The Continental Origins of Bristol Brass

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Summary: German entrepreneurs helped to establish the English brass industry during the sixteenth century. Bristol eventually became an important centre for the production of beaten hollow-ware vessels, known as battery ware. Documentary evidence, including surnames of continental origin, suggests that the Bristol industry may also have made use of foreign expertise. This article examines the historical evidence and industrial archaeology of the mining and metallurgical industries of the Aachen area on the borders of France, Germany and Belgium and suggests that a continental workforce may have been recruited there for the Bristol industry during the eighteenth century.

A series of brass-mill sites on the Avon between Bath and Bristol can be seen in various stages of quiet disintegration. The industry flourished early in the eighteenth century to become the most important in Europe, but, thereafter, suffered slow decline in competition with Birmingham. Two mills were still using their water-powered methods until closure in the 1920s. The physical remains of this industry constitute the main evidence for its existence, endorsed only by fragmentary documentary sources. As a result its study had been neglected, being dealt with only in a national review of brass and copper industries. It was the growth of interest in industrial archaeology which offered a new approach to an understanding of technical innovation in this important industry. Investigations were then still far from complete, for no study in depth could be satisfactory without enquiry into the continental origins of the men and techniques on which the Bristol industry was founded.

Introduction

The absence of a home industry in brass production gave rise to increasing cause for concern in post-medieval England. The government of Henry VIII wished to avoid a dangerous dependence on imports of the metal from Europe. The remedy involved persuasion of managers and skilled men to come to England from the continent, where the industry had been developing from medieval times. Eventually, by setting up two powerful monopoly companies, Elizabeth’s government provided a means of introducing brass production into this country under the guidance of German expertise. Supplies of the zinc ore, calamine, together with refined copper, charcoal and coal, and adequate water power were their main requirements. The Mines Royal Company achieved its aim of smelting and refining copper and the Society of Mineral and Battery Works found calamine, the zinc carbonate, ZnCO₃, on Mendip, but failed to produce a workable brass. This failure led to a series of attempts in brass production and manufacture during the following century, ostensibly still controlled and licensed by the monopoly companies. Most of these efforts were quickly abandoned, mainly because of difficulties experienced in meeting license fees and also in obtaining supplies of refined copper after the Mines Royal production had lapsed. Significantly, the most successful of these seventeenth century pioneers was the immigrant Jacob Momma, who will be referred to later. Nevertheless, he also suffered from similar restrictions which limited his achievements.

The eventual collapse of the monopoly structure came with the passing of the Mines Royal Act of 1689, reinforced in 1693. At about the same time new coal-fired techniques of copper smelting were being pioneered in Bristol. New markets were soon being sought in Bristol for the copper which had been refined by the new methods. The combination of these two events offered new prospects for brass production by the early years of the eighteenth century. With calamine available from Mendip just 12-15 miles away, it is hardly surprising that the initiative came from Bristol. In the first few years of the eighteenth century Abraham Darby became actively involved, with fellow Quakers, in establishing an industry of brass production and manufacture. It was to survive and flourish, implementing many new techniques and, eventually, was to be described as the largest of...
its kind in Europe. At its outset, however, it was deemed prudent to acquire skilled men from the continent. According to Hannah Rose, writing much later, Abraham Darby 'went over to Holland and hired some Dutch workmen, and set up the Brass works at Baptist Mills'. The relevant dates quoted by Hannah Rose are not quite in accordance with other sources and it is also believed that her references to Holland and the Dutch might be interpreted as referring to the general area between the Meuse and the Rhine where the industry was concentrated. Other details are lacking but it can be inferred that the new business would have required skilled melters to produce brass metal and batterymen to operate fast water-powered hammers. Water-powered beating was used to shape hollow-ware vessels, known as battery-ware, which was to become the main product of the Bristol industry and to remain so throughout most of its existence.

The continental workforce

In the villages of the Avon Valley and its tributaries, to which the brass company expanded in the early decades of the century, the traditions today concerning these immigrant workers are still very strong. They can be supported by entries in local parish registers and other documentary records. As early as 1708 the Keynsham records of St John's Church show the birth of a son for John Buck, described as a brass worker, and believed to have been an immigrant. A month later similar records refer to the Steger family who are known, from later registers, to have had continental origins. Names appearing later include those of Francome, Craymer, Rackham, Fray (anglicised from Varoy), Crinks (anglicised from Krintz) and Ollis, most with variable spelling but all can be connected with immigrant workers. The local tradition declares that the company undertook

Brass and copper working sites which were established in Bristol and the Avon valley from c1680 to c1845

Fig. 1
Plate 1 Indenture apprenticing John Varoy to the Bristol brass company in 1745. His original signature was erased and anglicised to Fray, the family still holding the document.

to employ descendants up to the third generation and, although this cannot be verified, many families were still represented in the mills a century later. A few descendants of immigrants were still working in the mills when they finally closed in the 1920s and their families can still be found locally today. The tendency to remain with the company can be explained partly by a difficulty highlighted in ‘An Agreement made between the Parish of Keynsham and the Brass Wire Work Company concerning the men and their families’, signed 30 June 1740. When falling on hard times and needing parish relief through ill health or misfortune, English workers from outside the parish would have been required to return home for assistance under the Act of Settlement of 1662. The impossibility of this solution for their foreign workers had been the cause of several disputes between the brass works and the paymaster of Keynsham parish, who had faced an additional burden. The company solved the problem by taking responsibility for these families in the 1740 Agreement. The immigrants were then recorded in church registers as ‘no parishoners’, a convenient means of identification for the paymaster, and also for present-day research. From then on, quite clearly, it was in their own interest for these men to stay with the company.

