THE VALE ROYAL COMPANY AND ITS RIVALS

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It is a surprise to some that so rural a county as Cheshire should have had an iron industry, but it did. Its history was told at length in these *Transactions* some thirty-five years ago by Mr B. G. Awty.[1] A few years earlier Professor B. L. C. Johnson published a detailed study for the period 1688 to 1712 of works in which Philip Foley was interested.[2] One of the ironworks they referred to was Vale Royal Furnace, near Vale Royal Abbey, on the eastern side of Delamere Forest near Northwich and Winsford in central Cheshire. As we shall see, it belonged successively to two firms of ironmasters, one of which is well known from the work of Awty and Johnson, whereas the other has hitherto remained obscure.

From the sixteenth to the mid eighteenth century, iron was produced by an indirect process using charcoal as fuel. Before that, it was made by direct reduction in bloomeries, a process that persisted in parts of Lancashire until well into the eighteenth century.[3] In the indirect process the ore (commonly referred to as mine) was smelted in a blast furnace using charcoal and the resultant molten iron was tapped at intervals and cast as pig (or sow) iron or into cast-iron goods. Afterwards the metal was taken to a forge and remelted in a hearth called a finery, in which the excess carbon was oxidized; the resultant bloom of iron was drawn out into bar iron under a water-powered helve hammer, being reheated as necessary in another hearth called a chafery. The process made more efficient use of charcoal and was capable of being carried out on a larger scale than the older one.[4] The main limitation on the production of a

furnace and forges seems to have been the amount of wood available within a few miles of the ironworks for conversion into charcoal.[5] Some bar iron was slit in a slitting mill into rods suitable for making nails. Bar and rod iron were an ironmaster's finished product and were the raw materials for a host of workmen, who, financed and organized by ironmongers, made wrought-iron goods.[6]

Outside the Weald, the production of cast-iron goods was little more than a sideline. Cast-iron hammers, anvils, and plates were needed in forges; in some areas they were produced in specialist furnaces such as Hales (i.e. Halesowen) Furnace (now West Midlands), but even there cast-iron goods were only a modest proportion of the output.[7] In the late seventeenth century many furnaces produced modest amounts of 'country castings'.[8] Some Midland furnaces made a few tons a year of pots, that is cast-iron cooking vessels; the artisans of that trade were mainly members of the Legas family.[9]

In 1707 Abraham Darby, a brassfounder at Bristol, patented a new method of casting iron pots. His pots were thinner, and hence cheaper, than those made by older means. In 1709 he acquired Coalbrookdale Furnace and succeeded in smelting iron using coke. Coke pig iron was suitable for casting pots, but very little was made into bar iron until several decades later.[10] For the next half century the iron industry was largely divided into a charcoal industry producing bar iron and a coke industry producing cast iron. The only charcoal furnace known to have cast a significant quantity of pots in that period was Backbarrow in Furness between 1735 and 1748, when Isaac Wilkinson was potfounder there.[11]

I

Before about 1560 the newer process was confined to the Weald. Afterwards it spread to many coalfields, where ironstone (iron carbonate) occurs in seams in the coal measures, and to the Forest of Dean and south Glamorgan, where there is an ore known to geologists as limonite or brown haematite (hydrous iron oxide).[12] Those kinds of mine produced, respectively, coldshort and tuff (tough) iron. Coldshort iron is liable to shear when cold; tuff iron sometimes tended to be redshort, that is

liable to break at red heat, the worst fault that iron can have. To strike a mean between them a blend iron was sometimes made, either by charging the furnace with two types of mine to produce blend pig iron, or by using different types of pig iron together in the finery.[13] The relatively high cost of transport generally confined ironworks, especially furnaces, to areas where mine was available; sometimes forges were at a distance from the edge of the orefield, where they did not compete with furnaces for the supply of charcoal.[14] The iron industries of Shropshire,[15] east Derbyshire,[16] Staffordshire,[17] and Denbighshire[18] all fitted into the general pattern, save that in Denbighshire the industry developed slightly later than in the others, perhaps due to its relative remoteness.

The earliest furnace and forge in Cheshire were probably those of Sir Harry Delves at Doddington and Lea, which were apparently in existence in 1657.[19] They lay in the extreme south of the county in or near the north Staffordshire coalfield. The later Street and Lawton Furnaces were in the same general area. Vale Royal and Oulton Furnaces, further north, were unusual in that they were a considerable distance from any source of mine. Surviving accounts for the former show it to have made blend pig iron by mixing Staffordshire ironstone with haematite ore from Furness and west Cumberland, known from its colour as redmine.[20] The other advantage of the district was probably the availability of charcoal from Delamere Forest.

A typical early ironworks consisted of a furnace and a forge, usually in common ownership and often on adjacent sites.[21] From the mid seventeenth century it became more usual for there to be two forges for every furnace; they would generally be some miles apart and often were rented from different landlords.[22] By the early eighteenth century there were a number of forges in the Severn basin with no particular connection with any furnace; they relied on purchasing pig iron from furnaces sometimes far afield.[23] Thus in the late seventeenth century the iron industry was dominated by a few great industrialists and partnerships who made pig iron for their own forges, such as Thomas Foley and his sons in the Stour valley (Worcs.) and Forest of Dean,[24] Humfrey then John Jennens in Derbyshire and north Warwickshire,[25] Boycott & Co. in central Shropshire,[26] and Richard Foley of Longton in north Staffordshire and Cheshire. In the early eighteenth century

most of those groups of ironworks broke up: the Foley partnership withdrew to the Forest of Dean;[27] and only in Cheshire and Staffordshire did an extensive partnership continue and expand.

