

Surrey's industrial past: a review

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This paper provides a summary review of work carried out on the history and archaeology of medieval and later industry in Surrey. It deals principally with manufacturing and extractive industries, motive power, transport and utilities. Agriculture is touched upon only incidentally. Emphasis is on the modern administrative county but examples from metropolitan Surrey are included as appropriate. The paper attempts to identify gaps in present knowledge and suggest directions for future research.

Introduction

Surrey is fortunate in its *Victoria County History*. Published in 1902–12, it contains a substantial account of the manufacturing and extractive industries of the historic county contributed by Montague S Giuseppi, one time Secretary of the Surrey Archaeological Society (*VCH*, 2, 243–424). This still provides a starting point for inquiry in many fields. A few specialized works followed but it was in the 1970s, with growing interest in industrial archaeology, that publications on the subject began to proliferate. The British Association's Surrey conference volume discusses past and contemporary industry (Salmon 1975, 161–4, 177–99) and the first gazetteer of industrial sites appeared two years later (Payne 1977). The Surrey Industrial History Group (SIHG) then compiled gazetteers for the modern county (Crocker, G 1990) and for each of its eleven administrative districts. These are (with abbreviations used for locations in the text): Elmbridge (El; Baker 1989; Tarplee 1998), Epsom & Ewell (EE; Wakefield 1997), Guildford (Gu; Haveron 1993), Mole Valley (MV; Tarplee 1995), Reigate & Banstead (RB; Stidder 1979; 1996), Runnymede (Ru; Mills 1991), Surrey Heath (SH; Mills 1995), Spelthorne (Sp; Mills 1993), Tandridge (Ta; Tadd 1994), Waverley (Wa; Haveron 1985; Crocker 2003), and Woking (Wk; Wakeford 1995). These districts, together with London boroughs (LB) formerly in Surrey, are shown on the location map in the Introduction to this volume.

Medieval industries

Corn milling for local communities represents the first use of water power. The Domesday survey recorded 118 mills, plus five parts of mills, in the historic county of Surrey. All were water-powered corn mills as windmills did not appear in England until the late 12th century. The location of early mill sites known from documentary evidence and their correlation with later rebuilds and features in the landscape is a matter for continuing investigation, which has been discussed and speculated upon by many authors. Published work includes county-wide surveys and gazetteers (Hillier 1951; Reid 1987;

1989; Stidder 1990; Blythman 1996), studies of mills in particular areas such as Wandsworth (Gerhold & Ensing 1999), the lower Wey and Mole (Greenwood 1980) and the estates of the bishops of Winchester in the Farnham area (Brooks & Graham 1983). There are unpublished works on mills on the Wandle (Wilks MS) and Surrey volumes on watermills and windmills in the Simmons manuscript collection (Simmons 1940s). The standard work on Surrey windmills (Farries & Mason 1966) notes that one of the earliest known windmills in England is recorded at Warlingham (Ta) at the close of the 12th century. The distribution of known wind and watermill sites is shown in figure 16.1.

Commercially significant industries in medieval Surrey were the manufacture of woollen textiles, pottery, Wealden iron and glass and the quarrying of Reigate building stone. The early iron industry is discussed by Jeremy Hodgkinson in this volume and is mentioned only briefly here.

THE WOOLLEN INDUSTRY

An early cloth-manufacturing region extended from Sussex across south-west Surrey and Hampshire to Berkshire, Wiltshire and Dorset (Kerridge 1985, 15). Research on the woollen industry in southern England has tended to concentrate on counties farther west where it achieved greater prominence and survived longer and the industry in Surrey has received relatively little further attention since the publication of Giuseppi's account in 1905 (*VCH*, 2, 342–9). There is evidence for the export of Guildford cloth in the late 14th century (Origo 1957, 72–3) and records show that in the 16th century products of the district were made chiefly for export (*VCH*, 2, 343). Dyeing was carried out by clothiers and some specialist dyers (*ibid*, 346–7, 363–4). Woad was prominent among the dyes used and was mainly imported but some was cultivated in the Godalming area in the 1580s (SHC:LM1966/2–4).

The woollen industry was the next after corn milling to use water power. Mechanized fulling mills, for the controlled shrinking and thickening of the

woven cloth, were widely adopted in England in the 13th century as shown by Carus-Wilson (1941), whose conclusions regarding their economic significance is however disputed (Holt 1988, 145–58). Many have been noted especially at mill sites in south-west Surrey and also in the east of the county and on the Wandle but a systematic search is needed to establish a pattern of distribution.

The use of fuller's earth in south-west Surrey and its sources are matters for investigation. Deposits in east Surrey around Nutfield (Robertson 1986, 178–90) are often mentioned in the context of the county's woollen industry, for example by Giuseppi (*VCH*, 2, 342) although he states elsewhere (*ibid*, 280) that there is no definite evidence that they were worked at an early date. Transport costs would have been high and alternative detergents may have been used, for example lye from plant ashes and stale urine (Patterson 1956, 215). Chemical analysis of fuller's earth found in late 12th to early 13th century hearths at Swan Lane, City of London, suggested that it could have come from east Surrey (Robertson 1986, 97; Egan 1991, 12–14, 18n7). There were deposits in Hampshire (Robertson 1986, 216–18) close to the Surrey textile area, and in Kent (*ibid*, 171–7) where coastal transport was convenient. Fuller's earth occurs in a Winchester fuller's inventory of 1433 (*ibid*, 101n) and reached Alton in Hampshire from Southampton (Platt & Coleman-Smith 1975, 2, 18).

The decline of the woollen industry was recognized as early as 1621, in Guildford Corporation's proposals for making the river Wey navigable (Nash 1969, 34). There was a general shift in demand from heavy woollen textiles to the lighter mixed fabrics known as the 'new draperies' which had been taken up by merchants in the 16th century (Coleman 1969; Kerridge 1972, 27–30). The local circumstances by which the decline was accelerated in the 1630s, through the fortunes of an individual merchant, Samuel Vassall, are related by Crowe (1973).

WEALDEN GLASS

A forest glass industry was established in several parishes around Chiddingfold (Wa) and the Surrey-Sussex border in the first half of the 13th century and 45 of some 80 known glasshouses in Britain in the period 1250–1600 were in this region. Improved technology was brought by Jean Carré of Antwerp and a community of French workmen in the 1560s.

Further technological advance came with the successful use of coal as fuel in glass furnaces in Southwark in 1611 and Lambeth in 1613. A monopoly of coal-fired glass acquired in 1615 by Sir Robert Mansell was enforced and the forest industry ended by 1620 (Crossley 1994, 68).

The first detailed account of the Wealden industry and its surviving traces was published by Kenyon (1967). The early 14th century site at Blunden's Wood, Hambledon, and the mid-16th century furnaces at Knightons, Alfold, both pre-dating the immigrant phase, were excavated by Wood (1965; 1982). A reassessment of the archaeological evidence of the industry was begun by Crossley in 1991 and continued under one of the English Heritage Monuments Protection Programmes referred to by Marilyn Palmer in this volume. All previously recorded sites were visited and their condition assessed and a research agenda was proposed. This emphasized (a) laboratory examination of material from past work, including establishing the source of clays for crucibles, (b) more field walking to locate further sites and relocate those not recently confirmed, and (c) study of the relationship between furnace sites and coppice woodland (Crossley 1994).

POTTERY

The medieval pottery industry and its continuation into the post-medieval period, is a large subject which can be touched upon only briefly here.

The whiteware industry of north and west Surrey and the Surrey-Hampshire border was a major supplier to the London market from the mid-13th to the 16th century (Pearce & Vince 1988, 6). The first comprehensive study of this industry was made by Holling (1971; 1977). Pearce & Vince (1988) have since published a dated type-series of medieval Surrey whiteware found in the City of London which comes from the industries at Kingston upon Thames (see Andrews in this volume), Cheam (LB Sutton) and in the Surrey-Hampshire border region. Kiln sites of this period have been reported at Kingston (Hinton 1980; Nelson 1981; Miller & Stephenson 1999) and at Cheam (Marshall 1924; 1941; Orton 1979; 1982). Pearce (1992) has continued the study of the whiteware industry into the 16th and 17th centuries when production sites are known at Farnborough Hill and Cove in east Hampshire (Haslam 1975), Hawley, Ash (Holling 1969), and possibly Pirbright.