Other registers of parishes connected with the industry contain similar records but at a later date than those at Keynsham. At Twerton, near Bath, a village well placed to accommodate men working at the Weston mill on the opposite side
of the river, there are records of John Jockman, a ‘Dutchman’ buried in 1723; George son of John and Elizabeth (no surname) Dutchman, baptised in 1724; and a burial in the Buik or Buick family which may have been connected with the Bucks at Keynsham. Several entries for the Graft, Graff or Graef family, also described as ‘Dutch’, confirm that this description does not necessarily imply a Netherlands origin, as a stone memorial inside the church records that they were from Weit in Germany.

Bristol remained the major centre of initiative in the manufacture of brass for a considerable part of the century but was not alone in establishing important and long-lasting industries in brass and copper production. Neither was it unique in extending the practice of employing foreign skilled labour. The English Copper Company had done so when setting up smelting works in Redbrook, Gloucestershire during the 1690s and, when expanding its activities to manufacturing at Wimbledon in 1712, it was said to have spent some £10,000 on equipment and acquiring foreign skills. In the 1730s when Thomas Patten established the production of brass at Cheadle in north Staffordshire, he obtained the services of John Essor from Germany at a cost of ten guineas in travelling expenses plus a two guinea fee to an agent. Essor later changed his name to Keys and descendants of his family continued to act as chief melters to the company throughout its existence, eventually taking over some parts of the business. These additional instances serve to emphasise the reliance on foreign expertise in the formative years of the industry but the trend is best exemplified in Bristol where descendants still survive in significant numbers. Thus, to carry an investigation of the Bristol industry to a satisfactory conclusion necessitates an enquiry into the origins of these workers and the industry from whence they came.

THE EUROPEAN INDUSTRY

No direct evidence of the origins of the Bristol immigrants can be gleaned from local sources but, from the time of the Elizabethan attempts at producing brass, it had been recognised that European calamine could be obtained from Aix-la-Chapelle, otherwise known as Aachen, on the borders of Germany and the Netherlands. It was planned at that time to bring Aachen supplies to this country if home deposits were not discovered. It could be made available at a reasonable rate as transport to England would have been mainly by water with Aachen lying between the Meuse and the Rhine. Elizabeth’s Assay Master of the Mint, writing to Sir William Cecil in 1565, spoke of the hope of finding calamine in England, but:

'notwithstanding yf all the rest shold fayle...may it therefore pleas your honor to understand that my principall grounds for callamyn is from the mynes of Akon wher it is to be had in great aboundance for the said myne lieth open to all people that will buy thereof withowte restraine, and that which is to be brought into this realme for 7s the hundredwaite cannot be recovered to Nurhenburgh for 14s the hundredweight by reason of land carrige'...

The source of calamine was an important consideration in deciding the site of brass production, and was to remain so until new methods of brassmaking were introduced in the late eighteenth century. The ancient method of ‘cementation’ required the crushed ore of calamine, to be used in combination with highly refined broken copper pieces. As the ore still contained a proportion of waste material, a greater weight and a much greater bulk of it was required in proportion to copper, even though the resulting metal contained only 20% to 30% zinc compared with 70% to 80% copper. The fact that calamine was the source of zinc was not properly understood at the time and the ore was usually described as an ‘earth’ or ‘stone’ with the capability of colouring copper and adding 20% to 30% in weight. There was no technique known in the western world for producing zinc from its ore and only small expensive supplies of the metal could be brought from India and China where its production had long been mastered. Therefore, the use of calamine in bulk for brass production in Europe was a strong influence on the siting of the industry. This indicated that the calamine deposits in the Aachen area might well be relevant to the origins of the Bristol industry.

Medieval production

An investigation into the history of brass production in Europe reveals that the main area of the medieval industry was concentrated in urban communities along the River Meuse, some 50 to 70 miles to the southwest of Aachen. The process employed was basically similar to that believed to have been used by the Romans for their coinage. Theophilus, a German monk,
described the technique in some detail during the twelfth century. By the fourteenth century, an area lying between the Rivers Meuse and Rhine, nowadays encompassing parts of Belgium and Western Germany, emerged at the forefront of metallurgical development in Europe. The production of brassware developed where local calamine supplies were available and pockets of the ore were to be found along the northern fringes of the Ardennes, outlined by the valley of the River Meuse. The same uplands extend into Germany, there known as the Eifel, with similar deposits and giving rise to supplies at its northern extremities near Aachen.

Attention was drawn to the output of brassmakers during the fourteenth century at Dinant on the Meuse, which developed a speciality in the production of objets d'art and decorated ware later known as ‘dinanderie’. On the opposite bank of the river, the more utilitarian goods produced at Bouvignes complemented those of Dinant. Pots, pans and vats were made there by batterymen who beat the goods to shape by hand in individual workshops, almost 250 in number in one documentary record. Because brass was regarded as merely copper of a different colour, these craftsmen were described as coppermasters, or copper beaters, a continuing trend which has created a source of confusion in early records.