Except in the Weald, where the production of cannon was important,[28] throughout the seventeenth and early eighteenth century the main product of the iron industry was bar iron suitable for the production of wrought-iron goods.[29] A major market for bar iron was the iron manufacturing district of Birmingham and the Black Country. The forges of the Severn basin could use cheap river transport as far as Bewdley.[30]

II

The lack of a navigable waterway connecting Cheshire and the Black Country (until the opening of the canals in the late eighteenth century) placed Cheshire at a considerable disadvantage in that expensive land carriage was necessary. The cost of transport was minimized by organizing the trade so that iron should, as far as possible, always move towards its eventual market as it passed through successive stages of production; that was achieved by uniting all the works under a single firm, which may conveniently be described as the Cheshire Ironmasters. It can be traced back to the mid 1670s, when Richard Foley of Longton brought together Lawton Furnace[31] and the forges at Cranage[32] and Warmingham;[33] he already had Mearheath Furnace and Consall Forge in north Staffordshire, later known (with Oakamoor Forge) as the Moorland Works.[34]

In the decade from the death of Richard Foley in 1679, the works passed rapidly through the hands of a succession of relatives.[35] About 1685 the works in Cheshire were transferred to the Yorkshire ironmasters William Cotton, Thomas Dickin, and Dennis Heyford, for whom they were managed by Thomas Hall of Cranage.[36] In 1689 John Wheeler took over the Moorland Works, employing Obadiah Lane as manager; to them were added in or about 1692 Chartley Forge and Lord Paget's Works (Canckwood or Cannock Wood and Abbots Bromley Forges and Rugeley slitting mill), all in Staffordshire; they were supplied with pig iron from furnaces in Cheshire.[37] In 1696 Thomas Hall, who had probably just bought out Dickin

and Heyford, made Obadiah Lane an equal partner in ironworks in Cheshire; Lane shared his part with his Staffordshire partners, John Wheeler and Philip Foley;[38] Hall probably shared his part with Daniel Cotton and possibly others.[39] In 1707 the Cheshire and Staffordshire partnerships were amalgamated into a single firm,[40] which, although there were several reconstructions of the partnership, remained intact until about 1780.

In 1698 the Cheshire Partnership leased a corn mill at Bodfari in Flintshire and converted it into a forge.[41] In 1707 the Cheshire and Staffordshire Partnerships were amalgamated into a single firm,[42] which acquired Doddington Furnace and Lea Forge (Cheshire) in 1710.[43] Outside the partnerships, from 1683 Thomas Hall also had held Madeley Furnace in north Staffordshire,[44] and presumably its associated forges at Norton and Winnington. Following the acquisition of Doddington, Thomas Hall and his partners had a local monopoly in the iron industry except for a couple of forges held by Thomas Hart, whom they supplied with pig iron.[45] From 1711 there was an associated partnership operating in Lancashire, usually called the Cunsey Company; the original partners there were Edward Hall, Thomas Cotton, William Rea, Ralph Kent, and Robert Foley of Stourbridge, who was soon replaced by Edward Kendall. Initially they had works only at Cunsey and elsewhere in Furness, but later the company expanded into south Lancashire, as we shall see.[46]

III

Vale Royal Furnace was built by Thomas Hall for the Cheshire Partnership in 1696.[47] It was most unusual in being a considerable distance from any source of iron ore. The objective was to use haematite ore from Furness and west Cumberland, brought by sea to Frodsham, mixed with some Staffordshire ironstone.[48] The agreement with the landlord was probably for Hall to build a furnace before midsummer 1697 and then rent it for twenty-one years from that date, since it is implicit in the various agreements mentioned below dated 1716 to 1718 that the landlord would not have possession of the furnace until midsummer 1718. Thomas Hall also took a lease