Opposite: Fig 16.1 Distribution of known water-powered sites and windmills in Surrey. Windmills are more numerous in the eastern part of the county, reflecting the landscape, and near London reflecting the demand for power. Particular concentrations of watermills are seen on the Wandle and Tillingbourne and a number of tide mills operated along the Thames. Note that the definition of a watermill site is imprecise since many mills were composite and in multiple use. The map is a compilation for all periods from that of the Domesday survey onwards, and is based on information from many sources, in particular Blythman 1996; Brandon 1984; Brayley 1848, 35; Cleere & Crossley 1995; Crocker, A 1989–90, 1992, 1994; Crocker, G & A 1990; Farries & Mason 1966; Hillier 1951; Reid 1987, 1989; Stidder 1990; Wilks MS.

The industry of the Limpsfield area, which produced coarseware from the mid-13th to the mid-14th century, is discussed by Prendergast (1973; 1974). The excavation of kiln sites at Limpsfield Chart is reported by Ketteringham (1989) and at Clacket Lane, near Titsey, by Hayman (1997). A production site of coarseware at Earlswood, near Redhill, included a 14th century kiln (Turner 1974) and the occurrence of white slip on jugs from this site raised the issue of the transport of materials (*ibid.*, 50). From the point of view of industrial history, more work is needed on such matters as sources of materials, transport, production sites and methods, and on the producers themselves. In his important study of the pottery from Clacket Lane, Jones (1997, 76) notes the advantages of opening up large areas around kilns for showing relationships between kiln, workshop and waster heap. He also calls for more work on production sites on both sides of the Surrey-Kent border and for local historians to continue their search for references to the industry in documentary sources.

Medieval kilns for roof tiles have been excavated at Borelli Yard in Farnham (Riall 2003), Guildford Castle (Poulton forthcoming), and in Farnham Park (Riall 1997) and a kiln for the production of the important pictorial Chertsey Abbey floor tiles has been discovered in excavations at the Abbey (Poulton 1988, 39–40, 81).

REIGATE STONE

Building stone was extracted from underground workings in the Upper Greensand of east Surrey, between Brockham (MV) and Godstone (Ta), from pre-Conquest times to the 19th century (Sowan 1975). An example from the extensive Chaldon-Merstham complex is illustrated in figure 16.2. The Domesday survey records two stone quarries at Limpsfield (Ta) (*VCH*, 1, 311). Reigate stone was used in some of the earliest Saxon churches and prestige buildings in the London area but its susceptibility to erosion was recognized in the mid-15th century (Tatton-Brown 2001, 198) and from then to the 17th century it was used mainly for internal work. It continued to be used locally as building stone into the 19th century. It had later uses also as 'firestone' for refractory purposes and 'hearthstone' for whitening stone floors and doorsteps (see section on stone quarrying below).

A research project was set up in 1998 by the Historic Royal Palaces Agency to study the stone and the quarries in order to establish procedures for the conservation of buildings and locate suitable stone for repairs. Sowan observes that Reigate stone is a unique type which is not sandstone, limestone or calcareous sandstone so that established methods are not always appropriate for its conservation; also the

quarrymen's skill in distinguishing good from inferior stone has been lost (Sowan 2000a).

Documentary evidence indicates that stone was transported to London and stored in Battersea on a site called 'Bridges' on which the archbishop of York's mansion was built in the late 15th century (Tatton-Brown, 2000; 2001, 193–5). Evaluation excavations were carried out in 1996 and 1998 to establish the extent of York House and ancillary buildings prior to development (Hawkins 2000a). No traces of Reigate stone were found but the inferred location of 'Bridges' is under the late 19th/early 20th century Price's candle factory building which was not affected by the development (Hawkins 2000b).

Post-medieval and later developments

Post-medieval industry was advanced by the enterprise of 'projectors' and the granting of letters patent and by the acquisition of expertise from the Continent and the formation of chartered companies (Donald 1961; Thirsk 1978). Most of the new industries which were established in Surrey in Tudor and Stuart times continued into the period of accelerated growth and innovation of the industrial revolution and some survived into the 20th century. An overview of manufacturing industry in the mid-19th century, with some quantitative data, is given by Brayley (1848).

MILLS AND MOTIVE POWER

After its application to corn milling and fulling, water power was used in bloomery iron furnaces in England from the 14th century (Crossley 1990, 154) and from the 16th century onwards was applied to a growing number of industrial processes. Some new industries occupied the sites of fulling mills which closed as the woollen industry declined but many new water-powered sites were brought into use. The Tillingbourne and the Wandle had particularly intensive use (fig 16.1). Brandon (1984, 75) comments that of 21 water-powered sites identified on the Tillingbourne nine were in use before 1500 as corn or fulling mills and the rest were established in the Tudor and Stuart period. The Wandle had at least 24 corn mills by 1610, when a proposal to abstract water for London was successfully opposed (Giuseppi 1908), and Wilks has gathered information on 49 mill sites, many in multiple use, which were eventually developed on this river for a wide range of industries (Twilley & Wilks 1974; Wilks MS). Tide mills were used along the Thames and these require further research and analysis (fig 16.1; [Plunkett 1999]).

The establishment of a new mill site might involve construction works to provide a head of water or increase an existing one or to form a reservoir. The topography of water supply to mills, as outlined by Crossley (1990, 140–4), and its links with other



Fig 16.2 Quarry Field building stone quarry, Merstham, showing part of the Chaldon-Merstham complex of drift mines in the Upper Greensand of east Surrey. The tunnels appear to be medieval in origin but were reopened by 1807 and extended below the water table by the civil engineering partnership of Joliffe and Banks. The drainage adit no longer functions, hence the flood water as photographed in January 2001. The floor-ceiling height is generally *c* 1.5m. These early 19th century workings show characteristic pillar-and-stall features, with stalls or tunnels at right angles to the joint system. The pillar wall shows pick marks indicating up-dip working and distinct beds of stone, some more suitable for building than others. Spoil was backfilled underground. The notice was placed by the Wealden Cave and Mine Society to provide information on safety procedures and cave rescue during a detailed survey of the workings, of which some 17km were recorded. Photograph by Paul Sowen

aspects of water management, for example in agriculture and transport, requires more understanding. The projects of Sir Richard Weston on the Wey near Guildford in the 1620s are of national significance, involving early experiments with new crops and land improvements by irrigation which were linked to plans for making the river navigable (Hartlib 1650; McDonald 1908, 68–78; Nash 1969; Mayford History Society 1979); the Wey Navigation, eventually authorized in 1651, was one of the earliest in Britain (Vine 1996). John Evelyn (1675, [7]) alludes to the irrigation of land in the Tillingbourne valley, where his forebears were engaged in industry, and water management there has been discussed by Brandon (1984) and by G & A Crocker (2000, 10–12, 16–17). Other examples include works on the Mole at Cobham (Crocker, A 2000, 25–6, 27), its bifurcation the Ember at Thames Ditton (Greenwood 1980, 9), and on the Wandle (Montague 1992; 1999; Gerhold 2002). The bays and hammer ponds of the Wealden iron industry, in which a steady source of power was needed to keep furnaces in blast for extended periods, are an important category in the remit of the Wealden Iron Research Group (Cleere & Crossley 1995). Some new mill sites were situated on the artificial cuts of waterways, where a head of water would coincide with a lock. Four such sites are recorded on

the Wey and Godalming navigations (Stidder 1990, 88; Crocker 1992, 215–6; 1994, 4–6; Barker 2000).

Many mill sites were occupied by several industries in succession, and sometimes in parallel, adopting new sources of motive power and new technologies, and eventually changing from manufacturing to modern business use. There is scope for detailed documentary research such as that by Greta Turner (2003 and forthcoming) on the parish of Shottermill, Haslemere, and on Catteshall Mill, Godalming (Crocker, A & G 1981). Standing buildings and evidence of power installations were recorded at Catteshall but little evidence of past usage now survives at large manufacturing sites since they have been cleared for redevelopment.

