

Chapter 3

CLAY, WOODLAND AND METAL INDUSTRIES

Clay has been dug for making bricks, tiles and pottery in many parts of Surrey and the heavily wooded lands on the Weald Clay in the south supported early glass and iron industries. The iron was smelted in the Weald but on rivers in northern Surrey, nearer the London markets, water power was used to work iron and non-ferrous metals into consumer goods.

Pottery

Before the Staffordshire potteries came to dominate the national market in the eighteenth century an important pottery industry flourished around the Surrey-Hampshire border. It supplied London in the Middle Ages and in Tudor and Stuart times but goes back much further, to the Roman period, when there was a major centre of production in Alice Holt Forest, close to Farnham but just over the county boundary. Its remains have been excavated and its products studied over many years. Research in the 1970s included the reconstruction of Romano-British kilns and the experimental firing of reproduction pottery, with valuable results.

In the Middle Ages coarse pottery was made in south-east Surrey around Limpsfield. The sites of two pottery kilns of thirteenth to fourteenth century date, situated on the Gault Clay, were excavated in advance of the building of the Clacket Lane service station on the M25 motorway. Archaeological displays have been placed in both the east-bound and west-bound service areas.

The county was best-known from the thirteenth century onwards for the pottery known as Surrey White-ware, which was made from white-firing clay from the Reading Beds and decorated with a translucent green lead glaze. It has been studied in detail from the large quantities found in archaeological excavations in London and divided into groups according to the location of production sites: Kingston ware, Cheam ware and Border ware from the Surrey-Hampshire border near Farnham. The term Tudor Green ware has also been used for the fine pots with a white fabric and green glaze made between about 1380 and the mid-sixteenth century. The Farnham area has outcrops of Reading Beds clay for whiteware and also of London Clay and Gault Clay, both of which produce pottery with a red fabric. Products included dishes, bowls, jugs and other cooking and drinking vessels, and also items such as money boxes, lamps and crucibles.

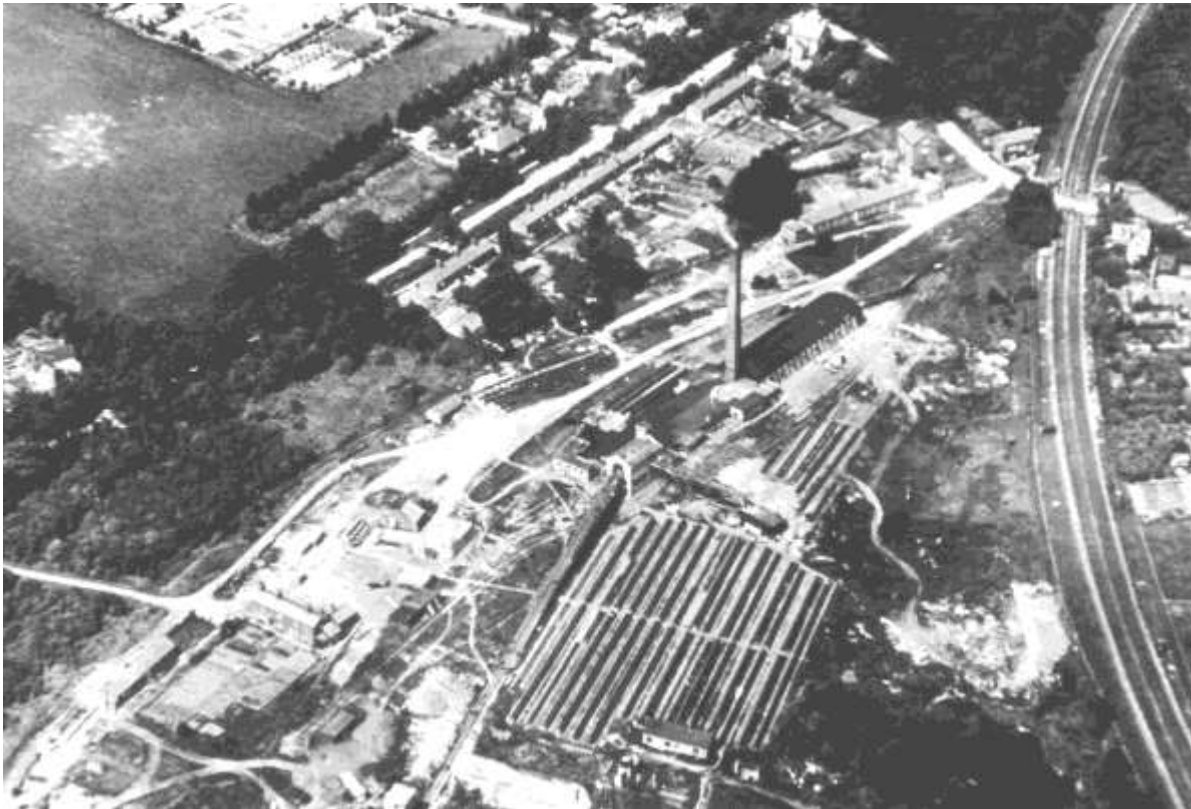
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Although Surrey potteries lost their major London market for table ware in the eighteenth century, many continued into the nineteenth century and later, supplying a local demand for garden and utility products.