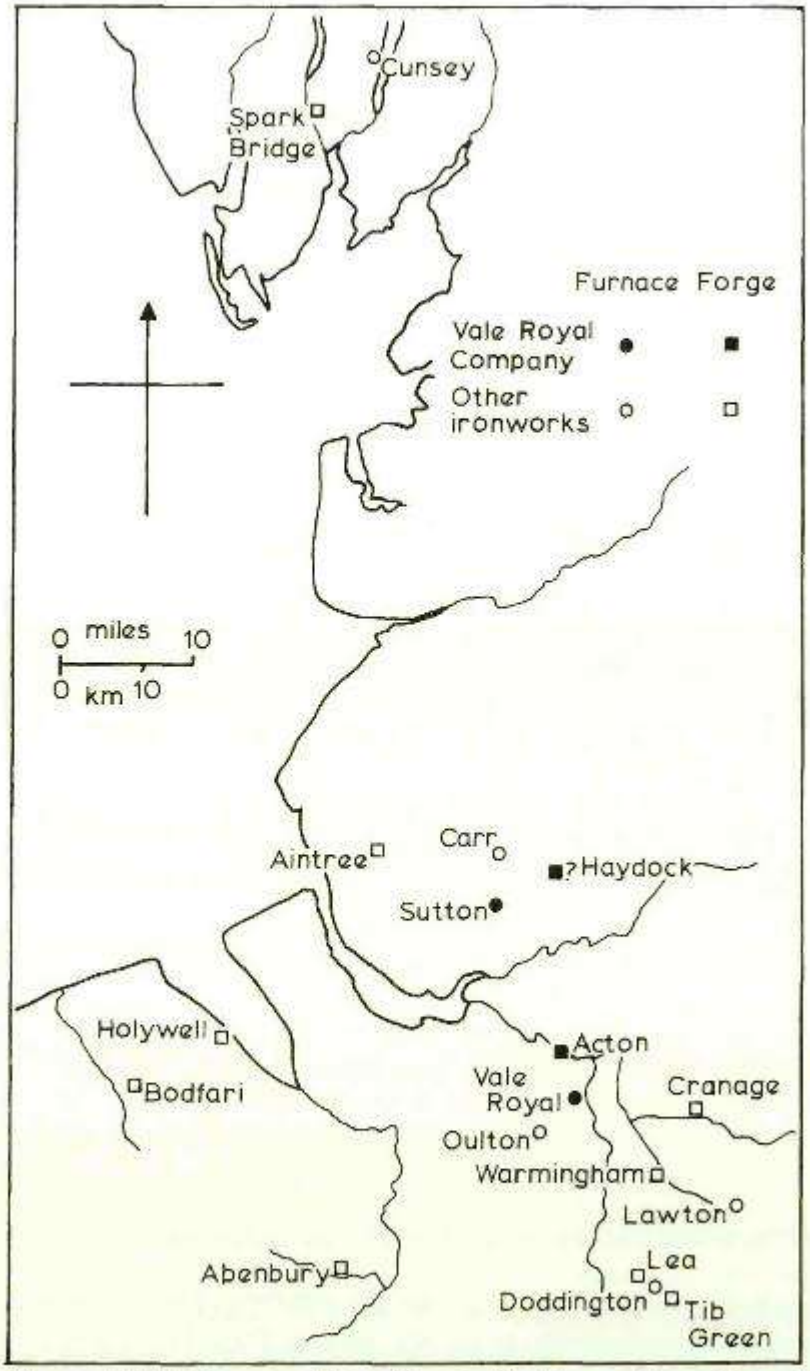

Figure 1 *Blast furnaces and finery forges in Cheshire, and Lancashire and Flintshire about 1725. (Redrawn by Peter Robinson)*

of Pettypool Farms in 1696,[49] and was permitted to charge the rent for them in the ironworks accounts since they had been taken for the benefit of the furnace;[50] this suggests that the furnace stood beside the brook that flows out of Pettypool.

Vale Royal Furnace's output provided additional pig iron for Warmingham and Cranage Forges, for the trade into Staffordshire, and from 1698 for Bodfari Forge. At the same time Lawton Furnace mainly supplied pig iron for Abbots Bromley, Tib Green, and Cranage Forges and to the owners of various forges in Shropshire and Staffordshire.[51] In 1709 Tib Green Forge on the border of Cheshire and Staffordshire was transferred by the partnership to Thomas Hart, their manager there;[52] he renewed the lease in 1712. In March 1709/10, with William Burslem of Newcastle under Lyme (Staffs.), he took over Bodfari Forge and contracted to take 100 tons a year of Vale Royal pig iron for eight years; George Sparrow of Glasshouse, Wolstanton (Staffs.), was quickly brought into the partnership. In 1711, with other partners, Thomas Hart took grist mills at Greenfield, below Holywell in Flintshire, and converted them into a wiremill. In 1715 William Burslem had to hand over most of his property to Lord Gower, who paid a large debt for him. Following Burslem's death the next year, Bodfari Forge was sold back to the Cheshire Partnership. Thomas Hart continued running Tib Green Forge and the wiremill at Holywell until his bankruptcy in 1729. Tib Green Forge then closed,[53] and the wiremills at Holywell passed to a copper firm.[54]

IV

Abraham Darby's success in foundry work at Coalbrookdale enabled him to build a second furnace there in 1715.[55] He and his partners, John Chamberlain and Thomas Baylies, branched out by acquiring land for a furnace at Dolgûn near Dolgellau and agreeing in 1716 to take over Vale Royal Furnace from midsummer 1718. But the death of Abraham Darby in 1717 and the lack of a partnership agreement led to confusion.[56] An agreement made on 31 January 1717/18 should have resolved the confusion: Mary Darby kept her husband's patent and took over the furnace site at Dolgûn

(which was soon sold off); she and John Chamberlain retained Coalbrookdale; the third partner, Thomas Baylies, took over Vale Royal Furnace; Chamberlain and Mary Darby also consented to judgment being entered against them.[57] Thomas Baylies, however, was unable to extract his capital from Coalbrookdale at once. He had Chamberlain's shares there sold by the sheriff[58] and in November 1718 obtained letters of administration as a creditor to the estates of Abraham Darby and his widow, who did not long survive her husband. Eventually, by various transactions, he extracted at least £1,250 from his former partners.[59] Even that did not leave him with the cash he needed to help stock Vale Royal Furnace.