Watermills which remained relatively small have however survived in many cases, occasionally intact but more often adapted for commercial or residential use. Surviving structures mostly date from the 18th century or later. The county-wide surveys of watermills noted above give varying amounts of historical detail and physical description. Detailed recording of structures has been undertaken at Paddington Mill, Abinger (MV), on the Tillingbourne (Crocker 1999), and unpublished surveys of High Mill, Farnham, Shalford (Gu) and Wonersh (Wa) mills are held by SIHG.

The industrial revolution is generally associated with the adoption of steam power and mineral fuel. Water and wind power remained important however. For example, the generator for Godalming's pioneering electricity supply in 1881 was powered by a water-wheel (Gravett 1981/2, 103–5). The problems for small businesses investing in steam power are illustrated by entries for 1851–3 in the diaries of James Simmons, papermaker of Haslemere (Crocker & Kane 1990, 113, 119–22, 126, 130–2). Eminent engineers, notably John Smeaton, increased the power and efficiency of the traditional prime movers in the late 18th century. A catalogue of Smeaton's drawings held by the Royal Society includes designs for water-wheels and other machinery in Surrey mills engaged in corn, bark and oil milling and the manufacture of paper, gunpowder and iron hoops (Dickinson & Gomme 1950, 10–11, 16, 18–19, 27, 30–1, 33).

Windmill design was improved from the 18th century onwards, for example in Smeaton's design (undated) for a 'china mill' at Nine Elms, Vauxhall (Dickinson & Gomme 1950, 5). Rocque's map of Surrey (1765) marks eighteen windmills and Farries & Mason (1966, 15) estimate there were nearer 25 by that date. They list 85 windmills known to have stood in the historic county since 1800, of which eleven plus six mill bases survived in 1964 (*ibid*, 241). Distribution was weighted towards the east of the county including the London area where many windmills were sited along the Thames (*ibid*, 14, 16/17), as shown in figure 16.1. Standing structures of windmills were also recorded by Simmons (1940s) and a survey was carried out in 1970–4 by Smith (1976).

There is doubt about the date of 1665, accepted by Farries & Mason (1966, 165), for Outwood (Ta) post-mill, from which it is claimed the miller, Thomas Budgen, watched the Great Fire of London in 1666. Mills specialists consider that there is no firm evidence for this date and that the present structure is more typical of 18th century work. Their view is however based on an instinctive feeling derived from experience rather than on evidence which would justify publication (Stephen Buckland *et al*, pers comm).

Gregory (2002) has shown that, while steam became the dominant power source, the windmill played a significant part in the industrial revolution since it was sometimes the most economic way of obtaining more power, particularly for family-sized businesses. Many corn millers owned both wind and watermills, on the same site in the case of 'Brazil Mill' at Wandsworth. Gregory discusses industrial windmills, as distinct from those used for corn milling or pumping. His list (*ibid* 2002, 28–30) covers eighteen industrial uses and for the whole of England contains entries for 79 mills operating in the 18th century and 88 in the 19th. It includes sawmills at Horsell (Wo) and Lambeth (LB) and six other windmills in metropolitan Surrey for uses

including paper making and the crushing of oil seeds, gypsum and bone manure.

Perrett (1979; 1980) discussed the early employment and manufacture of steam engines in London and noted those which survived in 1978. The early reciprocating engines were used for pumping and ten were in use in 1775 by water supply companies in London, including engines at Lambeth and London Bridge. Rotative engines were available from 1782 and were used in the late 18th century for rolling iron at a forge in Rotherhithe and at several locations in Southwark: a brewery, a dye-crushing works and the huge Albion corn mill (at the south end of Blackfriars Bridge) which had two steam engines each driving ten pairs of millstones, and a third planned, when it burned down in 1791.

Before the rotative steam engine became available to drive machinery, reciprocating engines were used to pump water back up for re-use in water-wheels. Such a water-returning engine was proposed by Boulton and Watt, and probably installed, at gunpowder mills at Worcester Park on the Hogsmill in 1778 (Crocker 1996, 17–19).

Data on the size and structure of water-wheels and on the use of steam engines in manufacturing is scattered in such sources as trade directories, sale particulars of properties, newspaper reports and legal documents. For example Esher (El) paper mill, which was built in 1847 but closed after a fire in 1853, had three steam engines (*The Times*, 26 Dec) in addition to water-wheels (PRO: J90/1206) and a fatal accident at Merstham (RB) stone quarries in 1811 involved a steam-powered winding engine (Sowan 1985/6, 88). Both the gunpowder and paper mills at Chilworth (Gu) installed steam engines in the 1860s (Crocker, G & A 2000, 86–7, 90, 94). Oil and gas engines were also used and some factories made their own gas, for example Catteshall paper mill, Godalming, in the 1890s (Crocker, A & G 1981, 20). A systematic collection of data has been made in the case of water turbines (Crocker 2001), which provided a more efficient form of water power from the mid-19th century onwards. Two peaks in usage are indicated: one between 1880 and 1910, to obtain more power, and a larger one in the 1920s and 1930s when many turbines were installed for generating electricity at mill sites and for operating pumps at waterworks and hydraulic power sites.

TRANSPORT: ROADS, WATERWAYS AND RAILWAYS

Manning & Bray (1804–14, 3, xxxii–lx) list Acts of Parliament relating to Surrey and give details of the county's bridges, roads and navigable canals. A summary account of roads, waterways, railways and aviation services has been compiled by SIHG (Crocker 1999a, 73–94) and selected features on transport routes are noted in SIHG District *Guides*.

Little detailed historical research has been carried out on particular road routes, apart from a study of the Bramley and Rudgwick turnpike trust of 1818, which incidentally corrects a popular misunderstanding of the date of the obelisk in Cranleigh (Wa) (Budgen 1991–2). The development of roads in the Weald, including routes radiating out from London and crossing Surrey, is discussed by Fuller (1953). An important subject for a research agenda is a consideration of transport routes for heavy freight, in particular products of the Wealden iron industry and of east Surrey's stone quarries bound for London and the transport of building materials within the county.

Historical accounts of the Wey and Godalming Navigations, authorized respectively in 1651 and 1760, and of the Wey & Arun Junction Canal, authorized in 1813, are provided by Vine (1996). A survey of the Wey and Godalming Navigations has been carried out for the National Trust for management purposes (Currie 1996). Fairclough (1999, 62–9) discusses records of boat building and voyages on the Thames and Wey for the transport of gunpowder by the shipping entrepreneur and philanthropist Thomas Coram in 1723. Vine (1968) gives an historical account of the Basingstoke Canal, authorized in 1778, which enters the Wey Navigation at New Haw. Historical guides to the Grand Surrey and Croydon canals, now in south London, have been published by Living History (1986).

The first railways in Surrey were horse-drawn plateways which pre-date the railway era proper. The Surrey Iron Railway (SIR) from Wandsworth to Croydon, the first public railway, opened in 1803 and in that year the Croydon, Merstham and Godstone Railway (CM&GR) was authorized. It opened from Croydon to Merstham in 1805, effectively as an extension to the SIR, but was never completed to Godstone and was used to transport products of the Merstham stone quarries and limeworks. It was bought out by the London & Brighton Railway in 1838. Archaeological and historical research on the CM&GR has been reported by Osborne (1982), Sowan (1982) and Burgess (1983; 1987) and the route is described by Bayliss (1981).

A history of the Southern Railway (Dendy Marshall 1936) was published by the company. Among the many more recent works on railway history, the Surrey Record Society's edition of the Minutes of the Board of Directors of the Reading, Guildford and Reigate Railway Company (RG&R), broke new ground in the Society's publishing programme (Course 1987). The minutes cover the period 1845–52 when the RG&R existed as an independent company. Jackson (1999) gives an account of the development and modernization of the county's rail network and discusses its influence on settlement

patterns and the lives of communities and its relationship with industry. This deals with private railway sidings and private industrial rail systems; freight for public utility undertakings such as gasworks and pumping stations and for major institutions, such as the vast mental hospitals in the Epsom area, and internal rail layouts for various industries. The largest group is extractive industries and there are also examples in a corn mill and in timber, linoleum, chemical and motor vehicle works.

The value of geological and water supply records in understanding 19th century civil engineering methods has been demonstrated in relation to the construction of railway tunnels by Sowan (1979; 1984a; 2000b).

