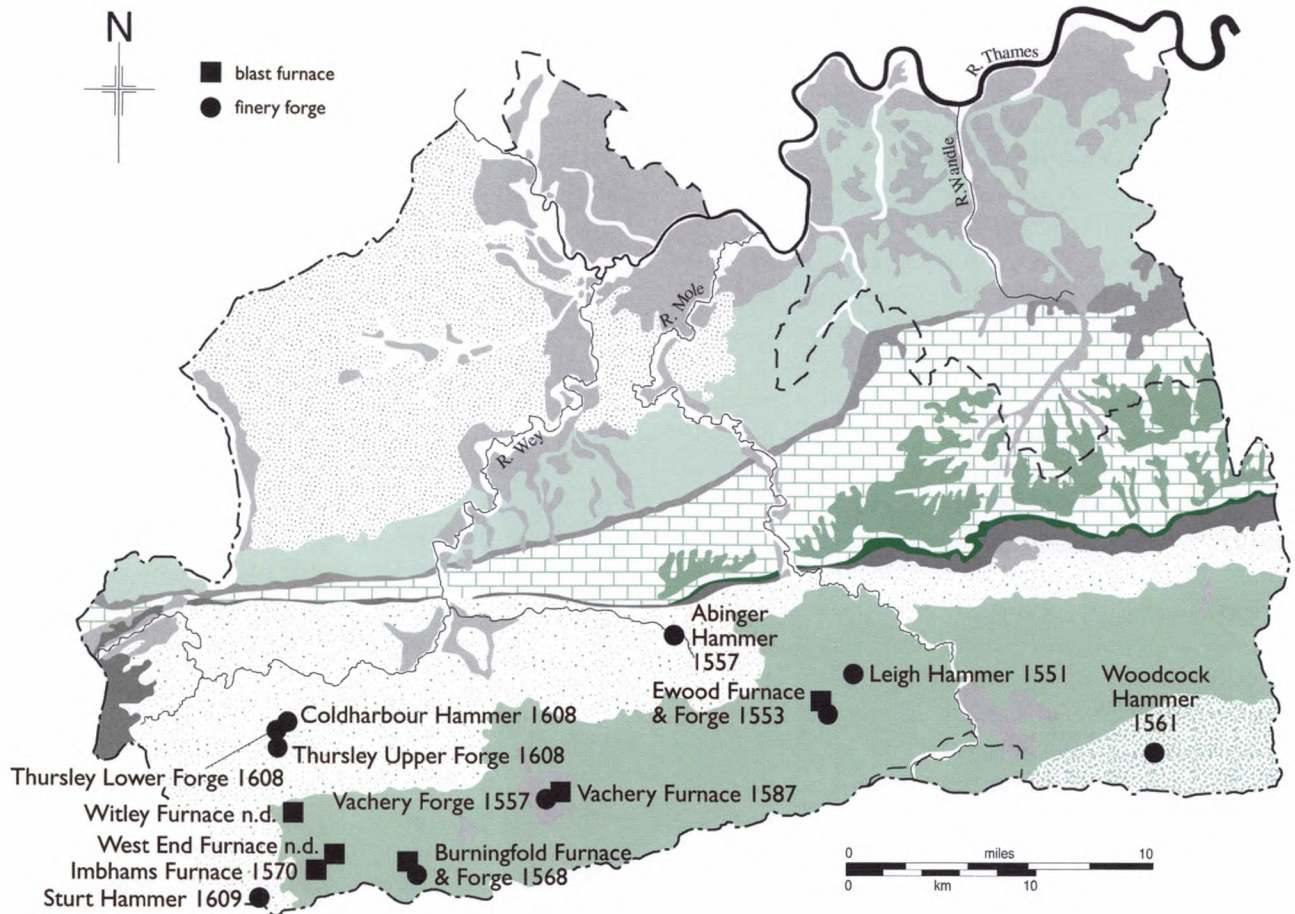


Fig 17.3 Blast furnaces and finery forges. For key to geological background see map on page x.

south-eastern part of the county, where Ewood furnace had what was probably the largest pond of any ironworks in the Weald; estimates being as high as 100 acres (Straker 1931, 454). A consequence of the lack of a need for forges to be located near sources of ore was the exploitation, mostly after the beginning of the 17th century, of the faster-flowing and more abundant streams of the Lower Greensand formation in the south-west of the county. In the area around Haslemere, the competing demands for charcoal by furnaces and forges could be eased by a distinct separation, with furnaces located on the clay where the ore outcropped, and forges located on the sandstone.