These Meuse communities suffered heavily from petty local hostilities and more severe infiltration from the Duke of Burgundy in France. Craftsmen fled from the area in 1466, following the sacking of Dinant, and established the industry in other areas. Namur, on the Meuse some 15 miles to the north, was one centre where they were encouraged to settle and which later became well known for its brassware. Similar provocation at Bouvignes resulted in fugitives escaping to Aachen. Thus the dominance of the medieval industry on the Meuse was gradually dissipated. Those who returned to the area after the conflict were obliged to continue their methods of hand production, being forbidden by their overlords to erect watermills for the purpose. It is believed that waterpower was reserved for iron manufacture, possibly for the supply of armaments as a lucrative and important trade for those in power. Prohibition of the use of waterpower was thus a further factor in the decline of brass production in the Meuse communities, in addition to the depletion of
local supplies of high-quality calamine. From 1589, the ‘copper’ beaters of Namur and Bouvignes were allowed privileges which specified the right to obtain calamine from the mining area near Aachen where the best supplies were available, but this was some 50-70 miles distant. Not until 1643 were they allowed the use of waterpower to operate their bellows. At Bouvignes this right was neglected because of the guild restrictions imposed by a body of men who wished to protect their own employment, while at Namur only the most successful could afford the expense of new premises which waterpower entailed. This led to domination of the trade by those successful few and further depletion in numbers, a situation which the men of Bouvignes wished to avoid. When writing of the industry at Namur in the mid eighteenth century Galon implied that producers of brassware had diminished in number still further. The hub of the industry had long since moved elsewhere, nearer Aachen, where it was possible to take advantage of supplies of high quality calamine and make a natural progression to the use of water-powered techniques.

Stolberg brass

In the city of Aachen itself brass production had long been practised but here, too, city life favoured the tight organisation of guild activity. Regulations followed the restriction of new methods in order to protect employment and such restrictions were responsible for forcing coppermasters to settle in communities outside the city. At Stolberg, on the small River Vicht some seven miles east of Aachen, the industry received every encouragement from the overlords who saw it was to their ultimate advantage. Further impetus was given to this settlement by periods of religious persecution in Aachen when protestant brass workers were forced to leave. Many of these moved to Stolberg where they were allowed to practise their trade without restriction and live according to their religious convictions. In Aachen in 1559 there had been more than 100 smelting furnaces in which 30,000 cwts of brass could be produced. By 1648, there were only 50 furnaces remaining with a production of 10,000 cwts, but at Stolberg at that time 65 furnaces produced 19,500 cwts of brass, indicating their greater efficiency. By 1692, there were but ten or eleven men producing brass in Aachen, most using single furnaces. By contrast in Stolberg there were up to forty owners, some with six to eight furnaces. During the seventeenth century this strongly protestant industrial community had developed into the most important centre in the world for the production of brassware of the more utilitarian kind. Fine wares such as scientific instruments, clocks and bells were made in Nuremburg and Cologne but probably acquired brass metal from Stolberg.

The products of Stolberg included half-finished goods such as brass plate, sheet and wire, and unfinished bottoms of large hollow-ware vessels. In addition a large variety of finished wares were manufactured including wire goods such as pins and needles and all kinds of hollow-ware such as pots, pans, kettles and vats which were made by highly skilled men handling water-powered hammers. By the eighteenth century a large number of the Stolberg ‘coppermasters’ had become wealthy men with status and high living standards. Their personal occupations were concentrated on furthering relationships and the organisation of their supplies.

The fuels they required could be obtained from sources close at hand. Coal was mined locally, although subject to troublesome restrictions from the landowner. Charcoal and wood was available from forest areas of the Eifel just to the south of the area. Copper was the most costly of the raw materials, particularly in the highly refined form needed for the Stolberg production of brass and was bought mainly from the Mansfeld area of the Harz mountains, which involved hazardous and expensive overland transport. Supplies also came from Scandinavia through the port of Drontheim, especially during the Thirty Years War when Mansfeld ceased production. It was also acquired from other parts of Europe and as far afield as Peru and Chile. Scrap metal was also utilised but seems constantly to have been in short supply, coming mainly from the Netherlands and other more distant parts of Europe.

Calamine supplies

Calamine could be extracted in the Stolberg locality and from additional nearby sources. Inevitably, the largest proportion came from these local areas at the outset of the industry, but it was found that supplies of a higher quality
Fig. 3 The area surrounding Aachen (Aquisgranum, Aix or Aken) in 1603, with Stolberg (Staeberg) to the SE and Kelmis/La Calamine (Calmine) to the SW, from Karte Ducatus Limburgum, Martini.

were needed. The main brassware products of Stolberg were those which depended on metal which was malleable and ductile, able to be spread and deformed. Hammered goods and wire production stretched these requirements to their limits and the grades of brass needed depended on the exclusion of certain impurities which could be introduced in the raw materials. As previously related, the Meuse communities had acquired privileges in the sixteenth century to obtain their calamine from one particular area near Aachen which was known for its suitable qualities. Its source was usually referred to in French as Vieille Montagne, or Altenberg in German. Translated to ‘Old Mountain’, perhaps it can be equated with the ‘Old Man’ of ancient English mining references. The Stolberg coppermasters also found that production of their best quality wares required calamine from this same source.

The best [brass]...was produced with copper from Drontheim and calamine from Altenberg. These are used in this factory for the manufacture of brass goods which demand the most preparation and must be easy to forge.

As the eighteenth century progressed the impetus of Stolberg slackened as the masters neglected to introduce the latest new methods. The new Bristol industry was becoming established, evolving its own innovations and so gaining precedence. The Stolberg decline was comparative and the area remained an important centre of production but with local calamine sources diminishing its dependence on Altenberg increased.