Several specialist craft potteries have operated in the county in more modern times. Some were associated with the Arts and Crafts Movement of the late nineteenth century and in particular with the Home Arts and Industries Association. The artist George Frederic Watts and his wife Mary Watts, who lived and worked at Compton near Guildford, were supporters of the Association and Mary Watts, besides building the memorial chapel for her husband, established a pottery in the village which continued until 1956.

Ashted Pottery Limited was established in 1922 by Sir Lawrence and Lady Weaver to employ ex-servicemen who had served in the First World War. The pottery occupied the Victoria Works which had originally been a photographic works and had then been used for various purposes including a depot for imported steam cars. Between 30 and 40 people were employed by 1926 but the pottery closed in the depression of the 1930s. Its distinctive decorative products have since become collector's pieces.

A country pottery which has been recognised as of national importance is at Wrecclesham near Farnham, where Absalom Harris, a member of a family with a long tradition of pottery making in the area, established his works in 1872. Using local Gault Clay, the firm produced bricks, tiles and architectural mouldings. As part of the Arts and Crafts Movement, it revived post-medieval 'Farnham Greenware' and produced a range of 'Art Pottery' in collaboration with the Farnham School of Art. The works continued under five generations of the Harris family, but seemed likely to close in the 1990s. In 1998 however negotiations began for the purchase of the premises by the Farnham Trust. The buildings, including the best example of a traditional wood-fired pottery kiln in the country, and the unique collection of nineteenth century tools and equipment, are being recorded. It is planned to continue the pottery on a smaller scale and to establish other craft workshops on the site.



Oxshott brickworks from the air. *Ernest Crossland Collection.*

Bricks and Tiles

Bricks can be made wherever there is clay and brick works are scattered throughout Surrey. Clay pits were often dug to make bricks for an individual house and survive as ponds adjacent to the building. The bricks were fired in clamps, in which the stacked bricks were covered with old bricks and turf. In the nineteenth century bricks were made near the sites of housing developments and it is sometimes possible to detect gaps between houses where the clamps once stood.

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Commercial brickworks have operated at many places in Surrey, on London Clay at Ashted and Oxshott, on the Gault Clay at Brockham, close to both limeworks and hearthstone mines, and especially on the Weald Clay, where some very large brickworks were modernised in the 1980s. The South Holmwood and the Smokejacks Brickworks, for example, each has a production capacity of a million bricks per week.

Bricks are formed by firing clay at 950-1150°C. Their exact colour and composition will depend on the method of firing and the composition of the clay, which varies from place to place. Weald Clay, for example, is not pure clay, which would shrink during firing, but contains varying amounts of sand and silt. Besides minerals such as kaolinite and illite, the clay can also contain soluble salts, in particular sulphates, which if untreated would cause 'dryer scum' on the bricks which have been dried ready for firing, and this would burn to an unsightly white. On some sites

therefore, barium carbonate is added to the water used in preparing the clay in order to 'fix' the soluble sulphates.