UTILITIES

An historical account of water, sewerage, gas and electricity supplies and communications services is provided by SIHG (Crocker 1999a, 103–24) and the Group's district *Guides* include sites relating to utilities. Of particular significance are those for Elmbridge (Tarplee 1998) and Spelthorne (Mills 1993) which feature the extensive reservoirs constructed for London's water supply. Croydon holds an important place in the history of town water supply and drainage (Lancaster 2000). An English Heritage Monuments Protection Programme on water and sewage industries assessed ten sites in Surrey, all in the north of the county, of which eight were rated of national importance, in particular Surbiton waterworks (Trueman 2000, 43). Rivers, hydrogeology and water undertakings are also discussed by Fish *et al* (1975) in the British Association's volume on Surrey. Godalming had the first public electricity supply in Britain and very early street lighting which was celebrated in its centenary year of 1981 (Gravett 1981/2; Haveron 1981). In the field of communications, the county has surviving structures of the early 19th century Admiralty semaphore system (Wilson 1976, 33–63; Holmes 1983).

Surrey industries: the 17th to 19th centuries

Industries which have received particular attention in recent decades are Wealden iron (see Hodgkinson in this volume), the extractive industries and the manufacture of gunpowder, paper and certain textiles.

EXTRACTIVE INDUSTRIES

Stone quarrying, chalk extraction and lime burning, clay industries and the extraction of fuller's earth, sand and gravel have a long history in the county but developed on an industrial scale in the 19th century (Crocker 1999a, 4–22). Sowan (2000c) draws attention to valuable research resources, in particular non-statutory lists compiled in 1858.

Stone quarrying

It has been noted that the underground building-stone quarries in the Upper Greensand of east Surrey (fig 16.2) were reworked in the 19th century for the softer hearthstone, for whitening stone floors, doorsteps and hearths. This fashion continued into the 20th century and the last hearthstone mine, at Colley Hill, Reigate, which had been developed solely for the purpose, closed in the 1960s.

An account of the firestone and hearthstone mines by Sowan (1975) deals with the mines, geological and economic factors, working methods and uses of the stone and contains a summary gazetteer of sites. A more recent account (Sowan 1991) follows extensive surveying and photographic recording of the Chaldon-Merstham complex of underground workings. Funding is being sought to extend the Reigate Stone Project to include medieval and post-medieval underground quarrying and the distribution, use, performance and conservation of Reigate stone, to carry out conventional excavations at selected quarry entrances, extend and crystallize the research carried out from 1967 onwards and publish the completed surveys of underground workings (Paul Sowan, pers comm).

The firestone quarries at Merstham were, together with the limeworks, served by the CM&GR. Osborne (1982) describes the structure of the CM&GR plateway and of plateways in the quarries themselves, mainly at Merstham and Godstone, and provides a schedule and analysis of known extant plates.

In west Surrey a stone strongly resembling Reigate stone was used in and around Farnham but little is known about the quarrying of this material (Paul Sowan, pers comm). Surrey's second most important building stone quarries are those of the distinctive Bargate stone in the Godalming area. There is scope for research further to that by Withers (1969) and Janaway (1993) and the listing of numerous workings in a survey of heritage features in Waverley (Waverley Borough Council 1986). The largest site, at Ockford Hill, was served by a private siding 1km south of Godalming station but this closed in 1935 and quarrying ceased shortly afterwards (Jackson 1999, 204).

Chalk and lime

Underground chalk quarries at Guildford were described by Lee & Russell (1924) and Williamson (1930). The quarrying of chalk for building stone at Guildford and at Westhumble near Dorking, where the site warrants archaeological study, is discussed by Sowan (1976; 1984b).

Limeburning has long been practised for soil improvement and building mortar and demand for both increased rapidly from the 18th century onwards. Deneholes and chalk wells, now generally interpreted as medieval and post-medieval agricul-

tural chalk mines (Le Gear 1978), are found in north-east Surrey. Chalkpits occur throughout the length of the North Downs but extraction and limeburning developed on an industrial scale in east Surrey with the coming of rail transport. The promoters of the CM&GR, Joliffe & Banks, established limeworks at Merstham in 1805 (Gravett & Wood 1967; Sowan 1982). These closed in 1956 and the site was lost to landfill waste disposal from 1961 and the building of the M23 motorway in 1983. An early 19th century limeworks at Dorking, which had a high reputation for greystone building lime which hardened under water, was never rail-linked and never a limited company. It continued into the 20th century but was lost to landfill in the 1950s and 1960s.

Other major sites which developed around the 1860s have also been affected by landfill and site clearance involving the loss of hydrator plant, aerial ropeways and other features. However they retain 19th century kiln structures which are of major technological significance, in particular patent 'Brockham' kilns and, in the case of Betchworth (MV), Dietzsch and Smidth kilns which show technology transfer, having been developed on the Continent for cement, and a 20th century separate-feed kiln (Sowan 2000d, 5). Recording was carried out by Subterranea Britannica and others in the 1990s at Oxted (Ta), Brockham and Betchworth. An English Heritage Monuments Protection Programme (Richardson & Trueman 1997) assessed these limeworks as sites of national importance. The kilns at Brockham are scheduled monuments and are being conserved in association with wildlife interests. Progress has been reported by Sowan (2000d; 2000e).

Chalkpit railway systems are discussed by Jackson (1999, 196–200) and Townsend (1980). The Narrow Gauge Railway Society established a museum on the Brockham site in 1962 (Down & Smith 1977; Smith 1979), from which material was transferred to the Chalk Pits Museum, Amberley, Sussex, founded in 1979. Records of the Merstham Limeworks and of the Dorking Greystone Lime Company of Betchworth are held by the Surrey History Centre (Gravett & Wood 1967, 142–7; Sowan 2002).

Fuller's earth

The history of fuller's earth extraction in Surrey is discussed by J Greenwood (1982) and Robertson's comprehensive and literary account of the substance from the ancient world onwards includes a section on Surrey (Robertson 1986, 178–90).

It has been noted in connection with the textile industry that there is a lack of definite evidence for the working of the east Surrey deposits at an early date, before Aubrey (1718–19, 4, 214, 237) reported the prices fetched by Nutfield fuller's earth in the late 17th century.

Large-scale extraction began with William Grece near the end of the 18th century and developed rapidly with the coming of the railway. The CM&GR may have been a factor but a major expansion was begun by James Cawley at Nutfield in the 1840s. In 1890 the Surrey and Somerset businesses amalgamated into the Fuller's Earth Union, which merged with Laport Industries in 1954.

Tadd (1994, 24–5, 28; in Crocker 1999a, 15–18) discusses modern uses of fuller's earth and the related material bentonite, describes working methods, notes physical features of the industry remaining in 1994 and reports the announced closure of the last Surrey pit in 1996. Since then all workings have been landfilled or reclaimed and process buildings demolished.

Clay, sand and gravel

Brickworks and sand and gravel extraction are discussed in the context of industrial railways by Jackson (1999, 200–4, 208–9). Brickmaking has been widespread in the past (Crocker 1999a, 20–2) and most of the SIHG district *Guides* record selected sites, in particular those for Mole Valley (Tarplee 1995, 3–11) and Tandridge (Tadd 1994, 35–7). Very large modern brickworks and a hand-made tileworks are operating in the south of the county, on Weald Clay, in the 21st century. The subject warrants a systematic study, perhaps following the example of Beswick's history and gazetteer of the industry in Sussex (1993; 2001). Gower (1998) discusses the long history of brickmaking at Streatham (LB Lambeth) where the industry reached its peak in the 16th century.

Gravel extraction in north-west Surrey was discussed as a contemporary issue in the British Association's conference volume in 1975, when there were nearly 40 active pits in the Thames basin gravel field, about half of them in Surrey (Hollinghurst *et al* 1975, 195–8). Farther south, around Farnham, gravel pits were largely worked out in the 19th and early 20th centuries. Sand has been extracted from the Lower Greensand along the length of the county and latterly in areas east of Farnham and west of Reigate (Crocker 1999a, 6, 14–15). Silver sand for glass making was obtained from underground workings which have been found to be very extensive beneath Reigate where at least six distinct mine systems are known, some of which warrant archaeological study (Sowan 1980; Brown *et al* 1985–6; Arup 1991.)

