

Some unsuccessful blast furnaces of the early coke era

Philip Riden

Introduction

Between about 1750 and 1790 iron smelting in Britain was transformed by the adoption of coke as fuel in the blast furnace instead of charcoal, and by the introduction of steam blowing in place of water-powered bellows. In the middle of the century only three blast furnaces, all owned by the Darby family in east Shropshire, used coke, with almost the entire output of the industry coming from 60 or 70 charcoal-fired furnaces. By 1790, the number of charcoal furnaces had dropped to about two dozen, mostly to be found in South Wales, the Forest of Dean and Furness, whereas there were now some 70 coke-fired furnaces, concentrated on the coalfields of South Wales and the Midlands (Riden 1977, 448).

I have outlined elsewhere details of the charcoal blast furnaces at work in the period immediately prior to their demise (Riden 1987); the story of the early coke furnaces is by contrast much more familiar. When the first comprehensive survey of the iron industry since 1717 was compiled in 1794, the vast majority of coke-fired furnaces built since the 1750s were still in use and it was easy enough for the trade to collect details of ownership, plant and, perhaps most useful, date of construction. This information I have also summarised in a previous paper (Riden 1978). In addition to a list of furnaces then at work, most of them coke-fired, the same survey also included 'An Account of Charcoal Blast Furnaces which have declined Blowing since the year 1750 owing either to the want of Woods or the introduction of making Coke Iron' dated 1 January 1788 (Birmingham Reference Library, Boulton & Watt Collection, MII/5/10, cf. Riden 1977, 446). This very useful list, all the information from which is incorporated in my earlier gazetteer (Riden 1987), concludes with a sub-heading which reads 'Coke Furnace', beneath which are 14 names. Some of these are well known, others obscure, and at present one remains a mystery. The exact meaning of the heading might also seem ambiguous but, from what is known of the more familiar names on the list, it seems that these are coke-fired furnaces which had also 'declined blowing since the year 1750', although obviously not for the same reasons as the charcoal furnaces. This list is also of some value, since it appears to be the only attempt to catalogue the failures, as opposed to the successes, of the new iron industry of the second half of the eighteenth century. How far it is a complete list of coke-fired furnaces which had both opened and closed before 1794 is less clear. As yet, however, I have identified only one other unsuccessful coke

furnace of this period (Dukinfield, Cheshire), which, although listed as working in 1794, must have closed very shortly afterwards (see Gazetteer, below).

After the survey of 1794, there were at least nine occasions, prior to the start of officially compiled statistics in 1854, on which the trade assembled lists of blast furnaces, sometimes with details of ownership, output or other information, sometimes without. It is therefore possible to construct reasonably systematic statistics for a period of 60 years up to the publication of the first volume of *Mineral Statistics* to contain furnace-by-furnace returns. These continue until 1913 and, together with the material for 1794–1854 and figures from trade association year-books for the period since 1920, will form the subject of a future publication (Riden and Owen, forthcoming). The coke-fired furnaces which shut before 1794 do not fit easily into this scheme and, mainly for this reason, are dealt with separately here. A few of the names from the list of 1788 re-appear in later surveys, either because the list in question sought to include every possible blast-furnace site, including some which appear not to have worked for many years, or because a furnace was actually re-started. On the other hand, the only furnace discussed in this paper which is not in the 1788 list is the one at Dukinfield, which was evidently out of use by the time the next national survey (that of 1796) was compiled. There were obviously other furnaces listed in 1794 that failed within a few years but, with this single exception, all survived to be listed in 1796 (and in general 1806 also). Sites of this kind will therefore appear in the main publication planned on blast-furnace statistics from 1794 onwards.

Another reason for publishing these notes as they stand is to draw attention to some of the more obscure names on the list in the hope that their appearance in print will encourage those with a detailed knowledge of a particular part of the country to investigate local sources more thoroughly. No further information than that presented here appears to be available from nationally-compiled surveys or from accessible published sources. I suspect, however, that a close study of archival material in pursuit of particular ironworks or ironmasters would make it possible to enlarge considerably on what follows, as recent articles by Dr Chris Evans on two of the furnaces included here (Bedlington, Northumberland, and Redfield, Gloucs.), as well as my own work on Cefn Cribwr (Glam.), demonstrate.

It seems rather unlikely that any single explanation will emerge as to why these 15 furnaces failed at a time when most coke-fired blast furnaces were successful; indeed, in two cases (Horsehay and Melincourt) it is not clear why the compiler of the list thought the furnaces had closed. Three of the sites are in Shropshire, the leading iron-making region of the second half of the 18th century; three more are in South Wales, which saw the second greatest expansion of coke-smelting in this period; two are in the North East; and one each in Furness, North Wales and the West Riding. Two are in south Lancashire or north Cheshire, which failed to establish itself as a coke-smelting region, and another was near Bristol, in an area where there was no previous tradition of smelting. One name on the list ('Fordley') has so far eluded identification. Each furnace probably has its own individual history, although Carr Mill (Lancs.), Dukinfield (Cheshire) and Redfield (Gloucs.) share the characteristic of being outside established iron-smelting districts. Beyond this elementary conclusion, it is perhaps best to present such information as is available at present and hope that others will elucidate the history of each site further.

GAZETTEER

(For details of the nationally-compiled lists of furnaces of 1794, 1796, 1806 etc mentioned below see Riden 1977).