The Bray family were among the earliest to exploit the Walloon technology imported from France, with two forges, at Abinger and Cranleigh, in operation before 1557 (Cleere & Crossley 1995, 307, 361–2). It is not clear if these forges were set up to work up iron sows from a furnace also owned by the Brays, or from one already producing cast iron on the open market. Records of Vachery furnace, the most likely candidate, do not hint at when it was first blown in (Straker 1941). The enigmatic site in Coneyhurst Gill, Ewhurst, referred to above, might have been an early, failed attempt to set up a finery forge at this time. Further to the south-east, one of the other early sites, at Leigh, was set up by Richard Wheler and William

Hawthorne before 1554, when it passed into the hands of George and Christopher Darrell, who had acquired the nearby furnace at Ewood from the Nevilles the previous year (Giuseppi 1902, 30–2). The Darrell family also owned several sites around the Kent-Sussex border, and their business links with other ironmasters were widespread. While retaining the ownership of their Surrey works, they periodically sold leases to the two sites, taking them back in hand between times until they sold them to the Crown, leasing them back soon after. Another site, operated by someone with strong connections with other Wealden ironworking sites, was Burningfold. Here, the first recorded owner of the forge, Thomas Melershe of Wonersh, sold it to Thomas Blackwell of Petworth, who had a lease of the earl of Northumberland's furnace at Frith, near Northchapel, providing him with a further outlet for the iron he was producing there (Cleere & Crossley 1995, 321, 384). Many of the agreements that ironmasters made to acquire the control of ironworks were intended to secure the supply of raw materials, whether wood, ore or cast iron. Thomas Gratwick, who held Burningfold in 1574, was a kinsman of Roger Gratwick who had works in the Horsham and Crawley area, but his tenure was short-lived, the site coming into the hands of Thomas Smith. After Smith had died, Burningfold found its way into the hands of another

old ironworking family, the Bowyers. Records of Burningfold are missing for the years until the Cowdray estate purchased it from the executors of John Tanner in 1781, with the only tantalizing reference being to the occupation of the site, in the 18th century, by William and George Jukes, London ironmongers, who also worked the ironworks at Robertsbridge, Sussex (Cleere & Crossley 1995, 384). Unfortunately, the precise details of their involvement are not known.

With the sites already mentioned, the initial building of the ironworks had largely been carried out by Surrey landowning families, who had quickly leased their works to established ironmasters, with strong connections with other sites in the Weald. The motive was undoubtedly seen as an investment, but the profitable operation of such enterprises was best left to those with experience, and it is noteworthy that foreign ironworkers were providing the skilled labour at several of the Surrey works in Tandridge and Reigate Hundreds as early as the 1550s (Awty 1984, 74–7). One of these was Woodcock Hammer, near Lingfield, which, unlike the group mentioned so far, was set up by ironmasters from further south on land owned by the Gages, whose seat was in the South Downs. The forge had a long working life, being operated for more than half the 17th century by the Thorpe family, and then by a succession of tenants, including Jeremiah Johnson of Charlwood, who appears to have operated Bewbush furnace near Crawley but whose career is otherwise sketchy (Cleere & Crossley 1995, 366, 392; StRO: DW/1788/P38/B6). As a finery, it ceased working in about the 1770s.

A recently rediscovered site is Sturt Hammer, at Haslemere (Cleere & Crossley 1995, 391–2). This may have been the site referred to as a ‘blomarie’, the illegal erection of which Edward Tanworth was charged with in 1603 (Giuseppi 1905, 271). The outcome is not known, but the earliest record of Sturt is of 1609, when it was referred to as Wheeler’s Hammer. By the mid-17th century, the forge was in the tenancy of the Hoad family, but by the 1690s it was being referred to specifically as a sickle mill; the first instance in Surrey, and a rare example in the Weald, of an ironworks changing purpose from refining pig iron to specialized secondary iron processing. The name has stuck, although its working life as a sickle mill was short, for by 1712 it had become a corn mill, and in the 1730s it was converted to a paper mill. Subsequently, it has been a worsted braid factory, an engineering works and a council depot (Crocker & Kane 1990; 134; WBC: F30/032/AA). A similar change of use was to befall one of the forges at Thursley. The three forges, which formed the complex, are perhaps the least easily explained of all the Wealden iron sites in the county.