Although Vale Royal Furnace was assigned to Baylies in January 1717/18, he did not have actual possession until the following midsummer, but should have had time to collect a stock of charcoal (or possibly pitcoal) and ore and so be ready in the autumn to blow the furnace in. Baylies apparently did not expect to finance the stock of Vale Royal alone, even had he been able to extract his money from Coalbrookdale. On 28 May 1718 he therefore formed a new partnership, the Vale Royal Company.[60] It was an auspicious time to begin, as the price of iron was high because a wartime embargo on trade with Sweden had cut off the main source of iron imports. Charles Cholmondeley of Vale Royal Abbey (the landlord of the furnace) took a third share and £100 a year as rent; Richard Turner of Pettywood and William Watts of Newton near Middlewich each took a sixth, and Thomas Baylies had the remaining third. The capital was fixed at £5,000; the agreement mentioned that they had acquired the lease of a corn mill at Sutton (Lancs., now part of St Helens), which they renewed for thirty-one years; they also intended to take a lease of Dean Mill at Haydock (a few miles east of Sutton) from Peter Legh of Lyme and some waste land at Acton (a few miles north of Vale Royal) for the erection of forges and furnaces.[61] The lease of Sutton Furnace ran from April 1719; in May 1719 a 'furnace or smelting milne' was probably in the course of erection there. By the same date the necessary leases had been obtained from Thomas Fletwood and others and a 'forge or splitting mill' (presumably a forge and slitting mill) had been built at Acton, probably by Acton Bridge. There is nothing to indicate whether an ironworks was built at Haydock. Thomas

Baylies was at the time living at Marton, Cheshire,[62] presumably to oversee the operations of the new company.

Under the 1718 partnership agreement, Thomas Baylies's capital would have consisted of the £1,167 14*s.* 7*d.* due to him from the Coalbrookdale Company[63] and £500 more, a modest sum which he could easily have borrowed. In March 1721 he had still not paid up his capital, probably because of his inability to extract his money from the Coalbrookdale Company. By that time the capital of the partnership had been increased to £10,000 and the other partners had paid up their shares. A further deed was signed requiring Baylies to deliver up the 1716 articles of agreement for cancellation and to pay Robert Young, the clerk, one sixth of the increased capital, again £1,666 13*s.* 4*d.*; in default he was to forfeit his share.[64] The reason why a signed copy of the deed should be in a collection derived from Coalbrookdale is not clear: Thomas Baylies had returned to Coalbrookdale, but was not mentioned in the accounts there after October 1719.[65] It is possible that the agreement was deposited as security for a loan to enable Baylies to pay what he owed for his share at Vale Royal.

After 1721 little is known of the activities of the Vale Royal Company except that it sold ten tons of pig iron to the Coalbrookdale Company in 1725.[66] What is certain is that it was not a success. On 22 June 1731 Charles Cholmondeley wrote to his friend Peter Brooke, soliciting his services as a trustee for the benefit of his creditors:

> tho' I have often set about [my affairs] the melancholy state of them hath as often turned my head and my resolution hath failed me, tho' I knew it to be absolutely necessary; & the fretting hath once or twice given me a fitt of illness or two, to see myself brought into such unfortunate circumstances by the obstinacy of one man (Dick Turner) & being engaged with him in that unlucky partnership whereby I have lost 10000*l* besides other disadvantages, & without which I had owed nothing of consequence to have given me uneasiness; & tho' even this is better than if I had brought myself into it by any extravagence of my own yet I cannot think back upon it with any temper or patience.[67]

The assignment for the benefit of his creditors was dated 22 October 1731 with Peter Brooke and four others as trustees; Cholmondeley assigned them his life interest in the Vale Royal estates under his marriage settlement, reserving for himself only

an annuity of £300 after his wife's death. In the meantime they presumably intended to live on her pin money under the settlement.[68] In 1733 an Act of Parliament had to be obtained to authorize the sale of part of the estate to help pay the debts.[69] The debts were stated to amount to £12,000, 'by engaging for several debts due by his father by bond or otherwise, and being involved in a partnership for the carrying on of ironworks upon his own estate and other misfortunes'.[70] Charles Cholmondeley's trust continued until 1757.[71] He had been a substantial landed gentleman and a member of parliament. His wife was the daughter of Thomas Pitt, earl of Londonderry, and granddaughter of Thomas 'Diamond' Pitt, who made a fortune in trade in India. The ironworks partnership reduced him from a rich man to a ruined one, but he retained his seat in parliament until his death in 1756,[72] and as his estate was settled it passed to his descendants, and his grandson was raised to the peerage as Lord Delamere.