If carbon in the form of coke breeze, anthracite dust or town ash is added to clay, as in stock bricks, the bricks themselves ignite during firing, and this assists the kilning process. At high temperatures, of about 1,100°C, the carbon tends to reduce the ferric oxide, which gives bricks a red colour, to ferrous which is black. Hence some bricks are black inside or have a black surface.

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Black-and-red mottled stock bricks are still made in 1997 at Lamb's brickworks, at South Godstone, founded in 1919. The clay mixture or pug is made by mixing water and local clay with spent fuel from fluidised bed furnaces at Oxshott brickworks from the air. *Ernest Crossland Collection.*

such firms as Reed's paper mills and Tate and Lyles' sugar refineries. The blended mixture is conveyed by belts to a machine which presses it into brick-shaped wooden moulds which have been coated with sand. The soft bricks are dropped out of the moulds on to trolleys and pushed along rail tracks to drying sheds where they are dried for several days. The dried bricks are stacked in the kilns (clamps) which are then sealed at their fronts with waste bricks and sand. The kilns are gas fired.

Another active works, the Smokejacks Brickworks near Ockley, uses a modern Hoffmann kiln, installed in 1990. At Ockley, the mixture of clay and water treated with barium carbonate is extruded through grids to break it down and then crushed between heavy rollers with pulverised solid fuel. The resulting pug is then delivered to hand moulders, who press it into wooden moulds, or to a machine which cuts a rectangular column of pug into shapes. Both hand and machine formed bricks are dusted with fine sand before going to the drying ovens. After two days drying the 'green' bricks are taken to the gas-fired Hoffmann kilns, built in a ring as described for lime burning. Each of the chambers holds 19,000 bricks. The bricks are fired in one chamber to 1,030°C or more. After three to five days, firing is complete; the next chamber is fired while the first cools and another is loaded. The gas heating zone is advanced step-wise from chamber to chamber automatically and continues around the ring, never stopping.

Among the many brickworks which have closed, one of particular interest was Frederick Carroyer's works at Newdigate, which was started in the 1920s to provide employment for men in the village. It produced a hard steely-blue brick which can be seen in local buildings such as the school. The works closed in 1974 and the site is in private hands. A large lake in the former clay pit has become a wildlife haven.

At Crowhurst there is an abandoned Staffordshire continuous kiln, a variant of the Hoffmann system, with a ring of 22 chambers.

Tiles differ from bricks only in shape. They were used for roofs in Roman times but then went out of use and were not re-introduced into England until the mid-twelfth century. Medieval kilns for firing roof tiles have been excavated at Guildford Castle, Borelli Yard in Farnham and in the Farnham Park estate of the bishops of Winchester. The Guildford Castle kiln is particularly important because of its early date — the early thirteenth century — and its remarkably good state of preservation.

A particularly important product of medieval Surrey is seen in the famous thirteenth century floor tiles from Chertsey Abbey, which had designs in white-firing clay inlaid on a red ground.

In modern times the demand for clay tiles has decreased as cheaper products made of concrete have become available. Clay tiles are still needed however for the sympathetic repair and restoration of old buildings and they are still moulded by hand at Swallow's Tiles near Cranleigh. [Swallow's Tiles finally ceased production in April 2008.]

Woodland Industries

The Wealden glass and iron industries needed charcoal for fuel. Charcoal was also used, with saltpetre and sulphur, as one of the ingredients of gunpowder and the glass industry obtained potash, to mix with sand as a flux, by burning beech or oakwood. Although reports occur of fuel shortages, in general the woodlands were effectively managed as a renewable resource by a system of coppicing. This involved cutting the trees at regular intervals so that they made new growth of straight poles which were harvested in turn. In the eighteenth century Smith & Son of Guildford and Messrs Young of Dorking are both recorded as suppliers of charcoal to gunpowder makers and in 1792 Messrs Young had a contract to supply the government powder mills at Faversham in Kent and Waltham Abbey in Essex.¹

Coppice wood was also used directly in rural industries such as the manufacture of hurdles, hop poles and brooms and it was shaped by steaming to make hoops for barrels and walking sticks. Large quantities of hazel hoops were shipped down the Godalming and Wey Navigations to supply coopers in London. A walking stick factory at Wormley, which also made shepherds crooks for export to Australia, moved into the manufacture of modern walking aids in the twentieth century. Birch and hazel brooms were made by men known as 'broom squires'; nineteenth century census returns show many of them living in the district around Hindhead, on the heathland in south-west Surrey. The tools of woodland trades, and occasional demonstrations of their use, can be seen at the Rural Life Centre at Tilford, near Farnham.