Pottery

The manufacture of tin-glazed earthenware (known as delftware) and stoneware, based on imported prototypes, became established in Southwark and Lambeth in the post-medieval period (Edwards 1974) and there is also evidence of red ware produc-

tion in Lambeth and Rotherhithe (*ibid*, 4; TBAOG 1964, 9). Delftware production declined in the late 18th century with the development of hard-fired cream and white wares and the domestic market came to be dominated by the pottery industry of the Midlands. Stoneware manufacture continued to expand in the London area however, particularly in the 19th century with the development of public sanitation and civil engineering works. Contemporary descriptions of the manufacture of tin-glazed earthenware at Lambeth and stoneware pottery at Fulham in the late 17th century are reported by Weatherill & Edwards (1971) and the Doulton stoneware works at Lambeth at the beginning of the 20th century are described in some detail by Giuseppi in his historical and contemporary account of Surrey potteries (*VCH*, 2, 281–95).

Several kiln sites in south London have been excavated since the late 1960s (eg Bloice 1971; Dawson 1976; Edwards, R 1981–2; Killock *et al* 2003). The development of kiln types has been discussed, in particular the use in London in the 17th and 18th centuries of rectangular, single-flue, sub-surface kilns of Continental type and the later use of multi-flue round surface kilns of native tradition (Dawson 1981) and it is noted that there are still technical issues to be resolved (Graham Dawson, pers comm).

Farther from the metropolitan area Giuseppi comments, in particular, on potteries at Ewell, Cheam and Epsom and notably at Farnham where, at Wrecclesham, a 19th–20th century country pottery drew upon the local post-medieval tradition under the influence of the Arts and Crafts movement. With its rare surviving example of a circular twin-flued updraught kiln, this pottery was recorded in the 1990s (Menuge 1999) and is being restored and maintained as workshop units by the Farnham (Building Preservation) Trust. Giuseppi notes that country potteries producing the commoner sorts of earthenware were numerous and cites examples at Charlwood, Cranleigh, Crowhurst, Dorking, Godstone, Kingston, Leatherhead and Redhill which were active at the beginning of the 20th century (*VCH*, 2, 295). A gazetteer of sites of country potteries in Surrey was compiled by Felix Holling (Brears 1971, 212–16). Ashtead Potters Ltd was formed in 1922 to train ex-servicemen. Its art deco products are collected and workers' housing survives (Hallam 1990; Tarplee 1995, 46–7).

GUNPOWDER

Giuseppi's 1905 account of the gunpowder industry (*VCH*, 2, 306–29) dealt in detail with the 16th and 17th centuries, when Surrey powdermakers played a major role nationally, and more briefly with the period after 1700. Research has made considerable progress since the 1980s.

Sixteen manufacturing sites have been identified in the county (Crocker, G & A 1990). Water power was first used in the industry by the 1540s at tide mills on the Thames at Rotherhithe. The Evelyn family, which held patents from 1588/9 and then the crown monopoly until 1636, had mills on the Hogsmill at Tolworth (EE/LB Kingston), the Tillingbourne at Wotton and Abinger (MV) and on a tributary of the Eden at Godstone (Ta) (*VCH*, 2, 312–18). The Evelyns' operations are known largely from the perspective of their government contracts and research by Brandon (1984) on their industrial enterprises and estate management around Wotton needs extending to other sites.

The early mills noted above closed in the first half of the 17th century but those on the Tillingbourne at Chilworth (Gu), which were established in 1626 by the East India Company, were taken over and extended by Charles I in the 1630s and expanded further during the rest of the 17th century (Edwards 1995; Fairclough 1996; 2000a; 2000b; Fairclough & Crocker in prep). They continued on a smaller scale through the 18th and early to mid-19th centuries; the label illustrated in figure 16.3 dates from this period. The works expanded further in the late 19th century, finally closing after the First World War. Most of the Chilworth site is a scheduled monument. It has been assessed by an English Heritage Monuments Protection Programme as of national importance on account of its early history, the period after 1885 when it was at the forefront of new technology, and its rare surviving structures of an early cordite factory (Cocroft 2000, 146–7). A detailed survey has been carried out by English Heritage (Cocroft 2003). A change in technology from stamp mills to edge runners for incorporating gunpowder occurred in the late 17th and 18th centuries (Crocker, G & Fairclough 1998). Areas at

the eastern and western ends of the Chilworth site, outside the English Heritage survey, are among very few sites in England where traces of early stamp mills may lie buried, and therefore warrant archaeological investigation (Crocker, G & A 2000, 12, 16–18).

Apart from Chilworth, later gunpowder sites were located further north on the Wandle, lower Mole and Hogsmill. New mills were established during the Dutch Wars (1652–74) at Carshalton (LB Sutton), Wandsworth and East Molesey (El). These however closed in the 18th century. The Surrey Record Society has published transcripts of documents relating to the gunpowder industry. It contains inventories of mills in 1661, 1678 and 1753, together with a Chilworth letter book of 1790–1 (Crocker *et al* 2000). Fairclough's work on Wandsworth (*ibid*, 46–51) has been carried forward by Gerhold (2002). Knowledge of Chilworth in the 18th century has been extended, particularly in relation to Huguenot powdermakers, the private trade in gunpowder and the Spencer family archives (Fairclough 1999a; Crocker *et al* 2000, 73–88, 106–72). An account of the gunpowder and paper mills at Chilworth and Albury is given by G and A Crocker (2000).

Traces of a late 18th century gunpowder mill at Abinger Hammer on the Tillingbourne, whose proprietors failed to obtain a licence and left to establish mills at Gorebridge, Midlothian, have been recorded by English & Field (1991). Other mills established on the Hogsmill in the 18th century, at Worcester Park (1720–1854) and Ewell (1750s–1875), await more detailed historical study.

PAPER MAKING

The earliest Surrey paper mill for which there is definite evidence is Stoke Mill, Guildford, recorded by 1635. Over 30 mills were subsequently established on Surrey rivers, two on the Mole, one on the Hogsmill, ten on the Wandle and the majority on the river Wey, its tributaries, and both its headwaters extending into Hampshire (Crocker, A 1989/90; 1992; 1994). There were also two on the Colne at Stanwell, formerly in Middlesex (Blythman 1996, 43–4). The distribution pattern changed at the end of the 18th century with the introduction of chemical bleach, the paper-making machine and the steam engine. These removed dependence on clean water and water power and several steam-powered mills were established in Bermondsey and Southwark. The adoption of new raw materials, in particular imported wood pulp in the late 19th century, favoured large sites near the coast. The last Surrey paper mill, at Catteshall, Godalming, closed in 1928.

The subject has been intensively researched but some facets remain to be pursued, for example the history of the Merton Board Mills which operated

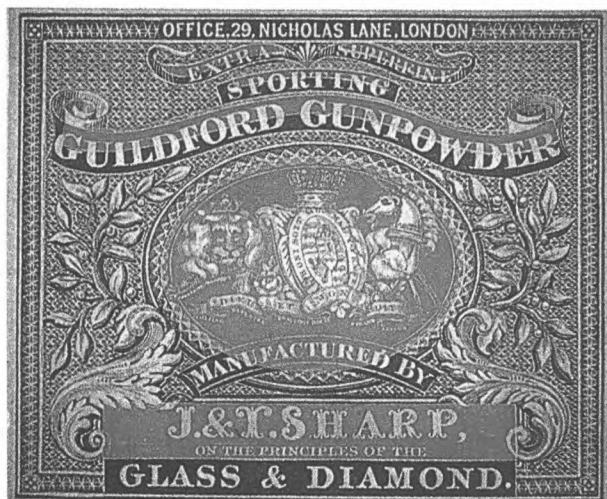


Fig 16.3 Gunpowder label of J & T Sharp, Chilworth, 1820s. The Sharp family operated at Chilworth from 1819 to 1881. Bodleian Library, University of Oxford: John Johnson Collection, Labels 17

within living memory. Detailed studies have been undertaken of Catteshall Mill, Godalming (Crocker, A & G 1981); the diaries (1831–68) of James Simmons, papermaker of Haslemere (Crocker & Kane 1990), and paper mills in the Tillingbourne valley (Crocker, G & A 2000). Other work by A Crocker, some jointly with other authors, deals with Surrey watermarks (1995), paper excise stamps (1996), and innovations in technology and the use of raw materials at Wandsworth and Neckinger Mill, Bermondsey. The developments at Wandsworth centred on the use of esparto grass and its importation from south-east Spain by William McMurray (1986; with Castillo Fernández 2003). Those at Neckinger Mill were chemical bleaching, developed initially for textiles (2002) and the early, and economically premature, use by Matthias Koops of straw, wood pulp and recycled materials (1998). The association between the papermaker at Neckinger Mill, Elias Carpenter, and the prophetess Joanna Southcott is examined by Crocker & Humphrey (2002).