It is clear that the calamine of quality obtainable from the Altenberg deposits had been of great significance to the development of the brass industry. There were other sources elsewhere but not of the same importance. From documentary sources however, the location is not easy to pinpoint without local knowledge.
An English doctor, Edward Brown(e) described the site on his visit in 1675: 

'Within two leagues of Aken, in the Country of Limbourg, is a Mine of Lapis Calaminaris... having been wrought Three hundred years... It is about eighteen or nineteen Fathoms deep. Lying all open like a Chalk Mine, of an Oval Figure; they digg at present in several places, and the best Calmey lies between the Rocks, in the deepest part of the Mine: They have now found an excellent Vein so placed, of eleven or twelve Foot thick, which they digg out with Pick-axes, with some difficulty, by reason that the Lapis Calaminaris is very hard... The Veins... being so large, they follow them not only in one place, but digg over one anothers heads, and frame their work into the shape of large Stairs, and one throws up what another diggs, and so upward till they hale the Carts with it. ... The works about the Mine the most remarkable, are these: 1. An Overshot-wheel in the Earth, which moves the Pumps to pump out the water; and this is cut out of the mine to the bottom of it, by which the Mine is drained; and another passage or cuniculus, out of the place where the wheel is turned, which lets out the water which turns the wheel, and also the water which comes out of the Mine into the Neighbouring Valley. 2. The washing of the Ore or Stone, which they perform, as at other works, by letting the water over it, and stirring; and this they do wheresoever they begin to work near the Superficies of the Earth, for there the Calmey is less, and more mixed with Clay and Earth; but the most remarkable work is the calcining of the Ore (for all our Lapis Calaminaris of the Shops is the calcined Calmey) and it is worth the seeing; for they place Faggots in a handsome order first, and cover a large round Area with them, of about Forty or Fifty yards Diameter, upon which they place Charcoal in as good an order, till all be covered and filled up a yard from the ground; then they place ranks of the largest Stones of Calmey, and after them smaller, till they have laid all on; and then by setting fire to the bottom, the fire comes to each stone, and all is handsomely calcined. '

By the eighteenth century Altenberg was acknowledged as the most important source of calamine for the brass industry, both in quality and quantity. With the emergence of the French Republic, appropriation of the mining area to the State was merely a repetition of earlier events but on this particular occasion resulted in important technological changes. In 1806, Napoleon signed a concession of Altenberg mining rights to Jean-Jacques Daniel Dony of Liège, encouraging his new work in the
Fig. 4 Napoleon's concession of calamine rights at Vieille Montagne to Dony in 1806. From the centenary publication of Vieille Montagne company.
production of metallic zinc. Dony had been developing a continuously heated furnace, which used fuel far more efficiently than the method introduced at Bristol during the 1730s. The Bristol innovation had been the first commercial production of zinc metal in Europe but it was costly and was soon superseded by Dony’s more economical process. Calamine was to be supplied from Altenberg to the furnaces at Liége, but by 1835 additional furnaces were smelting zinc also at Altenberg. Direction of this whole concern was assumed eventually by a company known, in short as Société Anonyme de la Vieille Montagne, thus acknowledging the French name of the old mining area. In the meantime, a Treaty of Limits negotiated at Aachen after the fall of Napoleon had marked the significance of the Altenberg mine by declaring it Neutral Territory. It was to remain so for just over a hundred years. Zinc smelting continued after the nearby resources failed with ore brought in from surrounding areas. Finally, zinc white was produced from the old waste dumps and, when this ceased in 1950, the foundry slags were still being incorporated into concrete blocks until 1974. The old mountain had run out of resources.

Much of the zinc produced at Altenberg had been transported to Liége and other company sites to be rolled into sheet, a product which the company had pioneered, particularly in its use as a roofing material. But zinc metal had at last become available at economic rates and this enabled a simpler method of brass production to become commercially viable with zinc being alloyed with copper in a simple melting operation.

Modernisation

At Stolberg during the nineteenth century, the working brassmills decreased in number but those that survived did so by modernising their methods. The new direct method of making brass was adopted and techniques introduced such as steam-operated rolling mills, which had long been working in the English industry, especially in Birmingham. Old sites were abandoned and new ones built. Some descendants of the traditional coppermasters amalgamated their businesses to bring their industry into the modern practices. Today, two of these businesses still survive and flourish in the midst of a community which can still show traces of its former industrial involvement.

THE INDUSTRIAL ARCHAEOLOGY

Meuse Country

While searching for traces of the medieval focus of brass production, the visitor to the Meuse country, just north of French borders in present-day Belgium, will find a tourist area of great beauty. The urban development of Dinant now encroaches upon Bouvignes, a more ‘down-town’ community on the opposite bank of the river. The Dinant tourist office displays folders referring, in passing, to the ancient crafts of the copper beaters and to examples of their finely decorated wares found mainly in churches and museums. These illustrate the art of ‘dinanderie’, but there are also craft workshops producing more workaday hand-beaten wares hidden away in Bouvignes. These enterprises are of recent origin, directed towards the tourist trade but apparently not thought suitable for the tourist’s eye. Local shops, and those of Namur some fifteen miles north, are full of their products, some ‘antiqued’ in appearance, but with no real link with the industrial past. Nevertheless, with further probing, it proves possible to discover real industrial relics, if only nineteenth century, which provide a connection with past traditions.