Of the fate of the other partners little is known. In 1731 Charles Cholmondeley's trustees paid Anne and Mary Watts, spinsters, debts due under bonds dated 1721; in 1738 they paid a debt of £505 10*s*. to the personal estate of Richard Turner. Thomas Baylies became manager of the York Buildings Company's ironworks at Abernethy in the Highlands of Scotland, which were built about 1729.[73] It was not his fault that that company collapsed in a morass of debt about 1735;[74] their iron business was in too remote a place to be capable of profit.[75]

V

The failure of the Vale Royal Company needs to be examined in relation to the availability of raw materials and the markets for its products. When Thomas Baylies took over Vale Royal Furnace he probably intended, as the assignment of the lease to him implies,[76] to make pots there. As the patent for the process had been assigned to Abraham Darby's widow, he could not lawfully do so at Sutton (save as her administrator) until the patent expired in 1721. It is indicative of the importance of the patent that soon after its expiry John Cookson built Little Clifton Furnace in Cumberland, a furnace always intended to

use coke.[77] However, Vale Royal was not in fact a particularly suitable place to produce pots, since there was neither pitcoal nor iron ore in the immediate area. That is likely to be the reason why the Vale Royal Company built a second furnace when they had hardly got the first going; Richard Turner came into full possession of a colliery at Thatto Heath, close to Sutton, in June 1718, having previously been a partner there,[78] and presumably persuaded his partners that Sutton was just the place for a coke furnace to make pots. John Evans, an iron pot maker, was certainly living at Sutton in 1736, when his son was buried at Prescot.[79] The Coalbrookdale Company are reported to have had difficulty selling pots at Liverpool, apparently because of competition;[80] the competition may have come from Sutton, but Little Clifton Furnace (Cumb.) would also have competed there. Insistence on the erection, or perhaps continued use, of Sutton Furnace may well be 'the obstinacy of . . . Dick Turner', of which Charles Cholmondeley complained in 1731.

The partnership proposals provided for Baylies to 'procure redmine for makeing or runing all such iron stone as shall be necessary to be used in or about the works aforesaid'.[81] Vale Royal was therefore probably intended to continue producing tough or blend pig iron for use by forges. Apart from Acton Forge and the possible forge at Haydock, the company did not have forges to use the forge pig iron they made. It is unlikely that there was much trade with the Cheshire Partnership, as they had their own sources of supply, including Cunsey Furnace on Lake Windermere; however, there were a number of forges unconnected with the firm that might have been customers for Vale Royal pig iron: Thomas Hart's at Tib Green, Abenbury near Wrexham, Wytheford and Moreton (Corbett) Forges in Shropshire, and Congreve and Brewood Forges between Wolverhampton and Stafford.[82] None of them was closely associated with a furnace, though some would have received pig iron from furnaces in Denbighshire. That Vale Royal pig iron went so far afield is shown by a small quantity being purchased for use in Coalbrookdale Middle Forge.[83]

Acton Forge had a 'splitting mill',[84] presumably a slitting mill, making rod iron for nailmakers. The preferred iron for nailmakers was coldshort, probably because it was cheaper and easier to work, though 'best rods' were sometimes produced in smaller quantities from tough iron.[85] That suggests that pig iron

to be refined at Acton did not come only from Vale Royal, and Sutton may have made some coldshort pig iron for it.

The problems with the Vale Royal Company's market may seem greater with hindsight, for the Company was founded at a time when the prospects could hardly have been better. England, having acquired a Hanoverian monarch, had become involved in a war with Sweden, fought mainly for the benefit of Hanover. An embargo had been placed on Swedish trade on 1 March 1716/17.[86] Since some 60% of the iron used in English manufactures came from Sweden, the embargo caused a shortage of iron and the price rose. Within a year or so Swedish iron was reaching England again via Holland and other third countries, but at a premium of about £4 a ton over the previous price, reflecting the middleman's costs and profit.[87] Thus initially the Company is likely to have been very profitable. With the ending of the war and the embargo, which was lifted early in April 1719,[88] direct Swedish imports were resumed and the prices fell back. The high prices had stimulated the erection of new ironworks, such as Oulton and Sutton Furnaces and Acton, Holywell, and Abenbury Forges; several of them, including Sutton Furnace, probably did not come into operation until after the end of the embargo; the lease for Oulton Furnace was dated 30 March 1719,[89] a mere few days before it ended. From 1725 Russian iron began to be imported for the first time.[90] Those factors combined to depress prices and led to business failures, including those of Thomas Hart and the Vale Royal Company.[91]

When built, both Oulton and Carr Furnaces competed with the Vale Royal Company's two furnaces for supplies of charcoal. None of the Vale Royal partners had much of the experience of the charcoal iron industry and probably did not appreciate the importance of securing the right to buy as much of the local wood as possible. That failure may well have contributed to the company's eventual downfall. In 1719 the Egertons of Oulton Park let Oulton Mill, on the opposite side of Delamere Forest from Vale Royal, to Edward Hall (of the Cheshire Partnership) for conversion to a furnace.[92] (Oulton and Vale Royal Furnaces have in the past been confused, perhaps due to the description by Schubert of Vale Royal as near Oulton;[93] they were, however, clearly distinct). In 1720 on behalf of the Lancashire Partnership, that is the Cunsey

Company, Thomas Hall took Carr Mill, north of St Helens, for the same purpose.[94] By 1727 the Lancashire Partnership also held Aintree Forge;[95] it had been Mr Martingall's bloomery until at least 1717,[96] the occupier being an anchorsmith.[97]

VI

There is no direct evidence of the use of any of the Vale Royal Company's works after its failure, but the presence of the iron pot maker in Prescot in 1736 suggests that Sutton Furnace continued in use for a few more years. In contrast, the Cheshire Partnership continued their operations in Cheshire and Staffordshire until about 1780, with some intervening retrenchments, including the closure of Oulton Furnace probably around 1750.[98] The Cunsey Company's Aintree Forge was idle in 1736, like Acton Forge,[99] but Carr Furnace was linked with that partnership's other furnaces at Cunsey and Duddon as a source for pig iron for Mitton Forges at Stourport (Worcs.) in the 1750s;[100] this suggests they were all using the same ore, evidently redmine from Furness. In 1759 Carr was let to a partnership including George Perry and John Gosling, who were both Coalbrookdale ironmongers;[101] the furnace thereafter used coke and probably local ironstone.