Bedlington, Northumberland

The *History of Northumberland* (IX (1909), 298ff.) and later writers (Bergen, c. 1948, 4–9; Martin 1974, 3–7) trace the history of the ironworks at Bedlington (NZ/276820) from a lease of December 1736 (taking effect the following May) from Mary Johnson to William Thomlinson, a Newcastle merchant originally from Cumberland, of premises on the south bank of the River Blyth at Bebside, and assume that Thomlinson, who died in 1737, built the works. The lease itself, however, of which a copy survives as Northumberland Record Office, ZMD.66/32a, while granting Thomlinson rights to timber, clay and quarry-stone, access to water-power and the right to erect buildings and make lanes, reserves to the lessor the coal and ironstone under the land, and gives her licence to erect fire-engines, mills, furnaces etc. This rather suggests that Mary Johnson, and not Thomlinson or his successor, established the ironworks. The origin and fate of this furnace remain obscure; when Bedlington works were bought by Malings & Co. in 1759 (rather than Martin's date of 1757; *ex inf.* S M Linsley) the plant consisted merely of a slitting mill, nailers' shops and warehouses. On the other hand, Wallis (1769, I.125) describes Bedlington as 'The only ironwork of any eminence with us at present', where 'The ore is digged out of the hanging banks by the river with great labour and pain', presumably then to be smelted nearby. This is confirmed by an advertisement in *Aris's Birmingham Gazette*, 3 November 1766, offering for

sale shares in Bedlington works, which states that the furnace is 'for smelting Iron from the Mine by Pitcoal or Charcoal' and is 'Well-established in a Vend for Cast Ware, &c.' (Ashton 1924, 37–8). Smelting had evidently ceased before 1782, when an advertisement for the sale of the works mentions only a slitting-mill and smiths' shops; in 1794 two works are listed (i.e. those on either side of the river), both occupied by Hawks & Longridge, one owned by the Bishop of Durham and the other by a 'Mr Ward', the plant consisting of a rolling-mill on one bank and a slitting-mill on the other. According to Tylecote (1983, 99), blast furnaces were erected by Malings of Sunderland before 1788 on the north bank, and pig was refined at a forge at Bebside. In 1788 the furnaces were blown out and the forge was taken over by William Hawks and Thomas Longridge of Gateshead, who used it for naval work until 1820. Both their activities and those of their predecessors at Bedlington are the subject of a detailed new study by Dr Chris Evans (forthcoming).

Bersham, Denbighshire

Bersham furnace, built about 1670 by Sir Richard Lloyd of Esclus, near Wrexham, who died in 1676, passed through various hands until in 1753 the site was leased by Isaac Wilkinson. Charles Lloyd had experimented with coke-fired smelting there as early as 1721 but when Wilkinson took over, the works was apparently operating as a charcoal-fired furnace. According to Palmer (1899), the output at Bersham under Wilkinson was largely castings, including ordnance, which suggests that coke was being used. In 1761–2 the partnership was reconstructed and Isaac Wilkinson passed control to his sons John and William (or, according to one account, to John Wilkinson alone). By the 1770s the two brothers were certainly operating Bersham as a coke-fired furnace, using a Newcomen steam-engine to return water. At some date, apparently 1793 (Palmer 1899, 27–8), the partnership came to an abrupt end in a violent disagreement between the two brothers which resulted in the destruction of much of the works, which were never fully rebuilt. This basic chronology is supported by the list of 1750–88, in which Bersham appears as both a disused charcoal-fired furnace and as a closed coke-fired furnace, which actually suggests that the furnace had been abandoned before the date suggested by Palmer. In 1794 only a rolling-mill (built in 1788) was listed at Bersham, operated by John Wilkinson. After his death in 1808, his trustees let what remained of the works, which were finally sold in 1828 (Palmer 1899, 37). The site is now an industrial heritage centre and remains of a furnace nearby (SJ/308493) are a scheduled monument.

Calcutts, Salop

The appearance of 'Calcott' in the list of coke-fired furnaces closed between 1750 and 1788 can apparently be explained by what is known of the history of the ironworks at the Calcutts, near Broseley in the Severn

valley. The Calcutts estate was leased from Sir Onesiphorus Paul, a Gloucestershire woollen mill owner, by George Matthews of Broseley in May 1767 (Trinder 1981, 39). Although Trinder suggests that two furnaces were subsequently built under this lease, the 1794 list mentions only one on the site, which was coke-fired, blown by engine and built in 1775. (According to Trinder, the bellows were in fact water-powered and the engine was used merely to return water to the reservoir.) By February 1786 Matthews had either died or given up the works, which were put up for sale (Trinder, loc. cit., citing the *Shrewsbury Chronicle*, 18 Feb. 1786) and were said to consist of two blast furnaces capable of making 40 tons of pig a week, air furnaces, two forges, three steam-engines and a variety of other plant, none of which is listed in 1794. The works were bought by Alexander Brodie, a self-made Scotsman, who accordingly appears as occupier in 1794, with Sir O Paul as owner. By 1806 the works had apparently been substantially rebuilt, since five furnaces were listed both then and in 1810, a number which had fallen back to two by the time the lists of 1823–30 and 1825 were compiled. (It is possible that the 1806–10 figure is either wrong or includes another separate works owned by Brodie.) The simplest explanation for the appearance of Calcutts as a closed coke-fired furnace in 1788 is that the compiler of the list believed that the works had shut down after the sale by Matthews, whereas in fact it may have been in the process of refurbishment by Brodie after his acquisition of the site. Confusingly, a print of 1788 (Trinder 1981, pl. 4) shows the ironworks in full operation. The site finally closed in 1828 (*ibid.*, 143).