Three miles north of Bouvignes, towards Namur, the Molignée lies hidden in its wooded craggy valley. This swift-flowing tributary to the Meuse provided water power for iron production from medieval times. In the latter part of the nineteenth century one of the mills at Warnant-Anhée was adapted to the working of brass and copper, partly to supply materials for manufacture into the traditional fine wares of Dinant, but also to make parts for locomotive boilers and for the casting of church bells. A portion of the site still survives in business, having changed hands in recent years and adapted to production of wire goods for electrical work and automobile accessories, but in May 1983, the old premises of the water powered mill were opened to the public.

The pleasant old buildings, topped by a crop of brick chimneys are grouped round a courtyard in the traditional manner of sites of an earlier era. Vast areas of pantiled roofing, with sections of glass-pantiled lights, recall the brassmills of the Bristol region. Similarly, areas of flooring are protected with heavy iron plates,
regarded locally as a relic of previous iron 
working. Such flooring was laid in the brassmills 
of Bristol near annealing furnaces to dissipate 
heat from products which had been annealed 
and needed cooling before further work.

At the heart of the complex the ancient head-
race, leading more than a mile from the 
Molignée, can still be unleashed to drive a huge 
breastshot waterwheel, of mainly cast iron 
construction, about 25ft diameter by 12ft 
mounted on a timber shaft of 3ft diameter. This 
wheel dates from the 1830s in the days of iron 
working but was later adapted to operate a large 
rolling and slitting mill through a flywheel and 
sset of gears. This plant was working until 1960 
and is still capable of turning over. The drive 
could formerly be diverted to power ancient 
wire-drawing equipment which is still displayed 
but no longer usable, and the layout is com-
pleted by a large hoist of rough-hewn timber. To 
witness this plant turning is a sight worth seeing 
and hearing and it is, apart from its larger scale, 
comparable with the water-powered rolling 
equipment of the Bristol industry.

In another wing of the courtyard a collection 
of steam-operated plant relates more closely to 
the era of late nineteenth century brassmaking in 
Birmingham. An 1895 vertical Couillet engine, 
described as 50cv with 600mm cylinder, 500mm 
stroke at 25pm, once operated a rolling mill for 
brass sheet, which is also displayed. A Lebrum 
single-cylinder horizontal engine of 18cv was 
installed on 23 March 1900 to turn a dynamo for 
the first works' electrical installation. Steam was 
supplied by two horizontal Couillet boilers, Nos 
208-9.

Equipment of a later period, 1912-13, 
cluded La Meuse No 2595, an engine with a 
vertically mounted flywheel which drove a triple 
pump for supplying water to three Piedboeuf 
horizontal boilers. From these, La Meuse 
No 2594, a tandem compound engine of 500cv, 
operated a reversible ‘two-high’ rolling mill. A 
compound horizontal engine, No 3095 by 
Zimmerman Hanrez turned a Hanrez dynamo of 
a new 1913 electrical plant. None of this 
equipment was operable at the time of viewing 
in June 1983.

Several groups of tools and small items of 
equipment are displayed in the workshops and 
courtyard, and also in the small cafe which has 
been integrated in the complex. Here, too, is a 
pile of leather-bound nineteenth century 
account books of the business and other 
documentary records. In the outer yard stands 
the Planet locomotive, by F.C. Hibberd of 
London, which drew wagons of brass and 
copper goods between the furnaces and rolling 
mills but, unfortunately, no furnaces remain, a 
deficiency compensated for by the interest of the
items on display. The site had been opened to the public with the encouragement of the owner and as a result of much hard work and initiative by a small group of enthusiasts who gave their time mainly in a voluntary capacity.

Higher up the Molignée valley a derelict millsite with fallen roof lies well hidden from the tourist gaze. There, a 10ft diameter waterwheel of similar pattern to the rolling-mill wheel once drove two sets of three hammers which are no longer to be seen. Each hammer set would have been driven through rings ofcams mounted on large timber shafts through a chain of gears from the waterwheel. The two enormous shafts and two rows of stout timber frames on which the hammers once pivoted were still there, but slowly mouldering away. Apart from the geared drive the layout was quite typical of the brass battery mills of the Avon Valley, the last of which closed in 1908. A furnace structure had been added at a later date to the main building which had similarities to the annealing furnaces at Bristol. There were also important differences including the lack of flues which suggested a quite different mode of operation, perhaps using charcoal as fuel. The mill was said locally to have been in operation until some ten or so years previously, perhaps the early 1970s, but the vegetation and tree growth made this estimate doubtful. Nevertheless, the very existence of such remains indicate a working brass battery mill at a much later date than had previously been thought. It seems likely that other similar sites of interest may be hidden away on the flanks of the Meuse between Dinant and Namur.

From the Molignée confluence with the Meuse, the river continues northwards through Namur with its antique shops full of modern brassware and then changes abruptly to the northwest toward Huy, another centre of the medieval industry. The river banks become more industrial, particularly with large quarries, lime and cement works, some of which appear to have engulfed earlier calamine workings. Just beyond Huy, continuing north-west the valley has been an especially productive source of calamine. Here, in the mid-nineteenth century, the Vieille Montagne company established its Flône zinc-smelting site, in addition to those already working at Liège and Altenberg. This smelter had been progressively modernised to its
Plate 5 The derelict battery-mill site in the Molignée Valley.

General plan of the property of VIEILLE MONTAGNE at Kelmis
June 1853

Fig. 5 Vieille Montagne mid-nineteenth century, redrawn from an article by Walter Meven in Im Göttal, 31 August 1982, p. 46.
peak during the 1940s, when it was employing 600 men. Following the slump in zinc prices it had closed its gates by 1980 and blown up its two large brick chimneys. The remaining rows of riverside buildings, smelter, offices and workers' housing still have a haunted look but also a similarity of style to compare with Vieille Montagne premises elsewhere — industrial archaeology of the most recent era.