NOTES

1 B. G. Awty, 'Charcoal ironmasters of Cheshire and Lancashire 1600–1785', *T.H.S.L.C.*, CIX (1957), pp. 71–121. The two branches of Hereford and Worcester R.O. are here referred to as Hereford R.O. and Worcester R.O.

2 B. L. C. Johnson, 'The iron industry of Cheshire and north Staffordshire 1688–1712', *North Staffordshire Field Club Transactions*, LXXXVI (1953–4), pp. 32–55, mainly from accounts now in Hereford R.O., E12/F/VI [hereafter Foley MSS.], MAf, MBf, MCf, and MDf series.

3 *Travels through England of Dr. Richard Pococke*, ed. J. J. Cartwright (Royal Historical Society, Camden N.S. XLII, 1888), I, p. 13; William Lewis, 'The chemical and mineral history of iron' (MS., *c.* 1775, in Cardiff Central Library, MS3.250), IV, pp. 76, 79.

4 H. R. Schubert, *History of the British iron and steel industry from c. 450 B.C. to A.D. 1775* (London, 1957), chapters XIV and XVI.

5 It was generally uneconomic to bring charcoal from greater distances: G. Hammersley, 'The charcoal iron industry and its fuel 1540–1750',

Economic History Review [hereafter *Econ. H.R.*], 2nd ser., XXVI (1973), pp. 606–608.

6 For further detail of the slitting mill see Schubert, *History of iron and steel*, pp. 304–312; for a useful summary of recent views on the economic history of the industry see J. R. Harris, *The British iron industry 1750–1850* (London, 1988), pp. 1–53; for details of economic organization see, for example, M. B. Rowlands, *Masters and men in the west Midlands metalware trades before the industrial revolution* (Manchester, 1975).

7 Foley MSS., DEf/1 and DEf/12–13; Worcester R.O., 899:310 BA 10477, nos. 141–165 (Knight accounts).

8 Sheffield Archives, SIR/1–5 and SIR/12–19, various.

9 Examples of country castings from Cheshire and Lancashire cannot be provided. John Legas was paid for his services at Hampton Loade Furnace (Salop.) and Grange and Coven furnaces (Staffs.): Foley MSS., box 1119, receipt, 12 Apr. 1662; and James Legas bought 'pot iron' at Blakeney Furnace (Glos.) and Bishopswood Furnace (Herefs.) from 1705 to 1710: Foley MSS., DFf/1–6.

10 For the career of Abraham Darby see A. Raistrick, *Dynasty of ironfounders: the Darbys of Coalbrookdale* (London, 1953) and Nancy Cox, 'Imagination and innovation of an industrial pioneer: the first Abraham Darby', *Industrial Archaeology Review*, XII (2) (1990), pp. 127–144; note also Hammersley, 'Charcoal iron industry', pp. 610–612.

11 W. H. Chaloner, 'Isaac Wilkinson, potfounder', in *Studies in the industrial revolution presented to T. S. Ashton*, ed. L. S. Pressnell (London, 1960), pp. 23–51; D. Cranstone, 'Isaac Wilkinson at Backbarrow', *Historical Metallurgy*, XXIII (1991), pp. 87–91; Lancs. R.O., DDMc 30/1–9; Barrow in Furness R.O., z192.

12 J. D. Kendall, *The iron ores of Great Britain and Ireland* (London, 1893). In contemporary usage 'ore' seems to have referred to haematite minerals only; 'mine' was a more general term also including ironstone.

13 Harris, *British iron industry*, pp. 19–20; National Library of Wales, Bedford papers, 'Discourse on coldshort'.

14 For distribution maps of furnaces see B. L. C. Johnson, 'The Foley partnerships: the iron industry at the end of the charcoal era', *Econ. H.R.*, 2nd ser. IV, p. 321; idem, 'The charcoal iron industry in the early eighteenth century', *Geographic Journal*, CXVII (1951), p. 168. A distribution map of iron ores worked in the same period would look very similar.

15 There is no adequate printed account, but see Robin Chaplin, 'A forgotten industrial valley', *Shropshire Newsletter*, no. 36 (June 1969).

16 Philip Riden, 'The charcoal iron industry in the east Midlands 1580–1780', *Derbyshire Archaeological Journal*, CX (1990), pp. 64–84.

17 Peter Lead, 'The north Staffordshire iron industry 1600–1800', *Historical Metallurgy*, XI (1977), pp. 1–14.

18 Ifor Edwards, 'Charcoal iron industry in east Denbighshire 1630–90', *Denbighshire Historical Society Transactions*, IX (1960), pp. 23–54; idem, 'Charcoal iron industry of Denbighshire *c.*1690–1770', ibid., X (1961), pp. 49–97.

19 He bought pig iron in the Forest of Dean: P.R.O., SP 18/156B; and

shipped it to Uffington near Shrewsbury: Shrewsbury Library, deed 18289.