Carr Mill, Lancs.

In 1720 Edward Hall secured a 32-year lease of Carr Mill, in Ashton-in-Makerfield, from William Gerard of Garswood, with licence to build a furnace and forge, rebuild the dam-head and create new mill-ponds. Considerable quantities of Staffordshire ironstone were shipped down the Weaver in the 1730s and 1740s and it is likely that much of this was destined for Carr Mill, especially as shipments cease in 1751 on the expiry of the lease. There were also local purchases of charcoal. The lease was not renewed after this date and the furnace probably shut around the middle of the century (Awty 1957, 101, 109, 112). In the list of charcoal furnaces closed between 1750 and 1788 Carr Mill was said now to be a cornmill occupied by one Rigley. The site re-appears, however, as 'Carmill Wigan' in the appended list of coke-fired furnaces, which can apparently be explained by a lease of 1759 of Carr Furnace to Samuel Johnson of Liverpool and two partners, George Perry and John Gosling, both described as ironmongers of Coalbrookdale (*ibid.*, 115). This appears to mark the beginning of coke-fired smelting in Lancashire but was evidently an abortive venture which closed before 1788. The site is not listed in 1794 or later. Carr Mill Dam (SJ/5297) is still a prominent feature on the modern map, indicating the approximate site of the furnace.

Cefn Cribwr, Glamorgan

A furnace said to be at 'Cefn near Pyle' in the list of coke furnaces closed between 1750 and 1788 was in fact that built by John Bedford at Cefn Cribwr, about two miles north east of Pyle in central Glamorgan. The same site is listed in 1794 as 'Cefn Criffi', described as being near Cowbridge (which is actually nearly ten miles away to the south east). John Bedford acquired the Cefn estate in 1770 but it is not clear when, if at all prior to his death in 1791, the furnace went into blast. Indeed, it is possible that Cefn appears in the 1750–88 list not as a furnace which had closed, but as one which had never worked at all. The 1794 list describes the furnace as coke-fired and built in 1790. This may have been the year in which it was blown-in or may refer to a proposed lease of the site to a firm named Green & Price, who appear as occupier in 1794. The owner was listed on this occasion as '[Blank] Bedford': after John Bedford's death the works remained in the hands of three executors (a brother, son and son-in-law) until 1824–6 when the last survivor of the trio managed to sell the site. Prior to this the executors had made various attempts both to work the furnace themselves or find lessees prepared to do so, but with little success. After the sale of 1824–6, a family named Bryant, originally from Merthyr Tydfil, operated the works sporadically until about 1836, when it closed altogether.

The only list after 1794 to include Cefn Cribwr is that of 1823–30, which has a nil return for 1823 and a note that one furnace was built in 1824 which, however, was said to have no output in 1830. In fact, the Bryants appear to have refurbished Bedford's furnace, rather than built a new one. Apart from the blowing-engine house, which certainly dates from the Bryants' time, most of the other remains visible on the site today, including the furnace itself, a cast-house and the remains of a structure which supported the charging-ramp, appear to date from before John Bedford's death in 1791. All these features, which form a scheduled ancient monument (SS/852835), are currently undergoing conservation by Ogwr Borough Council, who now own the site and have commissioned a new study of John Bedford and his ironworks (Riden 1992).

'Cefn near Merthyr'

This name appears thus in the list of the coke-fired furnaces closed between 1750 and 1788. *Cefn* (ridge) is a common Welsh place-name element but the most likely identification in this case appears at first sight to be Cefn-coed-y-cymmer (ST/0308), now a suburb on the north-western outskirts of the town of Merthyr Tydfil, historically a hamlet in the Breconshire parish of Vaynor. An early coke-fired furnace at Cefn-coed would be a perfectly feasible notion in terms of geography and geology, but no reference to any such works has been found by generations of local antiquaries who have as a rule explored every possible aspect of the industrial history of Merthyr Tydfil and its environs.

An alternative identification is with an unsuccessful early furnace on roughly the same site as the later Aberdare Ironworks at Llwydcoed, about a mile up the Cynon valley from the modern town of Aberdare. This venture appears to be mentioned only in an unpublished tour diary of James Watt junior of 1800 (Birmingham Reference Library, Boulton & Watt Collection, MI/6/11, pp. 50–51; I am indebted to Mr John Davies, formerly of the BRL, for drawing this source to my attention and to Dr Chris Evans for the suggestion that the following quotation may relate to a furnace at 'Cefn'), written about the time Aberdare Ironworks was being built (Lloyd 1906, 115–16). Watt noted that:

There was an old furnace upon these Premises near where the present Upper Coal Levels are, which was erected by Capn. Hughes the former proprietor of the Ground. It was blown by a Common Engine the Cylinder of wh[ich] is still there and seems about 40 Inches. The regulator is cut out of the Rock and was lined with wood, with a wooden piston. The furnace seems also to be cut out of the rock and being damp was abandoned after a short trial, having made little or no Iron. . . . Mr Guest [of Dowlais] says he was consulted by Capn. Hughes who carried on this work jointly with a Mr Bower as to the propriety of continuing it, and that both he and his partners advised him to stop proceedings, from the bad manner in which the levels and other works had been executed.