TEXTILES

Although the woollen industry declined in the 17th century, it survived on a very small scale in Godalming into the early 19th century (*VCH*, 2, 348; Crocker 1991/2, 51). Other minor enterprises have been noted in Lambeth, Battersea and Worpleston (Gu) (*VCH*, 2, 353) and in poor-houses in east Surrey (Stidder 1996, 13; Crocker 1999a, 53). Worsted manufacture, using combed long-stapled wool as distinct from carded wool, is recorded in connection with the framework knitting industry (see below) and the manufacture of braid and trimmings for military uniforms by Appletons at Elstead and Haslemere (Wa) (Crocker 1999a, 51–2; Turner forthcoming). Other textiles include bolting cloth for flour dressing at Wandsworth (Davis 1898, 4–5). The principal ‘miscellaneous textile and allied industries’ discussed by Giuseppi (*VCH*, 2, 349–59) are silk weaving, linen weaving and, more importantly, framework knitting. The latter has been researched by G Crocker (1989; 1991; 1991/2) but other minor textile industries await further investigation. Giuseppi notes small silk and linen industries carried on by foreign workers in 16th and 17th century Southwark and Bermondsey and a small native linen industry in south-west Surrey in the 17th and 18th centuries.

Silk manufacture in the area of modern Surrey in the early 19th century was associated at Thursley (Wa) and Haslemere with the industry in east London (Crocker 1999a, 52), and with that in the Wandle valley in the case of Coxes Lock Mill, Addlestone (Ru) (Barker 2000, 33; Montague 1992, 63). Wilks (MS) notes other examples of silk mills on the Wandle, in addition to those engaged in textile printing (see below).

The hosiery and knitwear industry

The framework knitting industry in the Godalming area began as one of several country outliers of the manufacture of luxury silk and worsted stockings in London in the late 17th century and was unrelated to the earlier woollen industry. Nationally, framework knitting expanded to supply a mass market in wool and cotton goods and became concentrated in the East Midlands in the 18th century. It continued however in the Godalming area, beset by the general problem of the pauperization of its workforce, but was revived in the late 18th century by specialization in underclothing. This phase lasted until about 1890. A factory system was adopted relatively early in Godalming, *c* 1850, and a major East Midlands firm had its first factory in the town *c* 1860. Census returns show migration of workers from other hosiery-manufacturing areas. A pioneering manufacture of outerwear, of which an example is shown in figure 16.4, began in the 1880s and this phase continued up to the closure of Alan Paine’s Godalming factory *c* 1990 and shortly afterwards of small firms making sports sweaters with hand-operated machines. Census data of 1891 and 1901 may give better



Fig 16.4 Jacquard purl-stitch sweater by W T Pitchers of Godalming, 1893. The method of manufacture was developed by the Stoll knitting machine company in association with Mrs Lucy Pitchers, who had also devised a method of producing cable stitch sports sweaters on the flat knitting machines of the period. SIHG Collection, courtesy of Michael Pitchers

understanding of the early outerwear industry. Surviving buildings were recorded in the late 1980s (Crocker 1991) and two active factories were recorded on video before their closure in the 1990s (IA Recordings 1990).

Shere fustian

Fustian weavers are recorded at Shere (Gu) in the Tillingbourne valley up to the third quarter of the 18th century (Shere 2001, 25, 27, 41–2). The nature of the product needs clarification. Giuseppi included it in his chapter on woollen cloth (*VCH*, 2, 345) and Baines (1835, 94–5) notes the use of the term for wool textiles although it was properly a mixed fabric containing cotton, generally with a linen warp and cotton weft (*ibid*, 43; Wadsworth & Mann 1931, 11–23; Kerridge 1985, 124–5). The Norwich fustian industry was using cotton yarn imported from Aleppo by the Turkey Company by the 1580s (Peachey 2001, 51–3). Thirsk (1978, 42) notes a flourishing manufacture of fustians using imported cotton in the 16th and 17th centuries and among many locations of manufacture Kerridge (1985, 124–5) cites Uckfield in Sussex by 1623. The mention of a ‘Kallender’ for pressing or dressing fustian in the wills of John Stonhill, father and son of Shere, in 1646 and 1647 respectively, may shed light on the matter by providing a basis for comparison with the equipment of known fustian weavers elsewhere (PRO: PROB 11/198 sig 149; PROB 11/200 sig 99).

Dyeing, bleaching and calico printing

Dyeing by clothiers and some specialist dyers is recorded in the woollen industry of south-west Surrey in the 16th and early 17th centuries (*VCH*, 2, 346–7, 363–4). Giuseppi comments that a second early centre of the industry, in Southwark, is ‘a more interesting one, in that it better exemplifies the progress of the art’. It extended to other places along the south bank of the Thames and to the Wandle valley (*ibid*, 363, 364–8) where it became associated with the bleaching and textile printing industries (Montague 1992; Wilks MS). On the Wandle, mills for grinding dyewoods and madder root (known as drugs) are recorded at Wandsworth by 1569 (Gerhold & Ensing 1999, 17), at Carshalton by 1580 and in the 17th and 18th centuries at several sites in Mitcham and Merton, one of which operated as Mitcham colour mill from 1685 to 1885 (Montague 1992, 10–16), while Roberts Mill at Mill Green was still grinding ‘drugs’ in 1914 (Wilks MS). The bleaching industry developed in the Wandle valley from the 1590s onwards. There were extensive bleaching grounds, where calico was spread out and watered from a network of water channels – a process known as crofting. The practice declined after chemical bleaching was developed in the late 18th century. The

materials processed included fustians from Lancashire in the 18th century and Russian and Irish fabrics in the early 19th century (*VCH*, 2, 368–77; Montague 1992, 5–8, 17–22, 74–6). Calico and silk printing were developed, partly by Huguenot families, particularly in the 18th century but declined rapidly from the 1840s in the face of competition from the industrial north of England. By the end of the century only two printing works remained, both producing luxury textiles: Liberty’s mill (Luff 2002) and William Morris’s Merton Abbey printworks.

OTHER INDUSTRIES

Other industries have been the subject of individual research projects but more work is needed to extend and co-ordinate existing knowledge.

Among the metal industries, an illegal and consequently short-lived iron wire mill operated at Chilworth (Gu) in 1603–6 (Crocker, G 1999b, 5, 8). Non-ferrous metalworking is recorded elsewhere in the Tillingbourne valley in the 1620s (*VCH*, 2, 411; Brandon 1984; Crocker 1999b, 11–13) and on the lower Mole and Ember from the 1630s (Greenwood 1980). Works at Esher (El) became associated with those in Bristol and the Forest of Dean, where the brass industry developed rapidly with new technology and the lifting of monopoly restrictions in the late 17th century (Day 1973, 26–7). Byfleet mill was rolling copper sheeting during the American War of Independence (David Barker, pers comm) and the ironmaster Alexander Raby was engaged also in copper working and the manufacture of tinplate at Downside Mill, Cobham (El), which he held from 1790 to 1809 (Crocker, A 2000, 23–4; Taylor 2000, 19). Copper mills were established on the Wandle from the end of the 17th century onwards (Montague, 1995; 1997; 1999). Most were converted to other uses by the 1770s but Merton copper mill continued to about 1870 and Garratt copper mill in Wimbledon until 1887 (Wilks MS). Lead was worked at the lower mill at East Molesey in the late 17th century (Fairclough 1999b).