20 Johnson, 'Iron industry of Ches.', pp. 32–55, from Foley MSS., MDf series.

21 For example Perry Furnace and Forge, Bromwich Furnace and Forge, Chartley Furnace and Forge, Stone Furnace and Chebsey Forge (at Norton Bridge), and Ellastone Forge and Oakamoor Furnace (in 1619 all in Staffs.): P.R.O., C 3/493/93. Considerations of space prevent this point and those covered by the following two notes being more fully argued here, nor does space allow full references for the works mentioned in the two succeeding notes.

22 For example Lawton Furnace and Warmingham and Cranage Forges, Madeley Furnace and Norton and Winnington Forges, the Moorland Works: all referred to elsewhere in this paper.

23 Including many of the forges of Shropshire, Brewood, Congreve, and Swindon (Staffs.), Wilden, Shelsley, Powick, and Redditch (Worcs.), Clifford (Warws.), Strangworth and Peterchurch (Herefs.), and Mathrafal (Mont.).

24 R. G. Schafer, 'Genesis and structure of the Foley "Ironworks in Partnership" of 1692', *Business History*, XIII (1971), pp. 19–38.

25 There is no comprehensive account of their activities, but see W. Harrison and C. Willis, *The great Jennens case* (Sheffield, 1879); R. Johnson, 'Seventeenth century iron works at Bulwell and Kirkby', *Transactions of the Thoroton Society of Nottinghamshire*, LXIV (1960), pp. 44–47; Riden, 'Charcoal iron industry in east Midlands', pp. 69, 71; Schafer, 'Genesis of Foley partnership', p. 29 (from Foley MSS., KG series); Birmingham Central Library Archives Department, MSS Holte 18–20 and 88–91; P.R.O., C 78/1030/2; R. A. Pelham, 'The west Midlands iron industry and the American market in the eighteenth century', *University of Birmingham Historical Journal*, II (1949–50), p. 145 n.

26 Shrewsbury Library, deeds 3100, 3230, 14483.

27 Foley MSS., DEf and DFf series.

28 H. Cleere and D. W. Crossley, *Iron industry of the Weald* (Leicester, 1985), pp. 170–180, 194–211.

29 See works cited in notes 1, 2, 14–18.

30 Johnson, 'Charcoal iron industry in 18th cent.', pp. 170–171.

31 Foley MSS., MAf/4, 32, 34.

32 Two tons of Mearheath pig iron was sent to Cranage in 1677; other sales were to individuals: Foley MSS., MAf/4.

33 Awty, 'Charcoal ironmasters', p. 79.

34 Foley MSS., MAf series.

35 Successively his son Richard Foley (a Guinea merchant), half brother John Foley (a Turkey merchant), and the latter's brother-in-law Henry Glover (the Foleys' ironworks general manager): Hereford R.O., E12/F/IV/Glover; Awty, 'Charcoal ironmasters', p. 79.

36 Awty, 'Charcoal ironmasters', pp. 84–86. Cotton and Heyford also leased Lord Paget's works (Staffs.) in 1684: Foley MSS., MAc/4.

37 Foley MSS., MAf/15–31, MCc/1, MAc/4; Johnson, 'Iron industry of Ches.', passim.

38 Foley MSS., MCc/1, MDf/1ff.
39 The identity of the partners is not quite certain, but compare list of partners in 1707: Johnson, 'Iron industry of Ches.', p. 35.
40 Foley MSS., MCc/7.
41 Staffs. R.O., D593/C/21/4/1/10.
42 Foley MSS., MCc/7.
43 Awty, 'Charcoal ironmasters', p. 92.
44 Cheshire R.O., DCR 27/8.
45 Foley MSS., MDf/9–11, MDf/25–26.
46 A. Fell, *The early industrial history of Furness and district* (Ulverston, 1908; reprinted London, 1968), pp. 208, 265; P.R.O., E 112/957/107, Edward Hall.
47 Cheshire R.O., DBC 2309/2/9; Foley MSS., MDf/1–2.
48 Johnson, 'Iron industry of Ches.', pp. 36–40.
49 Cheshire R.O., DBC 2309/2/4.
50 Foley MSS., MDf/1–3.
51 Foley MSS., MDf passim; Johnson, 'Iron industry of Ches.', passim.
52 Foley MSS., MDf/10.
53 Staffs. R.O., D593/C/21/4/1/10–13; P.R.O., C 55/5438, no. 4 (Close Roll 5 Geo. II pt. 14). They also refer to the coal and other mining interests of Burslem and Hart in Flintshire.
54 K. Davies and C. J. Williams, *The Greenfield valley* (Holywell, 1986), pp. 31–32.
55 Raistrick, *Dynasty of ironfounders*, p. 103.
56 Ibid., pp. 44–48; R. A. Mott, 'Coalbrookdale: the early years', *Transactions of the Shropshire Archaeological Society*, LVI (1957–60), pp. 82–93; and as next note.
57 Cheshire R.O., DBC 1063/10, 31 Jan. 1717; Wiltshire R.O., Goldney collection, 473/156, 25 Nov. 1722, recitals.
58 Mott, 'Coalbrookdale', p. 91.
59 P.R.O., PROB 6/94, p. 112; Wiltshire R.O., 473/156, 25 Nov. 1722 and 1 July 1723, recitals.
60 Lancs. R.O., DDKe, uncatalogued, 1718.
61 Ibid.
62 Ibid., 1719.
63 Cheshire R.O., DBC 1063/10, 31 Jan. 1717.
64 Lancs. R.O., DDKe, uncatalogued, 1720; Shropshire R.O., 245/3.
65 Mott, 'Coalbrookdale', 89–91.
66 Shrewsbury Library, MS. 330.
67 J.R.U.L.M., Brooke of Mere [hereafter Brooke MSS.], III/4/1, 22 June 1731. Original spelling and punctuation retained.
68 Cheshire R.O., DBC 1621/Delamere/20A, 22 Oct. 1731.
69 Brooke MSS., III/4/1, copy bill and Act of Parliament.
70 Ibid., Act, p. 5.
71 Brooke MSS., III/4/1, accounts; Cheshire R.O., DBC 1621/Delamere/18.
72 R. Sedgwick, *The House of Commons 1715–54* (2 vols, London, 1970), I, pp. 550–551; II, p. 352; *Dictionary of National Biography*, s.vv. Thomas Pitt (1653–1726) and Thomas Pitt (1688?–1729).