They were set up by the More family, of Loseley, who had already established ironworks in Sussex. The problem lies in the fact that there were three different forges, two in Thursley parish, and the other, known either as Coldharbour or Horsebane Hammer, on the border of Witley and Thursley. Confusion in identifying the several works from descriptions in surviving deeds has resulted in an incomplete operating history (Cleere & Crossley 1995, 360). Two at least appear to have shared the same tenants, although only the lower forge seems to have remained working by 1769, when it was operated by Owen Knight & Co, of whom more needs to be known (SHC: P46/1/1). The lower site was worked periodically in association with Abinger Hammer; in the early 18th century they were operated by a Mr Dibble, and later by James Goodyear, a Guildford ironmonger, who had also worked Pophole Hammer, near Haslemere (King 2002, 34). Unlike Sturt Hammer’s transformation into a sickle mill, the conversion of fineries into other non-iron uses, such as corn mills and paper mills, and the lower forge at Thursley to a silk crape mill, was common. Woodcock Hammer, near Lingfield, was converted to use as a wire mill at the beginning of the 19th century (Evans 1985, 7). Wire making required a specialized type of iron, and although there is slight evidence of this specialization at Robertsbridge, Sussex, in the early 1700s, by the early 19th century the source of suitable iron would almost certainly have been London ironmongers (ESxRO: Microfilm XA3/13).

Another influence on the location of sites, and this is a theme which becomes increasingly resonant in Surrey, was the location of ironworks in relation to their markets. Again with Ewood, and its associated forge at Leigh, we have an example of the early influence of London. The Darrells, who took over the sites soon after they were built, were London merchants, and it cannot be insignificant that in legislation drawn up to restrict the demands for wood that the burgeoning iron industry was making, sufficient influence was brought to bear to have these sites, and the forge at Abinger, specifically excluded (1 Eliz c15; 23 Eliz c5). Regional centres such as Guildford, which were growing rapidly at this time, began to offer competition with London and, at Abinger Hammer, the London market was cited in a contemporary document as a determinant in the location of the forge, to the detriment of Guildford, although its role was to change more than once during its long working life (Giuseppi 1903, 270–1). Also, during the 17th century, the specialist branch of gun founding became increasingly important in the economy of the region, again with its principal market in London. Surrey’s only positively documented gun foundry of the period was Imbhams furnace, near Chiddingfold (Cleere & Crossley 1995, 338–9). Tenancy of this site



involved the Yaldwin family, who also worked at least one of the Thursley works, and who were later occupiers of some of the Petworth estate works as well. In the 1660s the Browne family, of Horsmonden, in Kent, included Imbhams among their largely Kentish group of gun foundries, which suggests an early specialization of the furnace for which no direct evidence has come to light. The Brownes were to set themselves up as gentry in the county at Buckland near Reigate.

Notwithstanding the resilience of the gun founding industry, the decline of primary iron smelting in the Weald caused the abandonment of most of the Surrey blast furnaces before the end of the 17th century. Only the furnace at Burningfold is likely to have continued in blast into the 1700s. However, while Swedish imports saw the demise of local pig iron production, the need for iron goods grew. The increased specialization of metalworking trades, such as the production of utensils for the processing trades, and domestic ironmongery such as pumps and stoves, saw a need for higher quality iron by craftsmen, beyond the skills of local blacksmiths. Such a requirement may be demonstrated by the growing importance of ironmongers in towns such as Guildford. An example, already noted, is James Goodyear, who acquired the lease of several forges,

including Abinger Hammer, where he may have experimented with steel making, taking out a patent in 1771 (Hodgkinson 1996). He probably over-extended himself by taking the lease of North Park furnace, south of Haslemere, for he was declared bankrupt in 1777.

### Surrey iron mills in the Thames basin

(fig 17.4)

The interest of the London mercantile community in the potential of Surrey mills as manufactories of commodities for the capital's domestic market is shown in the establishment of several mills on the Thames tributaries from the 17th century onwards. The earliest example is the iron wireworks established by Thomas Steere at Chilworth in 1603 (Crocker 1999, 8). The project survived only three years before the Mineral and Battery Works, which had been granted a monopoly in mining and sheet metalworking in 1568, successfully sued against the works in the Court of Exchequer. Most of the iron mills were set up closer to the Thames, and the location and working history of many of these sites has been documented by Potter (1982), and only summary information is given here. Many of these mills were established for other uses than the processing of iron, and only in the early 18th century