Wealden Glass

Glass was made by the Romans but its use died out in Britain after they left. It was imported from the continent from Anglo-Saxon times onwards and occasionally made in Britain by craftsmen brought over by monasteries, but a permanent industry was not established until the first half of the thirteenth Century. The Wealden glass industry, which flourished on the Surrey-Sussex border around Chiddingfold from then until the early seventeenth century, was part of an early Forest glass industry which was located in the woodlands of western and central Europe, using charcoal as fuel and beech or oakwood to burn for potash. This was needed as a flux to lower the melting point of the main ingredient, silica, to a level which could be reached in the primitive furnaces of the time, that is from about 1,800°C down to 1,150-1,500°C. The

silica, in the form of sand, was probably obtained from the Folkestone Beds and Hythe Beds of the Lower Greenland, around Chiddingfold, Hambledon and Lodsworth. Lime, which was another necessary ingredient, was obtained from the Chalk and clay for building the furnaces came from the Wealden beds.

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There were also early glass works in Staffordshire and Yorkshire but of some 80 known glass houses of the period between 1250 and 1600, 45 are in the Weald.

Archaeological excavations at glasshouse sites near Alfold and Hambledon have provided information about the quality of the product and the technology used, showing for example that the medieval glass makers used separate furnaces for the various stages of manufacture: the initial heating or 'fritting' to remove scum, the further heating to melting point and the final annealing, to eliminate differences of stress within the product.

Two phases of the industry have been identified, before and after the 1360s when immigrant glass makers began to arrive from Normandy and Lorraine. The early glass had been somewhat opaque and subject to weathering and better quality glass had continued to be imported- green glass from France and Germany and clear crystal glass from Italy. The new products were harder and more translucent and as quality improved the industry became better able to compete with imported glass and expanded to other parts of the country.

The most prominent of the immigrants was John Caré who was granted a patent to regulate the glass industry in 1567. He died in 1572 and his grave is reputed to be under a marble slab near the war memorial at St Nicholas Church, Alfold.

There are few remains of the industry to be seen. The excavated remains of a two-chamber annealing furnace of c. 1550 have been preserved as a feature on a forest trail near Alfold. In Chiddingfold Church there is a window made up in 1916 of 427 fragments of Wealden glass, 224 of them coloured. Most date from the period 1425-1559 but one piece has been dated not later than 1325.

Glass making, which used coppice wood directly as well as for fuel, had to compete for resources with other woodland industries, in particular the iron industry which was essential for the manufacture of ordnance. In the early seventeenth century coal was successfully used for fuel in glass making. In about 1611 the first coal-fired furnaces in England were set up in historic Surrey in Southwark and Lambeth, using 'sea coal' brought by coastal ships from the North-East. The Wealden glass makers began to move to

London and in 1615 James I finally prohibited the use of charcoal for glass making in the Weald and granted a monopoly to Sir Robert Mansell for the coal-fired industry.

Wealden Iron

Surrey was on the periphery of the early iron industry of the Weald which was mainly located in Sussex and Kent. Most of the ore was obtained from clay-ironstone deposits in the Wealden beds, which were worked open-cast or by sinking bell-pits. Clay itself was used for building furnaces and hearths and coppiced woodlands provided charcoal for fuel. The other necessary resource was water power, to work bellows and hammers, and elaborate systems of dams and 'hammer ponds' were created to provide a constant flow of water. A distribution map of bloomeries and blast furnaces shows that they were mostly situated on the older rocks of the central Weald and the Weald Clay outcrop which encircles them, but some were on the Lower Greensand to the west, in the Haslemere district of Surrey, where there were good streams for water power.

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The early furnaces were bloomeries — simple layers of iron ore and charcoal heaped into a dome and enclosed with clay. Temperatures high enough to reduce the ore were obtained by the manual use of bellows at the bottom of the furnace and a hole at the top allowed gases to escape. The process produced a 'bloom', a spongy mass of metallic iron mixed with slag, which had to be removed by reheating and hammering in the bloomery forge. Water power was adopted for operating the bellows and hammers of bloomeries from the twelfth century onwards on the continent and in England from the fourteenth century.