73 Scottish R.O., GD248/135/1/30.
74 Ibid., GD248/135/1/passim. See also the *Addendum* below.
75 J. M. Lindsay, 'The iron industry in the Highlands: charcoal blast furnaces', *Scottish Historical Review*, LVI (1977), pp. 59–60.
76 Cheshire R.O., DBC 1063/10, 31 Jan. 1717.
77 J. Y. Lancaster and D. R. Wattleworth, *The iron and steel industry of west Cumberland: an historical survey* (British Steel Corporation, 1977), pp. 19–20.
78 P.R.O., PL 6/61/11.
79 Lancs. R.O., Prescot bishop's transcripts.
80 Norris MSS. in Friends Meeting House, Euston Road, London: information from Mr B. G. Awty.
81 Lancs. R.O., DDKe, uncatalogued, 1717.
82 E. W. Hulme, 'The statistical history of the iron trade', *Transactions of the Newcomen Society*, IX (1928–9), pp. 25–33.
83 Shrewsbury Library, MS. 330.
84 Lancs. R.O., DDKe, uncatalogued, 1719 and 1720.
85 *A selection from the records of Philip Foley's Stour valley iron works 1668–74, part 1*, ed. R. G. Schafer (Worcestershire Historical Society, N.S., IX, 1978).
86 J. F. Chance, *George I and the Northern War* (London, 1909), pp. 210–212; T. S. Ashton, *Iron and steel in the industrial revolution* (2nd edn, Manchester, 1951), pp. 110–112.
87 K.-G. Hildebrand, 'Foreign markets for Swedish iron in the eighteenth century', *Scandinavian Economic History Review*, VI (1) (1958), pp. 3–52.
88 Chance, *Northern War*, p. 304.
89 Cheshire R.O., DEO 189/2, no. 54.
90 Hugh D. Hudson, *The rise of the Demidov family and the Russian iron industry in the eighteenth century* (Newtonville, Mass., 1986), p. 66; A. Kahan, *The plow, the hammer, and the knout: an economic history of Russia in the eighteenth century* (Chicago, 1985), p. 212: 1,522 tons was imported from Russia in 1727, rising to 4,456 tons in 1732.
91 A number of other ironworks closed at this period: other bankruptcies included Charles Lloyd at Dolobran Forge (Mont.) and Thomas Jukes at Peterchurch and Strangworth (Herefs.): H. Lloyd, *The Quaker Lloyds in the industrial revolution* (London, 1975), p. 57; P.R.O., C 54/5417, no. 4; compare Foley MSS., DFf passim, Bishopswood and St Weonards.
92 Cheshire R.O., DEO 189/2, no. 54; cf. ibid., DEO 187/1 and DEO 1/12.
93 Schubert, *History of iron and steel*, p. 357.
94 Awty, 'Charcoal ironmasters', p. 101.
95 P.R.O., E 112/957/107, Edward Hall.
96 *The great diurnal of Nicholas Blundell, vol. 2: 1712–19*, ed. J. J. Bagley (R.S.L.C., CXII, 1970), pp. 83, 87, 215, 240.
97 Information from Mr B. G. Awty.
98 Cheshire R.O., DEO 1/12 and 187/1.
99 Hulme, 'Statistical history', pp. 30–31. Acton Forge was apparently again in use around 1830, being run by William Swift and Son: W. Bryant, *Map of Cheshire* (1831); Pigot & Co., *Directory for the County of*

Cheshire (1834; reprinted Manchester, 1982), p. 49. The Acton tithe award shows a zinc works there.

100 Worcester R.O., 899:310 BA 10477, nos. 142–5 (Knight accounts).

101 Awty, 'Charcoal ironmasters', p. 112. Carr Furnace was probably succeeded by a forge which was in operation in the early nineteenth century: Lancs. R.O., DDGe(E) 815; DDGe(M) 842; *Aris's Birmingham Gazette*, 23 Feb. 1784.

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Addendum

See text at note 74, p. 10: Mr Bob White of Huntsville, North Carolina, tells me that Thomas Baylies died in 1754, having in 1737 left London for Massachusetts, where he and his son managed ironworks.