ART. X – *Mining and Smelting by the Cliffords, earls of Cumberland, in Westmorland in the early Seventeenth Century.*

By RICHARD T. SPENCE, B.A., Ph.D.

THE purpose here is to describe the development of coalmining on Stainmore and, in greater detail than has hitherto been possible, the establishment of an ironworks at Brougham by Francis Clifford, 4th earl of Cumberland (1559–1641). In these projects, the earl was extending to Westmorland the exploitation of mineral resources which he and his elder brother George, 3rd earl (1558–1605) had begun on their Yorkshire properties twenty years earlier. Francis's son Henry, Lord Clifford (1592–1643), later 5th and last earl, was closely associated with him in this work, and effectively took over the management during the 1620s. The Yorkshire projects – various coalmines and the Grassington leadmines in Craven, and the ironworks on the Crimple Beck near Spofforth – are dealt with in a forthcoming article in the *Yorkshire Archaeological Journal*.[1]

In Westmorland, as in Craven, the earls renewed a family tradition of utilising the mineral deposits on their estates. However with both their ironworks, on the Crimple and at Brougham, as will be seen, they did far more than that. The Clifford lords had mined lead, iron and coal at several sites on their Westmorland properties from the fourteenth century. The arbitrators in a dispute in 1580, who had examined the Cliffords' records about Milburn Fell, reported that Earl George's ancestors had 'digged and gotten in the said fell lead ure and Iron and converted the same to their own uses.' A remembrance listed iron mining by lessees of the Cliffords from 1389 to 1500. When Earl George granted part of Milburn Fell to Edmund Sandford Esq. in 1589, he reserved to himself Middle Tongue and 'all mines of lead coal or other metall' in the forest, moors and wastes, with free liberty to dig for, smelt and carry away the same. His 1604 surveyors noted that there used to be a mine for lead ore (the name suggests silver also, as is usual on the northern Pennines) at Eastenfield alias the Silveries on Knock Fell, but it was not then in operation.

There were long-established coal mines in Stainmore, east of Brough Sowerby, shown on Robert Morden's 1695 map of Westmorland, and smaller workings in Mallerstang, at the Fell's End, the latter in lease to Adam Waller in 1604.[2] The rents of the Stainmore pits increased from £5. 8s. in 1573 to £14 in 1612 when Earl George's widow, Countess Margaret, held the properties as her jointure lands. Appleby Castle, nine miles away, was supplied from Stainmore. The countess required her Kirkby Stephen tenants from 1606 to carry a load of coal apiece yearly to the castle from these pits.[3] Otherwise, the coal produced would be consumed locally, wood for fuel now being very scarce at the upper end of the Eden Valley.

Although Countess Margaret died in May 1616, Earl Francis did not get possession of the Westmorland estates until James I settled the inheritance dispute by his award in March 1617. By the summer, the earl had taken the first steps to utilise the mineral and timber resources, neglected for at least half a century since his father's, the 2nd earl's, death in 1571. As in Yorkshire, the earl acted as entrepreneur, and did so at the time he

was relinquishing that role in Craven. Only the coal deposits were being worked in 1617. John Taylor, the earl's man of affairs, assessed the operations, giving the miners twelve pence for drink.[4] It was easy for the earl to take over. He put his own 'bancksman' or overman in charge at Stainmore – successively Anthony Cleasby, William Waller, and Thomas Taylor – with £4 a year salary, and paid the cost of work on the pump and of extending the operations.

This early investment was reflected in higher profits, which from 1618 to 1622 averaged just over £20 a year. They rose to £55. 6s. in 1623, and £35. 8s. 11d. in 1625. In addition, Appleby Castle was heated with coal, saving valuable timber which was better used for building or sold. There were difficulties at the pits in 1626, probably flooding. All that year's profits and £45 more had to be disbursed on 'sinkeinge & workinge att the Coall mynes on Staynemoor for recoverye thereof'.[5] Thereafter, the pits were steadily profitable. As in Craven, Earl Francis later opted out of direct management. Thomas Robinson was leasing the mines between 1638 and 1643 for £20 per annum. The coal then needed for the castle was bought at the pits and carried by the earls' tenants to Appleby.[6]

Production may not have suffered much during the Civil Wars, despite the armies skirmishing on Stainmore. The evidence, indeed, is of heavy demand by the successive Royalist and Parliamentary garrisons at the castle. In 1649, Lady Anne Clifford, who had inherited the estates, began to restore all four Clifford castles, which thereafter consumed large amounts of coal. She bought £83 worth in 1665 – for Appleby, Brough and Pendragon from her own Stainmore mines, and for Brougham from Caldbeck and Hartside in Cumberland.[7]

Earl Francis's expectation of profit from his Westmorland estates rested less on coal than on the potentially far more valuable mining of lead and iron. He paid an expert, Mr Poskatt, two gold pieces (£2. 4s. 2d.) for seeking ore and giving advice. He employed miners to search for lead ore on Knock Fell, John Taylor rewarding them with twelvepence when he went to see their labours in August 1617. Another miner, supervised by Roland Dawson, was set on to look for ironstone. A large quantity of equipment for these men, including dornix canopies, spades and other tools, was purchased by John Taylor in London early in 1618, at a cost of £9. 3s. 8d., and sent to Westmorland.[8]

The annual investment in discovering deposits over the next three years was considerable, and it reveals a shift in interest from lead to iron. The charges of the leadworks on the Fell in 1618 came to £42. 7s. 11d., and there is no mention of any lead being smelted. Groving and searching for lead and now also ironstone, and making trials of some ironstone in 1619 cost about £60; in 1620 £35, though by then ironstone was being sought elsewhere.[9] It was on the strength of these trials that Earl Francis decided in the autumn of 1619 to build an ironworks on his demesnes at Brougham instead of, as probably the first intention, a smelt mill as at Grassington. Tradition had pointed to Knock Fell as the best source for both lead and iron. Failure there forced him to find usable ironstone outside his own properties to fulfill his determination to re-establish smelting on his lands.