The remains of zinc smelting at Flône have their roots in the long history of local calamine exploitation which, as related, had their importance in the early production of brass. But, increasingly, the deposits at Altenberg became more significant to the brass industry. At Liège, to the northwest of Flône, the zinc-smelting sites established early in the nineteenth century by Dony at St Leonards and by his successors at Angleur are primarily of interest to the history of zinc rather than that of brass. The emphasis in historical documents focuses attention on the Altenberg deposits in the development of brass production.

Altenberg identified

Clearly, the Altenberg area is of prime importance in an investigation into the history of the brass industry, but its exact location is far from apparent in documentary references or from a search on modern maps. References to the place name of Moresnet in company literature merely add to the confusion. To the unacquainted visitor leaving Liège for the German borders, place names have already given cause for concern. Liège becomes Luik on a Flemish signpost, and Lüttich in a German document. The German named Aachen may be fairly well known as Aix-la-Chapelle in the French version, but the Latin name of Aquisgranum is used in some documentary references. Some five miles southwest of Aachen the small hamlet of Moresnet can be located but no traces of mining will be found. All becomes clear, eventually, when one realises that near Moresnet lies the small town of La Calamine in French, with the much older name of Kelmis in German. The mining community once came under the jurisdiction of Moresnet and the Vieille Montagne company continued to use that name in all its records. Altenberg, or Vieille Montagne, was the name of the actual mine around which developed the community of Kelmis, or La Calamine, both names derived from the local product; that of Kelmis was in use from the twelfth century. It is possible to find a selection of these names in English works of metallurgical history implying quite different locations when, in fact, they are synonymous in that particular context.

The old highway from Liège cuts straight through the confines of the former mining terrain in the half mile immediately preceding the present-day town of Kelmis. The huge cavity of the ancient workings lying to the north of this road was still recognisable until the 1950s when a start was made on infilling with local household waste. Filled completely by 1982, today the old mine is merely an overgrown embankment in the side of the hill on which the town stands. North Mine, the most ancient part of the excavation, was worked out by the 1850s and was replaced by new workings immediately adjoining the site which became known as South Mine. These too were exhausted by the 1880s and from then on the processing plant was kept going by mineral brought in from outlying districts five to eight miles away. These new sources produced mainly blende (zinc sulphide) and galena (lead sulphide) to which the processing plant was adapted.

The length of the main road through the site is still flanked by pavement of double width which, from 1875, accommodated a rail link with some outlying sources of mineral, and later provided a passenger service to Aachen. Centrally placed along this stretch, the former administration building of the Vieille Montagne company still stands, displaying VM plaques and dated 1910, having been erected on the site of its predecessor. It now houses a modern garage and adjoins the building of the former railway station. To its rear are remains of an overgrown kiln-like structure where calamine was calcined, the heating process which converted the zinc carbonate to an oxide. Further to the rear lies a tall brick building which housed the zinc white plant. This utilised waste from the washing floors and proved a source of heavy atmospheric pollution until it closed in 1950. This building partly replaced the former retort house where zinc smelting had been carried out from its introduction in 1835. The only recognisable remains of this process are the banks of slag mixed with the broken burnt-clay remains of horizontal retorts. This debris is brightened by plants which can be
identified as those particularly tolerant of soils polluted by zinc and lead.

The southern side of the high road was utilised mainly for washing floors or other separation and concentration processes. The waters of the small River Göhl, (or Geule in French) were used for this purpose and from 1860 were dammed to form a reservoir. An additional stream was brought from a nearby valley by means of an overhead launder to augment the available supplies, thus enabling a whole series of washing floors and settling tanks to be laid along the length of the site at varying periods. A flotation process for the chemical separation of ores was introduced in 1935, but bombed during the Second World War and not used subsequently. 42

The reservoir is now surrounded by trees and is becoming a haven for wild life. A former area of slimes and dumps has been largely cleared but remaining banks of waste material are becoming overgrown with a wide variety of zinc-tolerant plants of great interest to the naturalist. Here grows the calamine violet, a zinc-tolerant version of the mountain pansy, *viola arvensis calaminara*, which is regarded locally as a symbol of the region and its historic past. 43 As it only grows on polluted soils it can be used, together with other similar species, as indicators of past industrial activity connected with zinc. Such indicators can be discovered in the outlying areas of mineral exploitation and along the rail connections which link with Kelmis.

In addition to the industrial premises of the Vieille Montagne company, many of the town's amenities are also relics of its industry. The large house of the Director of Mines still stands close to the mining site and is now used as a restaurant. It was built in 1840 replacing a similar building which fell into the cavity of the North Mine. Its former grounds are now the public park of Kelmis. A chapel, and protestant and catholic churches were provided by the company, the latter standing prominently in the central position of the town. Many of the domestic buildings are roofed with zinc tiles, or hung with these tiles on the weather-side wall. In a town which is so full of reminders of its past industrial involvement it is not surprising that there are plans to establish a museum which will record and display features of this history.

The vigorous and somewhat brash atmosphere of the town is not only derived from its growth
as a mining settlement. Kelmis is a border town where it is possible to purchase a locally-made box of Belgian pralines with a handful of Dutch guilders and receive German pfennigs in the change. The history of the area has been equally mixed, but the Neutral Territory formed during the nineteenth century was awarded to Belgium following the settlements of the First World War, although German is still largely spoken. The high road from Liège, which divides the old mining area, continues its way north-eastwards through the town to cross the borders (0 Germany just outside the built-up area. The traveller is by then on the outskirts of Aachen and from town to city centre is less than five miles.