The important leather industry of Bermondsey and Southwark is described in detail by Giuseppi (*VCH*, 2, 329–40). An account of Bevington’s works at Bermondsey (1795–1950) has been published by the firm (Bevington 1993). Tanning was formerly widespread and Giuseppi notes chance references from the 15th century onwards. He discusses a concentration in south-west Surrey around Godalming and Bramley (Wa), Shalford (Gu) and Gomshall (Gu) (*VCH*, 2, 340–1). Tanneries and leather mills have also been noted briefly at Haslemere and Woking (Stidder 1990, 81, 91, 124), Guildford (Hollinghurst *et al* 1975, 185) and Reigate and Redhill (Hooper 1945, 99–100). Most closed by the mid-20th century but the tannery at Gomshall, an early centre of the industry, was

modernized after the Second World War and continued until 1988 (Noyes 1997). Leather was manufactured on the Wandle at Carshalton from the 1680s to the early 20th century and at Merton, where Connolly's leather factory operated from 1922 to c 1990 (Montague 1996, 152; Wilks MS).

Mills for crushing oil seed proliferated on the Wandle in the period 1740–90, particularly in association with Shepley's leather mills at Carshalton and Wandsworth (Wilks MS). Brace (1960, 26, 136, 144–51, 157) lists oil mills at Kingston upon Thames and Weybridge (El) and numerous examples in London including many in Southwark and Rotherhithe. An unusual horizontal windmill at Battersea was originally built for oil in 1788 (Farries & Mason 1966, 50–2; Cooke 2001, 126). Stidder (1990, 120, 125) notes an oil mill at Kingston c 1781 to 1878, which then became a soap and candle factory, and one on the Wey Navigation at Weybridge from c 1830 to 1963.

Stidder (1990, 124) reports an isolated reference to snuff manufacture at Woking mill in 1749. Other known snuff mills were on the Wandle and most date from the 1770s. Wilks (MS) notes nine mill sites used for snuff of which seven were operating in the first half of the 19th century. The industry continued into the 20th century at Carshalton, Ravensbury and at Morden Hall which closed in 1922. Nationally the industry, which peaked in the reign of George IV (1820–30), has since been reduced to a few mills mainly in the north of England (Bourne 1990, 4–7, 12–14).

Mills on the Wandle at Wallington, Carshalton and Mitcham were used from about the 1830s onwards for the manufacture of hair and fibre products, such as rope, yarn and wadding, and flock made from recycled textiles (Wilks MS). Flock mills also occupied sites at Eashing and Unstead on the Wey and Postford on the Tillingbourne after other industries closed down in the late 19th century (Stidder 1990, 88; Crocker 1992, 215, 224). The manufacture of fibre products became linked with chemical industries to make materials such as floorcloths and linoleum, which was developed in the 1860s and manufactured at Esher, Staines, Addlestone and Mitcham (Greenwood 1980, 7; Crocker 1999a, 69–71). At Mitcham it was associated with a local paint and varnish industry which started in the 1840s and numbered fifteen firms in 1965, but declined in the 1980s (Montague 1993).

There were several fireworks manufacturers in south London in the 19th century including Brock's who moved out to Sutton (Brock 1922) and Pain's, who moved to Mitcham in 1872 and then out of the county to Salisbury in 1966 (Montague 1989/90). A naphtha and acetic acid works in rural Surrey near Bramley (Wa), shown on the 1871 25-inch OS map,

used by-products of charcoal burning. The distilling of essential oils (fig 16.5) was related to the growing of peppermint, lavender and other herbs, particularly around Mitcham, where Potter & Moore operated from 1759 to the mid-20th century. The industry spread outwards from south London to Banstead, West Byfleet, Ewell, Leatherhead and Dorking (Crocker, G 1999b, 64–7). Other process industries include the manufacture of soap and candles (*VCH*, 2, 402–10; Crocker 1999a, 67–8).

Besides the many forges, foundries, engineering and millwrighting firms which served primarily local needs, a major statue foundry at Thames Ditton (El) operated from 1874 to 1939 (fig 16.6). Its monumental work was sent all over the British Empire (Stevens 1994).

Many corn mills were rebuilt and extended in the 18th and 19th centuries to satisfy the growing market and to accommodate the additional machinery which was being installed for refining the product (Watts 1983, 5–10, 24–8). Some industrial sites reverted to corn milling when other manufacturing enterprises closed. A major change began in the late 1870s with the adoption of roller milling, as distinct



Fig 16.5 Peppermint distillery, Westcott, near Dorking, c 1900. Lavender and peppermint were grown on farms around Westcott from c 1893 and initially sent to Mitcham, the main centre of the industry, for distilling. The Westcott distillery operated from 1898 to 1907 when a new owner moved the operation to Croydon. Cultivation ceased locally c 1914. Kathleen Lane Collection

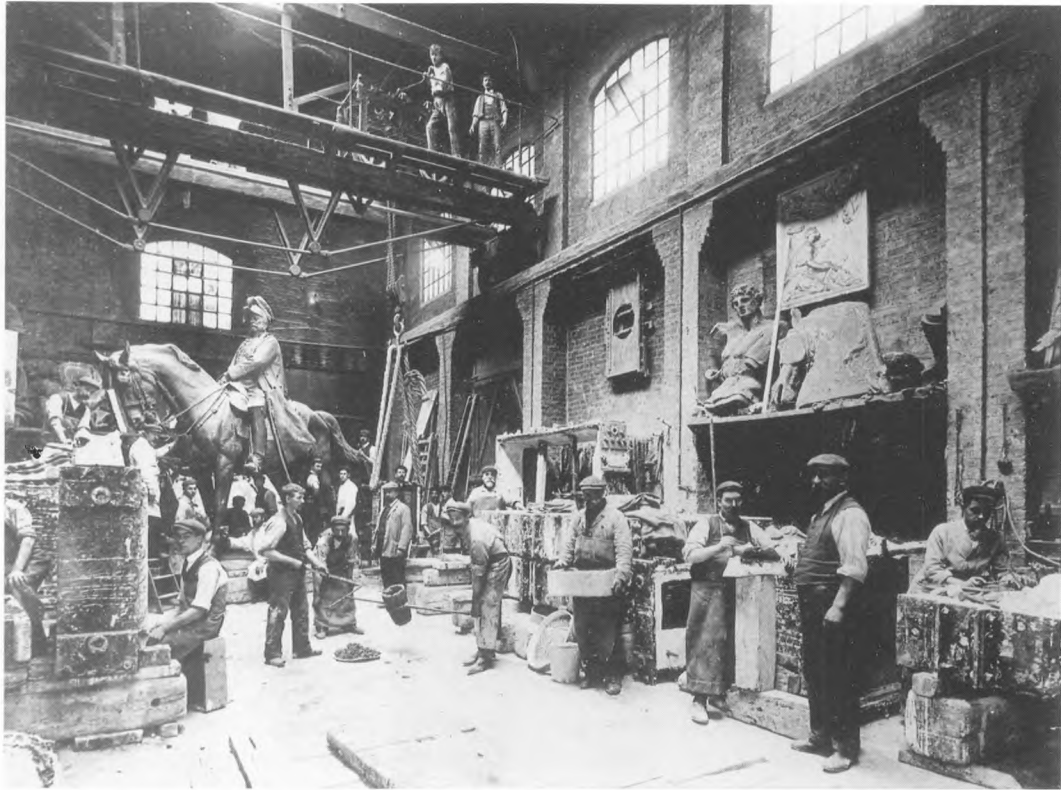


Fig 16.6 Bronze foundry, Thames Ditton, 1907. The foundry produced monumental statues from 1874 to 1939. Its products included the *Quadriga* at Hyde Park Corner and statues throughout the British Empire. SIHG Collection

from milling with stones, for grinding imported wheat. This led to the decline of small-scale local mills and eventually to the building of large mills near the ports. Some of the more successful owners of inland mills adopted the new methods. Stidder (1990) reports roller mills at eleven sites in modern Surrey of which five continued corn milling beyond the 1930s. Of these, Coxes Lock mill, close to the Thames on the Wey Navigation, continued to 1983 (Stidder 1990, 112–13) and Bottings' Albury mill at Postford on the Tillingbourne found a niche market and continued to use its 1910 roller equipment, which was recorded on video by SIHG before the mill closed in 1990. Of the other roller mills, Salfords (RB) had become an early health-food mill associated first with the Seventh Day Adventists and then with Dr Kellogg of breakfast cereal fame, but burned down in 1900 (Stidder 1990, 36–7).