On the evidence at present available, this identification seems reasonable enough, partly because, since there were so few unsuccessful coke-fired furnaces in South Wales, there are no other obvious candidates. Llwydcoed is only about three miles from Merthyr on the map, although rather further by road in the 18th century (cf. Yates 1799, who does not mark either an old or new furnace at Llwydcoed); and while there is no 'Cefn' on the modern map near the site of Aberdare Ironworks, this does not seem an insuperable objection, since there may well be a small ridge there to which in the past the name has been applied.

The owner named by James Watt was Samuel Hughes of Tregunter, Brecks., who sold the freehold of the land on which Aberdare Ironworks was built to Samuel Glover of Birmingham in 1787 (Lloyd 1906, 115), by which date Hughes had obviously abandoned his own attempt at iron-smelting. When the enterprise began is less clear, since the venture seems to have escaped the attentions of local writers. Presumably at any time over the 20 years prior to the sale of 1787 Hughes may have been tempted by what he saw being done over the hill at Merthyr into building a coke-fired furnace on his own estate, although, as others mentioned elsewhere in this paper also discovered, it was possible to fail with the new technique.

Without a closer examination of the map evidence for Aberdare Ironworks than has yet been attempted (cf. Grant 1991, 17–20), it is impossible either to locate Hughes' furnace precisely or establish whether any

trace survives on the ground today, although this seems unlikely, given the expansion of the later works at Llwydcoed. The approximate National Grid reference would be SN/993044.

Chester-le-Street, Co. Durham

In 1864 Isaac Lowthian Bell told the British Association that:

Mr Joseph Cookson, in a very interesting document drawn up for the writer, mentions that, for the Whitehill furnace, built in 1745, and abandoned before the end of the last century, ironstone was gathered in Robin Hood's Bay, and conveyed by water to Picktree, on the Wear, near Chester-le-Street, and carted from that place to the works (Bell 1864, 79).

A little later in the paper he added that:

To Mr I Cookson, who had recently purchased the Whitehill estate, near Chester le Street, the merit belongs of erecting and working the first blast furnace with coked coal in the North of England. The Whitehill furnace was 35 feet high, 12 feet across the boshes, and produced 25 tons of iron per week. The blast was supplied by bellows, worked by a water wheel placed on the Chester Burn. Its mode of supply of ironstone was from the thin bands on Waldrige Fell, and from Robin Hood's Bay, as has already been mentioned. The coal, of course, was obtained from the immediate locality. Mr Joseph Cookson, a descendant of the founder of pit coal smelting in this district, has given many curious particulars of this early attempt. The iron was used for colliery castings, and latterly for Government ordnance. Frequent interruptions, for want of water to drive their wheel, led at length to the furnace being 'gobbed', and ultimately abandoned, about the close of the last century. (Ibid., 84.)

These passages have been quoted at length since they appear to be the earliest authority for one of two pre-1750 attempts at coke-smelting in the North East.

The story reappeared in *VCH Durham* (II, 1907, 290), with the additional comment that 'The foundry was begun early in the eighteenth century', for which the authority was a footnote saying that 'Mr N C Cookson thinks that the blast furnaces at Whitehill were started about 1704', which in turn is the basis of later suggestions that the works dated from as early as 1704 and had more than one blast furnace. Both ideas seem highly improbable. *VCH* also printed, from an original in the hands of the Newcastle antiquary Richard Welford (died c. 1913), part of a deed of 1760, of which a fuller abstract was printed elsewhere about the same time (*Proc. Soc. Antiquaries of Newcastle-upon-Tyne*, 3rd series, III (1907–8), 170–1; cf. Durham University Dept of Palaeography and Diplomatic, Cookson MSS, Box 3/48). The deed, the original of which has not been located, recites earlier transactions going back to 1721 and the establishment of the blast furnace at Little Clifton, Cumberland, in

1723 (see below; for the original deed of 1721 see Gateshead Public Library, Cotesworth MSS, CA/2/65). A partnership deed of 1729 is also recited, which refers to foundries at Clifton, Gateshead and Newcastle, as well as an agreement for a lease of land at Whitehill, Co. Durham, on which a blast furnace had been built (and was evidently still in use in 1760). Unfortunately the date of this agreement is not given in the published abstract of the deed of 1760. After the abstract of this deed, *VCH* goes on to repeat Bell's comments about the sources of coal and ironstone for the furnace, with the added embroidery that 'at one time the Government got most of their ordnance from the forge at Whitehill'. The Cooksons are also said to have made a fortune from ordnance contracts during the Napoleonic War and to have supplied a cast-iron safe to the churchwardens of Chester-le-Street in 1813.