The Stolberg sites

This close proximity of Altenberg was the stimulation for the growth of the late medieval brass industry in Aachen. The city itself also had mineral resources of its own although of smaller importance. Following the guild restrictions and religious persecution which brought decline in the Aachen industry, these native deposits were later exploited by the brass masters of Stolberg who took over the initiative some seven miles east of the city. Stolberg had its own local supplies also but, as related earlier, they relied increasingly on Altenberg calamine for their best-quality products. As a consequence the industrial history of these two communities some twelve miles apart is closely interrelated. At Kelmis the involvement was in the supply of raw materials, whilst Stolberg produced finished or semi-finished wares of brass. The industrial remains of these respective activities can be contrasted rather than compared because, at first sight, there appears to be little remaining of the early phase of brass manufacture in the town of Stolberg today.

The sites of the old brass mills have been incorporated into high-class business premises, public buildings, domestic dwellings or absorbed by later industry, but they are still there to be searched out. This kind of adaptation has been aided by the traditional layout of the old mill premises which derived from a need for protection. Most of the Stolberg brass mills were built in the seventeenth century in times of frequent hostilities when adequate defences were essential. The master’s house and his working premises were formed around a courtyard with windows facing inwards and the millpond and races also served as defensive barriers. The owners gradually acquired increasing wealth and prestige and by the eighteenth century their living standards approached those of the minor nobility. Their houses became more luxurious with large gardens added to the traditional courtyards but furnaces, foundries and water-powered hammers were still located in close proximity to the master’s houses. When the industry contracted in size, many of these working premises were incorporated into the mansions. This has resulted in a number of fine houses, with varying present-day uses, being distributed along three miles of the Vicht valley in and near Stolberg. In many cases the working premises can still be identified from plans and documents relating to the days of brass manufacture. Most are situated with the River Vicht at their doorsteps or have watercourses running through the complex of buildings. The oldest building connected with Stolberg’s early production of brass is the Apothecary, built in 1575 for a member of the Schleicher family, whose descendents are still involved in brass manufacture in the town. It is now in a row of domestic dwellings in narrow, cobbled Burgstrasse, recently pedestrianised. Nearby, the mansion of Schardt faces the main road alongside the Vicht, of noble appearance but with a maze of dwellings surrounded two courtyards to the rear. Further into the town’s shopping centre, Grünsthal, still with its courtyard layout, is now a sophisticated building of rococo character which houses a pharmaceutical company, but plans show the former existence there of hammers and furnaces. The hospital just opposite is housed in a court built by the Peltzer family in 1697, with parts of it still recognisable from an 1836 drawing showing furnaces towering above the mansion. There are similar documents and illustrations of Rosenthal, regarded as the finest of all these buildings. At the lower part of the town, a group of former centres of the industry include Stock, Weide and Unterster Hof, all now converted to domestic dwellings but once utilising the watercourse flowing downstream from Rosenthal. Part of Unterster Hof is still used as the home of the director of a brass manufacturing company which evolved from the combination of three family businesses. The grounds contain several
relics of early processes of brass production, such as the large rectangular stones which formed moulds for the casting of early brass plates and the grinding stones which reduced calamine ore to a powder.

The nineteenth-century phase of this history can be interpreted from remains further downstream at the site of Atsch Mühle. Resources from the sale of several old premises were pooled to purchase and equip this new site in the 1870s to include steam-powered rolling mills and other steam-operated processes which enabled the
Plate 8 The noble frontage of Schardt conceals a maze of courtyards in the rear which once housed the processes of brass manufacture.

Plate 9 The battery mill at Grünenthal early nineteenth century. From Denkmäler der Stolberger Messingindustrie, Landeskonservator Rheinland.
industry to survive. Waterpower was still retained for the hammers producing hollowware and from Atsch Mühle an evocative illustration provides the only known photographic record of this process to date. The Atsch site is now a green landscape of bushes and trees but two conical structures of furnaces have been conserved and recently repaired. It seems most likely that these were annealing furnaces, but they have no inner structures remaining and no record of their use appears to exist. There is a similar conical structure at a millsite upstream of Stolberg with equally scant evidence of its use.

Masters and men

It is necessary to visit the graveyard of Stolberg’s protestant church to absorb the family relationships which developed within the brass industry. The most successful of these
Plate 12 Coats of arms adopted by some of the successful families of Stolberg’s brass industry. From Die Grabsteine auf dem sinkenberger Kupfermeister-friedhof, by Dr Siegfried Schleicher.
families adopted their own coats of arms which decorate the slabs dominating the burial ground. Here, one sees a series of stones of the Momma family which immediately forge a link with the seventeenth-century embryo English industry. In 1649, Jacob Momma was one of two ‘Dutchmen’ who established a brass wire mill at Esher in Surrey which continued to operate for thirty-four years. During this time Momma petitioned Parliament for reduction of import duties on Swedish copper which he was using to produce his brass. Ten years later he was involved with others in the copper mine at Ecton and Elastone Mill, both in Staffordshire, and is credited with introducing gunpowder to mining techniques there. Momma died in 1681 leaving the Esher brass-mill property to his wife, which may well have been the same premises which were later to be owned at Esher by the Bristol brass company. There was also a Jacob Momma junior amongst other members of the family.