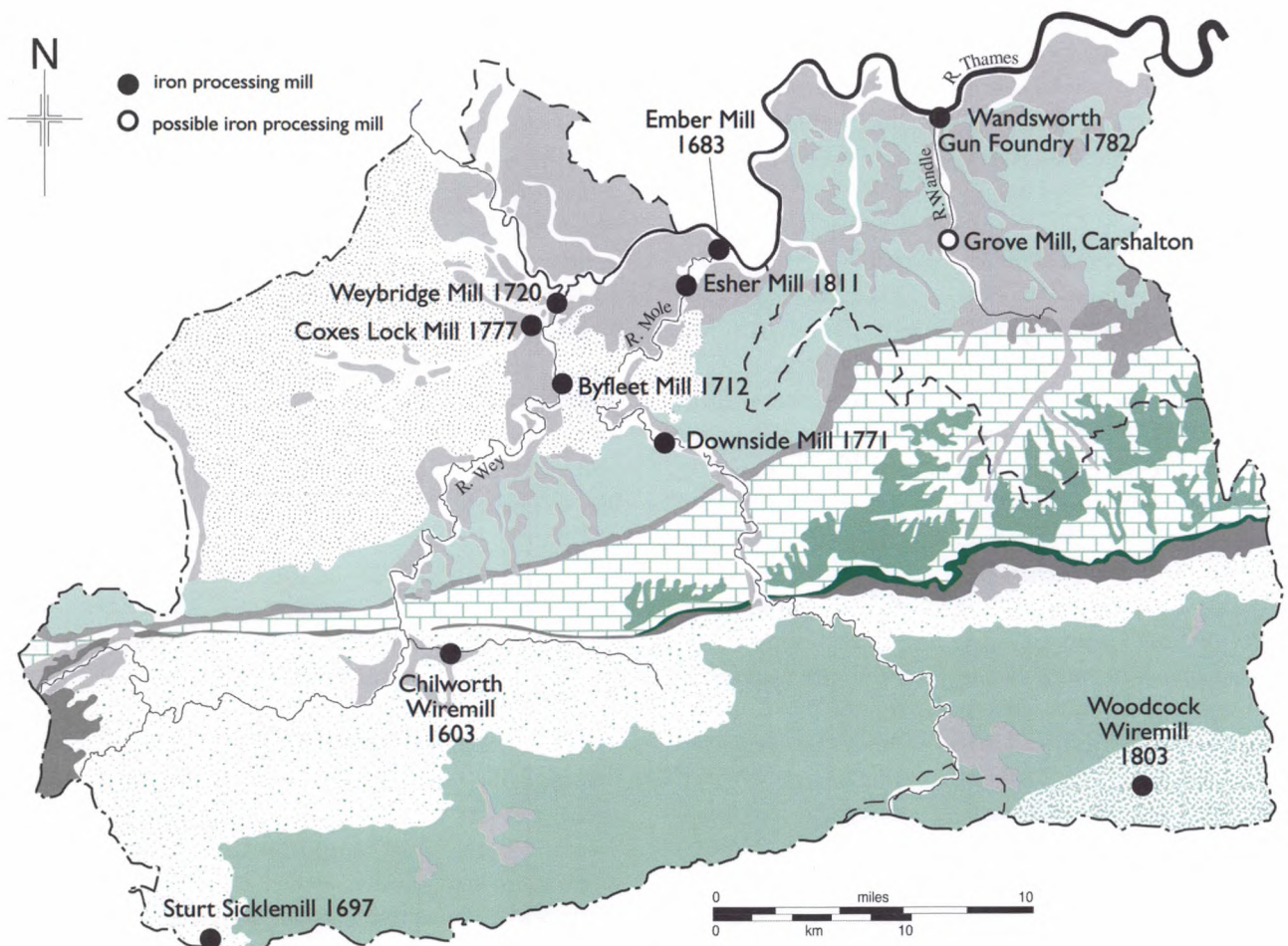


Fig 17.4 Iron processing mills. For key to geological background see map on page x.



was Byfleet Mill converted by Thomas Wethered for use as a hoop and wire mill, using iron, copper and brass. Like Thomas Steere's concern, and the subsequent uses of the Sturt and Woodcock forges, this was the secondary processing of metals. By the 1770s, the mill, which had remained the freehold of the Crown, was tenanted by John Berdoe, who also operated a mill in Crayford, Kent, on another Thames tributary. Weybridge Mill's history, which is not as long as that of Byfleet, owes its origin to the completion of the Wey Navigation in 1653. As with Byfleet, it started off as a paper mill, but in the 1720s, John Hitchcock, who had been active at Byfleet, acquired the lease and converted the mill for iron and brass working. Later lessees continued in the same vein, including the firm of Jukes Coulson, of Thames Street, London, who had also been at Byfleet. It has been suggested that Weybridge Mill was engaged in iron smelting, that is to say primary iron production – using ore derived from the same Bracklesham Beds that may have supplied the 6th century BC iron makers at Brooklands – but there is no evidence to support this. Forge slags are common at these sites, although the occurrence of what appears to be tap slag at Downside Mill, Cobham, suggests the possibility of more than mere forging (Potter 1982, 218). It is likely that most of the raw materials for these mills were derived from London iron merchants, importing from Sweden, although, in the late 17th century, some may have been supplied by Wealden furnaces.