At present there appear to be only two pieces of firm evidence for the continued existence of the Whitehill furnace after 1760. One is a letter from John Cookson to Isaac Wilkinson of June 1766 (Tyne & Wear Archives, 1512/5571; I am very grateful to Chris Evans and David Cranstone for drawing this important new evidence to my attention), in which Cookson returns answers to a number of queries from Wilkinson concerning the Whitehill furnace and, in a postscript, refers to cast-iron blowing cylinders, which Cookson was apparently thinking of installing at Whitehill and which were to be powered by a water-wheel 27 ft in diameter. Cookson invited Wilkinson to come and stay at Whitehill, presumably while Cookson considered adopting Wilkinson's blowing cylinders, patented in 1757 (Chaloner 1960, 39–40). It is not clear whether cylinders were eventually installed in place of bellows at Whitehill.

Secondly, towards the end of its life, the furnace at Whitehill did make small quantities of cannon for the Board of Ordnance, although Cookson was neither a major supplier nor a particularly successful one. He was only a contractor from 1777 and it is clear that the board used him only in times of great need; in 1780–81 he was responsible for just under 10% of the cast-iron cannon bought by the Ordnance (Brown 1988, 106–8; cf. Tomlinson 1976, 398). When precisely Whitehill was abandoned is not clear but it seems definitely to have been disused by 1788, since both Chester-le-Street and Bedlington (*qv*) appear in the list of failed coke-fired furnaces of that year.

The history of the site is further clarified by Hutchinson (1787, III.398n.), who refers to a coke-fired blast furnace then at work at Whitehill near Chester, the dimensions (about 34ft high and 12–13ft wide at the widest part) and operations of which he describes. The same note adds:

About three miles west of Chester is a place called the Old Furnace, where very lately was to be seen the bottom of a furnace hearth, according to the usual method of building them now, but of much smaller dimensions: they had blown the bellows with a water wheel, as appears by the cut of the water

race to convey it to the wheel from an upper part of the burne.

This appears to be a reference to a disused blast furnace some distance from Whitehill, possibly on the Twizzell Burn around NZ/2251. Tylecote (1983, 91–2) successfully located the later site, where 'Furnace Farm' now stands near the centre of Chester (NZ/265518), but was inclined to reject the idea that there were two separate furnaces in the neighbourhood. On the basis of Hutchinson's comments, however, it seems possible that the 'Old Furnace' preceded that at Whitehill, which Hutchinson apparently saw in use. Since Whitehill fails to appear in the 1794 list, however, but was included in the list of furnaces closed by 1788, a date of abandonment in the mid-1780s seems most likely.

Finally, it should be added that Dr S M Linsley (*pers. comm.*) suggests that the Whitehill furnace may date from 1747 rather than 1745, since it was in the former year that the Cookson family acquired the estate on which it stood.

Dukinfield, Cheshire

The 1794 list includes a coke-fired blast furnace at Dukinfield, owned by '[Blank] Astley Esq.' and occupied by S Bateman. The furnace was blown by water and was said to have been built in 1775. Further information is supplied by the local topographer John Aikin (1795, 456–7; cf. Hickey 1926, 15), who describes the activities of John Astley of Dukinfield Lodge (1730–87) in the improvement of his estate. These included the building of an 'iron foundry', which is said to have increased the population of the district by providing additional employment. But after spending a great deal of money in building the works and extra housing, Astley gave up and let the site to 'a company at Manchester', who likewise, after a short trial, abandoned the works. The furnace was then pulled down and a large cotton mill erected in its place, the water-wheel of which used water from the same stream as the ironworks.

From the evidence of the 1794 list the company from Manchester was probably the engine-building firm of Bateman & Sherratt, who seem to have made a brief and unsuccessful venture into smelting. The furnace was managed in 1783 (and possibly before) by a man named John Hawkins, who in March 1784 resigned and moved to a foundry at Neath in South Wales; at some period before 1782 Hawkins had worked at Merthyr Tydfil (*ex inf.* Dr Chris Evans, from the Dowlais Iron Co. letterbooks in the Glamorgan Record Office, Cardiff). There may also be a reference to Dukinfield in the diary of Thomas Butler of Kirkstall Forge, Leeds, who visited the Manchester area in 1797 and on the evening of 1 March 'went to Bateman's & Co. Iron Works, they seem to be erected on a Good Construction and do a great deal of Work — But they have cost a great deal of Money' (Butler 1906, 119; I am indebted to Dr Evans for drawing this reference

to my attention also). It is not absolutely clear whether Butler is referring to a furnace at Dukinfield or Bateman & Sherratt's foundry at Salford, which Aikin regarded as the leading establishment of its kind in the district (op. cit., 176–7 and note). If the former, then the furnace must have survived for at least three years after the compilation of the 1794 list and Aikin's information concerning demolition and the re-use of the site by a cotton mill was clearly wrong. This, however, seems a rather curious error for a local writer whose work is generally regarded as reliable. A theoretical alternative possibility would be that Butler saw the second Dukinfield furnace (the one listed in 1825), but this is scotched by the non-appearance of Dukinfield in any of the intervening lists of 1796, 1806 and 1810. There is at present no obvious solution to this conundrum.

Aikin (1795, 457) mentions two cotton mills at Dukinfield, of which the one not on the site of the ironworks was said to be 'Above the bridge', implying that the furnace stood on the banks of the River Tame downstream from the bridge which carries the main road from Dukinfield to Ashton-under-Lyne (SJ/9398).