The milling of oatmeal for ship's biscuits was carried out at Reigate from the early 17th to the mid-18th century. The town had twenty oatmeal mills operating at one stage, most of them apparently manually operated or driven by animal power; the trade was also carried on in Croydon (Hooper 1945, 100–3, 109n).

Like corn milling, brewing was widespread to supply local needs. The number of breweries peaked in the 19th century and was reduced by take-overs in the 20th century, but there has been a revival of small breweries particularly since the 1980s (Crocker

1999a, 40–2). Farnham was a considerable centre of hop-growing and malting (*ibid*, 38–9). SIHG district *Guides* have recorded the few structures which have survived, generally through adaptive re-use (Stidder 1979, 12, 13; Mills 1993, 27–8; Tadd 1994, 49–50; Stidder 1996, 25; Crocker 2003, 16–18). Documentary research on breweries and public houses has been carried out for Guildford by Sturley (1990; 1995) and Cobham (Taylor 2002) and is encouraged nationally by the Brewery History Society.

The 20th century

The contemporary industrial scene was reviewed by Hollinghurst *et al* (1975) in the British Association's Surrey conference volume. They discuss the pattern of development, noting the capitalization on wartime technological advances which had brought scientific expertise into the area and in particular the influence of major aircraft manufacturers at Weybridge and Kingston and the Royal Aircraft Establishment just over the county boundary in Hampshire. A large number of engineering works in the county have been related to aircraft and motor vehicle manufacture, directly or as producers of components.

An overview of extant industries (Hollinghurst *et al* 1975, 179–87) comprises sections on scientific and electronic engineering, aircraft, the automotive, marine and mechanical engineering industries, timber and construction industries, textiles and

leather, food and drink, pharmaceuticals, chemical and allied industries, and extractive industries. The authors note the concentration of research establishments in Surrey and give brief details of 36 principal organizations, ranging in scope from medical, pharmaceutical, veterinary, biological and oceanographic research to defence, many branches of engineering and manufacturing technology. The majority were in the northern half of the county with a concentration around Leatherhead.

Among industries which started in the 20th century, a few examples may be given from *SIHG Guides*: artificial silk and electrical products at Ashted and marine distress equipment at Newdigate (Tarpsee 1995, 53–4, 56); wax refining at Redhill and monotype printing equipment at Salfords (Stidder 1996, 29); chemical works at Cranleigh and camshafts at Elstead (Crocker 2003, 25, 28). Published works on individual industries include Vulcanised Fibre Limited at Shalford (Gu) (Brown 1995) and electrical construction works at Hackbridge and Hersham (El) (Mileham 1988/9).

MOTOR VEHICLE MANUFACTURING

The development of motoring and motor vehicle manufacturing in Surrey (Crocker 1999a, 98–102) began in Farnham with John Henry Knight's road steam vehicle of 1868 and subsequent three-wheeler powered by his 'Trusty' gas engine (Haveron 1985, 45–6). Brooklands, Weybridge (El), where the world's first purpose-built motor-racing track was constructed in 1907, is of international importance for the development of motoring, as well as of aviation (see below). The remaining track and other features, now within Brooklands Museum, are protected as scheduled monuments and the museum provides a focus for study and research on both motoring and aviation. Surrey's early association with motor racing continued

through the 20th century with a number of firms producing very fast cars for road use and track racing.

A firm of major importance, continuing in the 21st century, is Dennis Specialist Vehicles. It began as Dennis Brothers of Guildford making bicycles and progressed to the manufacture of cars, fire engines (fig 16.7) and other service vehicles. Its multi-storey works of 1901 in the town centre was one of the first purpose-built car factories. Later used for various other industries and known as Rodboro Buildings, it was converted for commercial re-use in the 1990s. The Surrey History Centre holds the Dennis archive (SHC: 1463) and has produced a series of pamphlets on the firm's products. A history of car manufacturing and motoring in Surrey is being prepared for SIHG (Knowles forthcoming).

AVIATION AND THE AIRCRAFT INDUSTRY

Aircraft manufacture (fig 16.8) was an important industry in Surrey, beginning and ending within the 20th century. Soon after it was built in 1907 the Brooklands motor-racing track became the scene of early experiments in flying by A V Roe and the site was particularly important nationally and internationally in the period c 1910–14, with record attempts, flying schools and air races which continued through the 1920s and 1930s. Brooklands was taken over by the government for aircraft construction during both world wars and remained a manufacturing site after 1945, eventually under the British Aircraft Corporation and from 1977 to 1989 under British Aerospace. The works was closed in 1986–9 and demolished in 1990. The site was redeveloped but some of the historic buildings were retained as part of Brooklands Museum. This holds archives of the industry at Weybridge and elsewhere in the county and provides a major centre for research.



Fig 16.7 Dennis fire engine manufactured for the Cairo Fire Brigade, 1920. Reproduced by permission of Surrey History Service (1463/PHTALB/1/3 f.77)



Fig 16.8 Aircraft manufacture at Weybridge showing the assembly of VC10s for BOAC and British United Airways in April 1964. Courtesy of Brooklands Museum

The industry at Kingston upon Thames was begun by Tom Sopwith in 1912 and continued under the Hawker Engineering Company, the Hawker-Siddeley Group (Hannah 1982) and British Aerospace. From the early to mid-1950s they used Dunsfold airfield (Wa), which had been built as a bomber base by the Royal Canadian Engineers in 1942 and used after the war by Skyways, as an assembly and flight-testing site (McCue 1992). The Kingston factory closed in 1992 and Dunsfold (Wa), which continued for a time to handle aircraft made at Brough, near Hull in Yorkshire, closed in 2000 and the aircraft industry in Surrey came to an end. Effort is being made to include an historical element in redevelopment at Dunsfold.

Other important Surrey contributions to the industry include the early Martinsyde works at Woking and Brooklands and Bleriot/ANEC at Addlestone, Sir Barnes Wallis's bouncing bomb, and work on Concorde at BAC Weybridge. A database is planned of the many aviation companies and related organizations that were based in Surrey (Julian Temple, pers comm). Many specific airfields also provide scope for research projects. The heritage of the world's first commercial airport, opened at Croydon in 1920, is in the hands of the Croydon Airport Society (Cluett *et al* 1977–86), an account of Gatwick airport (in Sussex since 1974) is given by King (1986), and the history of aviation in Surrey is summarized by Masefield (1993).

Future priorities

Some of the gaps in present knowledge have been indicated in the above review and it has been noted that research agendas have been proposed for the forest glass industry and the extension of the Reigate Stone Research Project.

Among sources of data, census enumerators' returns, which provide valuable information on occupations and the mobility of workers, have been little used in the study of Surrey industries except for hosiery and knitwear manufacture. Fire insurance registers, for which a limited indexing project begun by the former Surrey Local History Council has made modest progress, are a valuable source and the continuation of the project is to be encouraged, following the example of Evans (2001) for the parish of Wandsworth. A source of major importance for the industries of 20th century Surrey lies in people's recollections of their working lives. It is a matter of urgency to undertake oral history projects, to record people's experience, collect images and documentary material which they hold, and to encourage those who are able, such as Brown (1995), to write about the industries of which they have first-hand knowledge.

The recording of surviving industrial features, and the up-dating of existing lists, is a continuing need. This is addressed in the metropolitan part of historic Surrey by the exemplary database being created by the Greater London Industrial Archaeology Society (GLIAS).

Besides extending knowledge of particular industries there is a need to integrate this information into the wider picture of the industrial period as discussed by Marilyn Palmer in this volume and into the history of localities over a longer time-span. Such an approach might be made in the context of schemes in which the Surrey Archaeological Society is already involved: the Villages Project, tracing the development of individual village settlements in maps, and the collaborative ASHLV projects, involving the

Society and local authorities, for the study of Areas of Special Historic Landscape Value.

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