Both Thomas Wethered and John Hitchcock, who had been at Byfleet, were involved in the same line of business at Esher Mill, and at Ember Mill, Molesey, which had begun as a brass wire mill in the 1630s. For a while in the 1770s Ember Mill became a corn mill, but in the 1790s its tenancy came into the hands of Alexander Raby, who was already manufacturing iron and brass wares at Downside Mill, Cobham, and Coxes Lock Mill, Addlestone (Potter 2000, 11–13). Raby's father, a London ironmonger, had operated a gun-founding furnace in Sussex in the 1760s, in conjunction with Woodcock Hammer, and when he had died Alexander had decided not to pursue his father's ordnance business, which had already been overtaken by coke-fuelled furnaces in the north (Hodgkinson 2000, 3–7). In fact, Raby purchased the lease of the mill at Cobham shortly before his father died in 1771 (Taylor 2000, 15). Raby gave up his Surrey mills in about 1807, and moved his operations to South Wales.

The variety of ironwares produced at these mills was not consistent, and included hoops and wire, as well as domestic items such as pots and pans for which copper plating would be needed (which explains the presence of a copper foundry at Raby's Downside Mill at Cobham). An interesting feature of these mills is that their locations made them attractive to a wide

variety of uses, and those uses changed as economic conditions and demand altered, the necessary adaptations being made to the machinery and waterways. By the end of the first quarter of the 19th century, many of the mills on the Wey and Mole had reverted to the processing of agricultural produce.

In addition to the Mole and Wey, a large variety of mills existed on the Wandle, one of the most heavily industrialized rivers in southern England (Hobson 1924). Although most of the mills along its length were devoted to other purposes also geared towards the London market, such as paper, snuff, leather, oil and gunpowder, one at least was used for the production of metalwork. At James Henckell & Co's mills at Wandsworth, some or all of the processes of iron ordnance founding were carried on during and after the Napoleonic period. Henckell's first attempt, in 1782, failed in bankruptcy two years later, but with the financial help of his brothers-in-law, he was able to repay his creditors and start again in 1790. He achieved some success in supplying the Board of Ordnance with naval armaments, and examples of his work are to be found on HMS *Victory*. Although the company survived as ironmongers in the city of London until the 1860s, the Wandsworth mills had been turned over to paper production in the 1830s (Brown forthcoming). Briefly, Henckell also had a copper mill in Wandsworth. It has been suggested that gun boring took place at Grove Mill, Carshalton during the Napoleonic period, but there is no firm evidence. Gun founding had been the mainstay of the Wealden iron industry in its final phase, but like the iron mills on the Mole and Wey, the source of the iron for Henckell's guns was not indigenous, and it is an indication of the route industrialization was taking that both his principal competitors, Walker & Co of Rotherham and Alexander Brodie in Shropshire, had works which were more conveniently located near to sources of both fuel and ore rather than to their potential markets (Kennard 1986, 50, 150).

While not unique to Surrey, it was because of the county's juxtaposition with the capital that the proliferation of specialist water-powered metal-working mills came into existence. The influence of London on Surrey was greatest along its Thames river frontage in Southwark. Since Roman times the southern shore had attracted craft working, because it was accessible from the river, and because the pollution caused by such operations was sufficiently removed from residential areas. These factors remained unchanged and by the 18th century Southwark was a principal market for the produce of the South East. Not least of the products handled by the Southwark merchants was iron. Many of the Wealden furnaces were leased by merchants who had yards by one or other of the borough's wharves.

William Harrison at Morgan's Lane (GLL: Ms 6482a) and William Bowen at Marigold Stairs (SLHL: Ms 8287) respectively managed nearly half of the Weald's gun foundries in the 1740s. Others, like Edward Raby and Wright & Prickett (SLHL: Ms 3734), followed in their wake, and their successors, such as Alexander Raby, were key players in operating some of the mills along the Wey and Mole that I have just described. The rebuilding of London Bridge in 1831 further increased the importance of Southwark allowing direct access upstream from the sea, which had been inhibited before, and permitting the movement of goods, from the heart of London as well as from tributaries of the Thames such as the Wey, Mole and Wandle, through to the new docks which were being developed downstream in the same period.