John Astley's son and heir, Francis Dukinfield Astley (1781–1825) made a second attempt to establish iron-smelting on the estate but this too was 'a complete failure and he lost a large sum of money in the venture' (Hickey 1926, 18). This was presumably the furnace which appears in the list of 1825, when the owner was named as J D Astley Esq. & Co. No output is given for the single furnace, which is described in a note dated 20 March 1826 appended to the list as 'Building'. This must have been the works called 'Petersburgh Furnace' marked on Bryant's one-inch map of Cheshire of 1831 at SJ/941965, near Newton Wood to the south of Dukinfield town centre, about a quarter of a mile east of the Ashton Canal, from which a tramroad is shown running past the furnace to Newton Moor, just over a mile east of the canal. Even if the furnace was still in use in 1831, it would not be expected to appear in the nationally compiled list of 1823–30, since this omitted works in the smaller iron-making districts such as Lancashire and Cheshire. The owner's name in 1825 is presumably intended to be John Dukinfield Astley, F D Astley's eldest son, but he died within sixteen weeks of his birth in 1813 and, after his father's death in July 1825, the estate passed to the second son, Francis Dukinfield Palmer Astley, who was himself born only in April 1825 (Hickey 1926, 18, 20, 23). There is no evidence to suggest that the second furnace was any more successful than the first.

The choice of the name marked on the map of 1831 is a mystery: at first sight some connection with Napoleon's campaign against Russia and therefore a date of building of 1812 might be assumed, although that would hardly have been the most auspicious year in which to establish a new ironworks. Nor can it be reconciled with the description of the works as 'Building' early in 1826, unless the furnace was established about 1812, closed in the slump following

the end of the war in 1815 and revived in the boom of 1824–5, only to come into use too late to profit from the brief expansion of output in those years. All in all, the story of the two Dukinfield blast furnaces is an interesting and unexplored byway of the iron industry in the early coke era, which seems to bear some comparison with the sixth Earl of Balcarres' only slightly more successful efforts from 1789 to establish an ironworks not far away at Haigh (Birch 1967, 86–99). Like the Lindsays, the Astleys were keenly interested in the improvement of their estates but seem to have lacked some of the steadiness of character necessary to make a success of a works in a district that lay outside the main iron-smelting regions of the country (cf. Hickey 1926, 15–18).

'Fordley North Park'

This name, which appears in the list of coke furnaces closed between 1750 and 1788, simply cannot be identified: the only 'Fordley' on the OS 1:50,000 map is in Suffolk. It is tempting to suggest an emendation to Funtley (Hants.), the site of Henry Cort's puddling forge, but there is no evidence to suggest that there was ever a furnace there.

Horsehay, Salop

There appears to be no obvious explanation for the inclusion of the Darby family's furnace at Horsehay, established in 1755, in the list of coke-fired furnaces closed between 1750 and 1788. As far as is known (Trinder 1981, 21–2 etc), Horsehay remained in use continuously until the end of the Napoleonic War, when it did apparently shut down for a few years.

Little Clifton, Cumberland

A furnace was established by the River Marron in 1723 by the Cookson family (Marshall & Davies-Shiel 1969, 37, 39, 41, 250–1; Lancaster and Wattleworth 1977, 19–20; cf. Chester-le-Street, Co. Durham). This was an early and unsuccessful attempt at coke-fired smelting, which has left few traces behind on the ground. The furnace was still in use in 1765, when it was visited by Gabriel Jars, who reported that it could not make good forge pig, even with charcoal. Fletcher (1881, 9–10) suggested that the furnace was abandoned in 1781, if not before, when Cookson's colliery in the same area was drowned out. He concluded that 'with an imperfect knowledge of fluxes and the feeble pressure of blast in use at that time, it was not practicable to smelt in a satisfactory manner the red haematite ore of West Cumberland in coke furnaces'. The site was about three-quarters of a mile south of the village of Little Clifton (NY/059279), where in Fletcher's day there were some cottages called Furnace Houses still standing. The inclusion of 'Clifton' in the list of coke-fired furnaces closed since 1750 confirms a date of abandonment (as a coke furnace) by 1788 at the latest.



Melincourt, Glam.

A furnace near the confluence of the Melin Court Brook and the River Neath, near the modern village of Resolven, was blown-in in 1708 by John Hanbury of Pontypool (Schubert 1957, 382). The furnace was listed in 1717 with an output of 200 tons. In 1794 it appears as Melin Court, with the owner as Lord Talbot (in error for Lord Vernon) and the occupier as 'Dr Lettsom' (i.e. John Coakley Lettsom (1744–1815), the

Quaker physician and son-in-law of the previous lessee, John Miers; cf. Raistrick 1968, 304–5). The furnace was then using coke as fuel, but was still blown with water and was described as 'old'. There was no forge. In 1796 output was listed as 648 tons, which is probably a true annual figure, rather than a multiple of weekly production, and possibly points to conversion to coke. Phillips (1925, 294–9) established that Melincourt was built by Sir Thomas Mansel of Margam, 1st Lord Margam, and was later worked by Mansel himself in

conjunction with a forge at Aberafan. Accounts survive among the Margam muniments for the furnace in 1718. In 1736 the furnace was leased to Thomas Popkin, and in 1747 to Rowland Pytt of Gloucester, who was joined in 1748–9 by Thomas Lewis. John Miers, a London merchant and pioneer of tinplate manufacture in west Glamorgan, joined the firm between 1754 and 1758, as did William Coles, the firm then being known as Coles, Lewis & Co. In 1766 a new lease was granted to John Miers, William Coles and Thomas Lewis, the firm subsequently being known as John Miers & Co.