Another improvement was the shaft bloomery furnace which was introduced by the Romans. This was a drum-shaped structure larger than the dome type of bloomery. Its advantage was that ore and charcoal could be added through a hole in the top even while the furnace was being fired. The later blast furnace carried this adaptation further. It was larger and built of sandstone blocks lined with clay. By using water power to operate the bellows temperatures of over 1600°C could be reached to produce molten iron which could be tapped off. The product was pig iron with a high carbon content which was brittle. To make the malleable bar iron required by the blacksmith the carbon had to be burned out in a finery hearth. The 500th anniversary of the establishment of the first blast furnace in England, at Newbridge in Ashdown Forest in Sussex, was marked by the unveiling of a plaque on the site in December 1996.

The Wealden iron industry grew rapidly in the sixteenth century, doubling in size between surveys made in 1548 and 1574. Gun founders provided the major market for the iron and many operated in the region, in peace-time making castings for firebacks, grave slabs and various utensils. Bar iron was supplied in large quantities to ironmongers, many of them in London, and in smaller amounts to local blacksmiths. The industry began to decline in the seventeenth century, facing competition from the Forest of Dean, but it continued to hold its own for the manufacture of high-quality ordnance until 1775, when the Carron ironworks in Scotland began to take a lead. There was a brief revival in the Seven Years War of 1756-63 but then a rapid decline and the last Wealden furnace, Ashburnham in Sussex, closed in 1813.

Surviving features of the iron industry consist of scattered slag, dams and earthworks hidden in the woods and ponds, some drained as at Ewood near Newdigate, but some still in water as picturesque 'hammer ponds', for instance at Thursley in west Surrey. Other water-powered sites in Surrey include Vachery forge and furnace near Cranleigh, West End and Imbhams furnaces near Chiddingfold, Abinger Hammer forge between Guildford and Dorking, and Woodcock Hammer near Godstone.

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The Manufacture of Metal Goods

Besides iron smelting and founding in the Weald, copper, brass and iron goods were manufactured in less remote parts of Surrey. An attempt was made by Thomas Steere to establish a wireworks at Chilworth on the Tillingbourne in 1603 but this was forced to close after only three years because it was infringing

a monopoly held by the Mineral and Battery Works, whose main operations were at Tintern in Monmouthshire. Steere had persuaded workmen at Tintern to come to Surrey. He was making iron wire which was in great demand from the woollen industry for the wire-studded 'cards' used to prepare wool for spinning.

In the 1620s Richard Evelyn set up brass and copper mills at Abinger and Wotton. These produced wire and plate for making consumer goods such as pans and kettles and, despite some disputes with the holders of the monopoly, they continued to do so for much of the seventeenth century.

Metal working, in copper, brass and iron, was carried on from the mid-seventeenth century onwards at several mills nearer London, on the lower reaches on the River Wey and River Mole.² Iron ore occurs locally in the Tertiary Bracklesham beds at St George's Hill, Weybridge, but is now considered to have been smelted in the district only in prehistoric times.³ The proprietors of the mills in north Surrey had major business interests as ironmongers and merchants in London, and some were also associated with metal industries in other parts of the country. John Hitchcock, for example, who was active at Byfleet, Weybridge, Esher and Ember mills in the first half of the eighteenth century, was a partner in the 'Societies of Bristol and Esher for Making Brass, Battery and Brass Wire'. Later in the eighteenth century Alexander Raby operated at Downside Mill at Cobham and at Coxes Lock Mill at Addlestone on the Wey Navigation, before leaving the district in 1807 to develop ironworks in South Wales.

Notes

1. West, J, *Gunpowder, Government and War in the Mid-Eighteenth Century* (1991), 174-75.
2. Greenwood, G B, *The Elmbridge Watermills, Surrey* (1980, limited edition typescript).
3. Potter. J F, '*Iron Working in the Vicinity of Weybridge, Surrey*', *Industrial Archaeology Review*, 6 (1982), 211-23.