A gravestone at Stolberg refers to a marriage in 1682 of a Jacob Momma to Maria Peltzer who may well be that same man if not a close relation. Similar stones can also be found of the Buirette family who appear to have records in Stolberg indicating travels to England. Jacob Buirette is said there to have introduced samples of brass battery to England in the early part of the seventeenth century.

A link between workers’ families rather than those of the masters is more difficult to establish. The names of those families settling in Bristol have been identified as typical of the border area to the west of the Rhine. The name of Ollis, in particular, appears to have an equivalent Olles, with a number of representatives which can be found in the Aachen telephone directory and not so frequently elsewhere. A Bristol Ollis descendent has made contact with an Aachen Olles descendent and they hope eventually to discover some mutual ancestry. The Twerton church memorial recording of the Graef family home as ‘Veit’ has proved a source of confusion as no place of that name can be discovered. St Vith now over the border in Belgium has been suggested as the nearest in pronunciation, but is many miles south with no connection in brassmaking. However, Stolberg has a small outlying village upstream of the town which takes the name of the river, Vicht. The pronunciation is different,
Brass Battery Hammers as used in the Bristol industry

Fig. 8  Bristol brass battery hammers.
At the present state of knowledge it is not possible to state categorically that there was a direct connection between the Stolberg industry and that of Bristol but there are strong grounds for suspecting this to be the case. The implications of that premise may be taken further. Can it be inferred that Abraham Darby actually visited Stolberg in seeking expertise and skilled workers on his recorded visit to the continent? The protestant religion of the Stolberg masters may have provided connections which would not otherwise have been accorded. If Darby did not actually make his way as far as Stolberg, it is still possible that he was able to gather workers from that area, perhaps through an agency similar to that used somewhat later by William Patten. What evidence there is reinforces earlier contentions that Stolberg provided the basic skills for the Bristol brass industry.

Conclusion

At the present state of knowledge it is not possible to state categorically that there was a direct connection between the Stolberg industry and that of Bristol but there are strong grounds for suspecting this to be the case. The implications of that premise may be taken further. Can it be inferred that Abraham Darby actually visited Stolberg in seeking expertise and skilled workers on his recorded visit to the continent? The protestant religion of the Stolberg masters may have provided connections which would not otherwise have been accorded. If Darby did not actually make his way as far as Stolberg, it is still possible that he was able to gather workers from that area, perhaps through an agency similar to that used somewhat later by William Patten. What evidence there is reinforces earlier contentions that Stolberg provided the basic skills for the Bristol brass industry.

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4. Donald M.B., Rees W.,
7. Hamilton, English Copper and Brass, 64
8. Day, Bristol Brass, 26-35
9. Friends House Library, Norris MSS 10, MS vol S202, Hannah Rose’s ‘Some Account of the Family of the Darbys’, f124; Mott R.A., ‘Abraham Darby (I and II) and the Coal-Iron Industry’, Transactions Newcomen Society XXXI, (1957-9), 61; Dr Mott infers that Darby brought brass battery workers to England. There appears to be no basis for later assumptions that these men were skilled in casting brass vessels. The Hannah Rose MS contains no such evidence and other contemporary references to the production of brass hollow-ware are to the contrary.
10. British Museum, Add MSS 22675, f36. The first Deed of Partnership of the Bristol business specifically mentions the production of ‘battery’. Dated 1706, eight partners are listed, four of whom, including Abraham Darby, ‘had for several years then past jointly carried on the Trade or Art of making Brass or Battery...’ (This is somewhat different from the version given by Hannah Rose.)
11. St John’s Church, Keynsham, Church Registers; Ollis family records, communicated privately by Ian Haddrell; Fray family records, communicated privately by the late George Fray
12. Keynsham and Saltford Local History Society Archives, Agreement between Parish of Keynsham and Brass Wire Work Company
13. From details compiled by Mrs C. Turner of Bath
14. Hamilton, English Copper and Brass, 245
16. Victoria County History, Somerset, (2, 1911) 389, quoting verbatim State Papers Domestic, Elizabeth xxxvii, 73
21. Ibid. 53-55
22. Galon J., L’Art de Convestir le Cuivre Rouge ou le Cuivre Rose en Cuivre Jaune, (1764) 2-3
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43. Hirtz O., 'Die Galmieflora im Gohlal', *Im Gohlal*, (Vols 15, 16 & 17, undated); Personal observation, June 1983

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45. Landeskonservator Rheinland, *Denkmäler der Stolberger Messingindustrie*

46. Ibid; Personal observation under the guidance of Dr Karl Schleicher to whom the writer owes her most grateful thanks, also to his friends Günther Dott and Herr Mersch from the Volkshochschule Stolberg for their assistance. The help from Dr Alfons Biermann, Director Rheinisches Museumsamt, together with that of his colleagues from the museum service was also very much appreciated.

47. Schleicher K., *Geschichte der Stolberger Messingindustrie*

48. Schleicher Siegfried, *Die Grabsteine auf dem finkenberger kupfermeister friedhof zu Stolberg (Rhld)* (undated) and personal observation.

49. Ibid, and Robey, 'Ecton Copper Mines', 149-51

50. Schleicher K., *Geschichte der Stolberger Messingindustrie*, 33

51. Day J., *Bristol Brass* The only evidence for the design of Bristol battery hammers is the drawing made up from descriptions, by George Shellard of Saltford, of his memories of some sixty years previously. Mr Shellard died shortly after the drawing was made, and long before the existence of the Stolberg photograph was discovered. The two can be seen to be almost identical.