According to a contemporary traveller, Melincourt was rebuilt as a coke furnace in 1788 and continued in blast until 1808; in fact it seems more likely that conversion took place after a new lease was made to John Miers's executors in 1793 (Green 1980–1, 70–5). At the site today (SN/824018), which is a scheduled ancient monument, there are substantial remains of the furnace stack and other buildings.

Melincourt's inclusion in the list of coke-fired furnaces closed since 1750 is not readily explicable unless it indicates conversion to coke by 1788, rather than 1793. It was certainly not a disused coke-fired furnace in 1788. The site appears in the 1806 and 1810 lists, on each occasion with the furnace said to be in blast; the output in 1806 was returned as 950 tons p.a., clearly indicating conversion to coke. Melincourt last appears in the 1825 list, with the furnace out of blast and the comment: 'Am not acquainted with these furnaces [i.e. Melincourt and others] and have taken them from an old list [presumably that of 1806 or 1810]. They are probably worked with charcoal'.

Redfield, Gloucs.

The name 'Redfield near Bristol' in the list of coke-fired furnaces closed between 1750 and 1788 evidently corresponds with the comment by Samuel Rudder (1779, 294) that in the parish of Bitton, to the east of Bristol, 'Great quantities of coal are dug . . . Here is also plenty of iron-ore, and rich cinders of the same metal, for smelting of which a furnace hath lately been erected, where they use coke instead of charcoal'. The site does not appear in the 1794 list or any later compilation. No further references to this site in local topographical works have been found: H T Ellacombe (1881, 231–2, 238, 240) describes two iron forges elsewhere in the parish but makes no mention of a furnace at Redfield. A study of possible sites on the Bitton tithe map of 1841 (Bristol Record Office, EP/A/32/8) suggests that the furnace may have been at or near the point at which Redfield Lane crosses the River Boyd about a mile north of the village of Bitton (ST/688713), where the parcel on the west bank of the river immediately south of the lane is called Iron Mill Ground. The owner in 1841 was Samuel Whittuck, as it was in 1819, at the time of the inclosure award (Gloucs. Record Office, Q/RI 24), which establishes that Iron Mill Ground was old inclosure, but immediately adjoined an area of common field named Redfield. There are no surface remains at Iron Mill

Ground today to suggest that there was once a furnace there. Recently, however, Dr Chris Evans has found a Chancery action concerning what was known as the Boyd River Furnace, which was clearly the works at this site. The evidence produced in this case sheds considerable light on an interesting and unsuccessful venture, which was some distance from the main group of Gloucestershire ironworks in the Forest of Dean. The furnace at Redfield was built in 1776 but seems not to have worked after 1778 (Evans 1991).

Seacroft, Yorkshire W.R.

A furnace at Seacroft (SE/3536), four miles north east of Leeds, was operated by the Spencer partnership between 1696 and the mid-18th century, although it does not appear in the 1717 list (Schubert 1957, 387). Raistrick and Allen (1939, 169, 172) estimated average output at 300 tons p.a. from the Spencer accounts. Seacroft re-appears in the list of closed coke-fired furnaces appended to the 1750–88 list of charcoal-fired furnaces (in which it does not appear), which suggests that after the Spencer partnership gave up the works an attempt was made to use coke there. The site also appears in the 1794 list, but without the name of either owner or occupier and with only the letter 'D' (for down?) in the column for charcoal furnaces. No other plant is mentioned. The furnace was said to have been blown by water and to have been built in 1780.

Wiley, Salop

The older of the two furnaces at Wiley appears in both the list of charcoal-fired furnaces closed between 1750 and 1788 and in the list of coke-fired furnaces which follows it. The furnace was built between 1609 and 1618 and passed through various hands until 1733, when Richard Ford and Thomas Goldney took over the site and began smelting with coke in September that year. This concern continued until 1757, when it was succeeded by a New Wiley Co., which included John Wilkinson. The old furnace (SO/672981) had fallen into disrepair but was rebuilt, while a second furnace was built nearby (SJ/671006). Old Wiley furnace was finally abandoned in 1774: it appears as 'Old Wiley . . . W[iley] Co.' in the list of charcoal-fired furnace closures and simply as 'Wiley' in the list of coke-fired furnaces; since new Wiley furnace continued to operate into the early 19th century, both these entries must refer to the older works (Trinder 1981, 11, 16, 24–26, 37).

References

Archival references are worked into the text; the following published sources are cited there by author and date of publication.

Miscellanea. Local Partnership Deeds. (From the MS. collections of Mr Richard Welford.), *Proc. Soc. of Antiquaries of Newcastle-upon-Tyne*, 3rd series, III (1907–8), 170–1.