### Conclusions and research objectives

At no time in its history has Surrey been possessed of an iron industry. Evidence available at the time of writing points to the exploitation of limited local resources that has given rise to brief bursts of production in the early and late Iron Age, but these may not have been sustained beyond a few decades at most in each instance. Although there is very limited evidence for ironworking in the early Middle Ages, production does not seem to have developed in the district around Horley until the 14th century, when it formed part of a larger area that extended into northern Sussex and south-west Kent. This activity may be regarded as a precursor to the main expansion of iron production based on water power which promoted the Weald to national significance in the 16th and 17th centuries. Surrey was on the periphery of this region, but the position of the county in relation to London, and the increasing importance of the capital, influenced the re-use of these ironworks when a general decline in the region set in. The establishment of iron processing mills on the navigable reaches of the Thames tributaries represents an intensification of the capital as the dominant market in the South East, but also stands as perhaps the last stage in the viability of capital-intensive single units of production, before steam-dominated, full industrialization took over.

It is fair to state, I believe, that in every period the story of iron production in Surrey is under-documented (or perhaps under-published). In a few instances, intensive investigation, as at Brooklands, has presented a more complete picture, but as is so often the case with the history of a region, it is the detailed study of its parts which is important. Of these, two periods stand out – the Iron Age of the Bagshot, Weybridge and Egham areas, and the late medieval of the Horley area – and they, above all, deserve particular attention in the future.

The sites at Brooklands and at Thorpe Lea are not representative of a body of evidence of ironworking in their respective areas and periods. Each is the sole example, to date. For this reason, it is important that evidence of other sites contemporary with those should be looked for, and this can only be accomplished by systematic fieldwalking and examination of field names. The built-up nature of the areas where these sites have been found presents problems, but local archaeologists need to be alerted to the sort of evidence that can be found in gardens as well as on land subject to building development. Similar efforts need to be made in the Bagshot area, where the results of fieldwalking have been reported, but where a more rigorous programme needs to be introduced. The identification of sites by fieldwalking is often enough to draw conclusions about their distribution, without the need for invasive archaeology.

The data about iron making in south-east England in the Saxon period is very scarce, and it is not possible to speculate as to whether this is because sites have not been found, or because they did not exist in the region. The excavation of settlement and other sites of the period will require careful monitoring to identify any traces of ferrous metalworking at all.

The results that can be derived from fieldwalking have already been seen in the discoveries relating to ironworking in the medieval period in south-east Surrey. In this case the efforts of an individual need support, and testing through trial excavation. The specific dating of sites, and the identification of the relevant contemporary landowners and occupiers, may help to establish the manorial or other contexts in which iron production was being carried out. In the post-medieval period, iron making was organized in individual units of production, where details of ownership, occupancy, supply and output are sometimes available. Case studies of such units are an essential element in piecing together our understanding of the industry in general. The detail of family and business relationships often offers clues to wider issues affecting the management of groups of works. Accounts of the supply of raw materials can illuminate our understanding of the economy of an area. For this reason, research into the individual operating histories of sites, and the filling of gaps in incomplete records, is useful if broader views are to be gained. The early gunfounding activities at Imbhams furnace, the disentangling of the operation of the Thursley hammers, and the purpose of the water-powered site at Coneyhurst Gill, Ewhurst, are examples. In addition, two blast furnace sites in the county – in Park Wood, near the hamlet of Brook in Witley parish, and another, close to Frillinghurst Farm, south-west of Chiddingfold – have no documented history at the time of writing.



The changing nature of the markets for the iron industry in the post-medieval period is a field ripe for further study, particularly in Surrey where the marginal nature of the industry must have been more susceptible to economic fluctuations than in the core areas of the Weald. Some of this change is reflected in specialization, such as the refocusing of Sturt Hammer, Haslemere, or the development of Woodcock Hammer, near Lingfield. The decline in the viability of forges in the latter half of the 17th

century, through the increasing dominance of imported Swedish bar iron in the foundries of London and the other major east coast towns, resulted in even more radical change in the use of some iron mills. Local ironmongers like Goodyear, and some of his contemporaries in Sussex, whose activities represent a cross-over between primary production and the local wholesaling of iron, beg further investigation.

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