- J Aikin. *A description of the country for thirty to forty miles round Manchester* (1795).
- T S Ashton. *Iron and steel in the industrial revolution* (Manchester, 1924).
- B G Awty. 'Charcoal ironmasters of Cheshire and Lancashire, 1600–1795', *Trans. Historic Soc. of Lancs. & Cheshire*, 109 (1957), 71–124.
- I L Bell. 'On the manufacture of iron in connection with the Northumberland and Durham coal-field', in *The industrial resources of the district of the three northern rivers, the Tyne, Wear and Tees, including the reports on local manufactures, read before the British Association in 1863*, ed. W G Armstrong and others (London and Newcastle-upon-Tyne, 1864), 73–119.
- C Bergen. *History of Bedlington ironworks 1736–1867* (Bedlington, n.d. [c. 1948]).
- A Birch. *The economic history of the British iron and steel industry 1784–1879. Essays in industrial and economic history with special reference to the development of technology* (1967).
- Ruth R Brown. 'The Woolwich proof registers 1780–1781', *International Journal of Nautical Archaeology and Underwater Exploration*, 17 (1988), 105–111.
- A E, B F and H M Butler (eds.). *The diary of Thomas Butler of Kirkstall Forge, Yorkshire* (1906).
- W H Chaloner. 'Isaac Wilkinson, potfounder', in *Studies in the industrial revolution presented to T S Ashton*, ed. L S Pressnell (1960), 23–51.
- H T Ellacombe. *The history of the parish of Bitton, in the county of Gloucester* (Exeter, 1881).
- C Evans. 'Failure in a new technology: smelting iron with coke in south Gloucestershire in the 1770s', *Trans. Bristol and Gloucs. Archaeological Soc.*, 109 (1991), 199–206.
- C Evans. 'Opportunity and omission in the industrialization of the north east: ironmaking at Bedlington in the eighteenth century', *Northern History* (forthcoming).
- H A Fletcher. 'The archaeology of the west Cumberland iron trade', *Trans. Cumberland & Westmorland Antiquarian Society*, 1st series, 5 (1881), 5–21.
- R Grant. *Cynon Valley in the age of iron* (Aberdare, 1991).
- H Green. 'Melin-y-Cwrt Furnace. Earth, air, fire and water', *Trans. Neath Antiquarian Soc.* (1980–1), 43–80.
- J E Hickey. *Dukinfield past and present* (Stalybridge, 1926).
- W Hutchinson. *The history and antiquities of the county palatine of Durham* (Newcastle-upon-Tyne, 1787).
- J Y Lancaster and D R Wattleworth. *The iron and steel industry of west Cumberland: an historical survey* (Workington, 1977).
- J D Marshall and M Davies-Shiel. *The industrial archaeology of the Lake Counties* (Newton Abbot, 1969).
- E Martin. *Bedlington iron and engine works (1736–1867). A new history* (Newcastle-upon-Tyne, 1969).
- A N Palmer. *John Wilkinson and the old Bersham ironworks* (Wrexham, 1899).
- D R Phillips. *The history of the Vale of Neath* (Swansea, 1925).
- A Raistrick. *Quakers in science and industry. Being an account of the Quaker contribution to science and industry during the 17th and 18th centuries* (2nd ed., Newton Abbot, 1968).
- A Raistrick and E Allen. 'The south Yorkshire ironmasters (1690–1750)', *Economic History Review*, 9 (1939), 168–85.
- Riden, P. 'The output of the British iron industry before 1870', *Economic History Review*, 2nd series, 30 (1977), 442–59.
- P Riden. 'Eighteenth-century blast furnaces: a new checklist', *Historical Metallurgy*, 12 (1978), 36–9.
- P Riden. *A Gazetteer of charcoal-fired blast furnaces in Great Britain in use since 1660* (Cardiff, 1987).
- P Riden. *John Bedford and the ironworks at Cefn Cribwr* (Cardiff, 1992).
- P Riden and J G Owen. *British blast furnace statistics, 1794–1980* (forthcoming).
- S Rudder. *A new history of Gloucestershire, comprising the topography, antiquities, curiosities, produce, trade, and manufactures of that county* (Cirencester, 1779).
- H R Schubert. *History of the British iron and steel industry from c. 450 B.C. to A.D. 1775* (1957).
- H C Tomlinson. 'Wealden gunfounding: an analysis of its demise in the eighteenth century', *Economic History Review*, 2nd series, 29 (1976), 383–400.
- B Trinder. *The industrial revolution in Shropshire* (Chichester, 2nd ed. 1981).
- R F Tylecote. 'A survey of iron and steel making sites in the Tyne-Wear area of the United Kingdom', *Canadian Mining and Metallurgical Bulletin*, 76 (1983), 90–101.
- J Wallis. *The natural history and antiquities of Northumberland and so much of the County of Durham, as lies between the Rivers Tyne and Tweed* (1769).
- G Yates. *Map of the county of Glamorgan* (1799; facsimile ed. with introduction by G Walters and B James, South Wales Record Society, 2, 1984).

Acknowledgement

As a number of comments in the text make clear, I am particularly grateful for the help of Dr Chris Evans of the Historical Manuscripts Commission with this article, for which he generously allowed me to read two papers of his own in advance of publication and drew my attention to a number of stray references which would otherwise have escaped me.

Abstract

A list, compiled in 1788, of coke-fired blast furnaces which were both built and abandoned between 1750 and 1788, survives amongst other lists of ironworks in the Boulton & Watt archive at Birmingham Reference Library. The 14 furnaces listed there, plus one other with a similar history, are located on the ground and their history discussed in the light of other evidence. The paper forms part of the author's wider study of contemporary statistical evidence relating to the British iron industry in the 18th and 19th centuries.

Biographical note

Philip Riden is Lecturer in Local History in the Department of Extra-Mural Studies at the University of Wales College of Cardiff.