Brougham was an almost ideal site for an ironworks. The demesne was in hand. The Rivers Eamont and Lowther converged beside the castle, giving normally ample flow for mill races to power waterwheels. Fuel was readily available from the large reserves of

oaks and birches within the earl's Whinfell Park adjoining Brougham. He had rights of way and carriage. Communications were easy via the main roads south from Carlisle through Penrith to Appleby or Kendal. Furthermore, Brougham Castle was little used by the earl, except in transit to Carlisle. Brougham Hall and village were well screened by the curve of the river so that the nuisance caused by the noise of hammers and fumes would be minimal, the prevailing wind also carrying both away eastwards. The site, too, had a commercial advantage. Although there were several ironworks in Cumbria, none was in that area. The earl could expect a fair market for bar iron, not much below what refined lead would have commanded.

In one sense, Brougham was a manorial ironworks similar to others in Cumbria, the earl owning the site and rights and directly controlling at first the local mining and other supplies of ore. This was far more satisfactory than the rather makeshift arrangements on the Crimple, and made for permanence. George Goodgion gent., long experienced as the earls' officer at the Crimple works, was appointed clerk and overseer at Brougham. He was to remain there until his death in 1631. Furness was the centre of iron mining and smelting in Cumbria, and a bloomer from Cartmel, John Wright, was put in charge of production at Brougham. With Goodgion, he supervised the erection, equipping and early working of the forge.

The site chosen was on the north bank of the Eamont at its confluence with the Lowther. Here, although within Cumberland, was a 'parcel' of the castle demesne of just over two acres. Will Matson and other men made large earthworks for the place on which the forge was to stand, for the dam and head, the mill races above and below the forge, and also the floodhatches. Trickiest, considering the position, would be the weir they built across the rivers. These earthworks were the costliest part of the whole construction – £159. 4s. 6d., with £16. 16s. 6d. more for getting and leading the clay to make and ram the dam and the floodgates.

How many trees were cut down in Whinfell for building the forge, or their value, Goodgion could not say, though he paid 7s. 6d. for twenty to be felled. John Park the carpenter was in charge of all the woodwork, such as the house frame of the forge, the waterwheels, and troughs, these costing £99. 12s. 6d. The sawing of the boards and planks for covering the outshot and to lie over the floodgates and hatches came to £1. 5s. 6d. The wainmen who led the timber were paid £24. 13s. 8d. wages. The earl provided the draught for this work, and for the carting of fuel to the forge. He purchased the oxen for this (four cost £9), and provided permanent grazing for them in the Little Park, selling off the cattle he had but recently bought to stock it for £53. During the building of the forge, the oxen consumed £29. 12s. 6d. worth of hay, grass, fog and straw.[10] Goodgion makes no mention of stone-getting, to line the wheel-pits or for the construction of the furnace and forge and chimneys, or slate for the roofs. There was good stone in Whinfell, and possibly still excellent shaped stone and slate at hand in the ruins of the Roman fort or castle outbuildings.

Although John Wright and his servants rode over from Cartmel several times to oversee the construction, it was Goodgion who equipped the forge with all its 'furniture'. He obtained nails and ironwork from Tanfield in the North Riding, where a founder is known to have been working, had it cast on site into hammers, anvils, gudgeons, brasses, boits, plats and hursts. More of the iron went into hoops, tubs, basketts, swills, waingear and bellows. The hearths, too, were cast at Brougham, and the bellows made

by a specialist bellowmaker. But Goodgion bought a bray for pounding the ore, with other necessaries like flax, tar, pitch, oil and tallow. This equipment, the carriage and Goodgion's riding charges amounted to £145. 9s. 10d.[11]

Altogether, Earl Francis spent £447. 2s. 10d. on constructing his forge, excluding the value of the timber and most of the draught oxen; over four times the cost of the large water corn mill he built shortly after at Weighton on his East Riding estate.[12] This was an immense investment, which explains his altered approach to his Craven mining. It diverted large sums from the earl's Westmorland revenues which should have gone to reducing his huge London debts. Yet from the first he acted with resolution and confidence that the project would be profitable, and so it was to prove.

The Brougham ironworks may have been a bloomsmithy of the Cumbrian type, with the direct process of smelting and forging all under one roof, the furnace being used to reheat the cast iron for forging into bar. However, Goodgion's mention of chimneys in the plural is one clue that it could have had the finery and chafery hearths of the indirect process, akin to ironworks within the clerk's experience in Yorkshire rather than Wright's. Its size would have been at least as big as the Muncaster Head bloomsmithy, 15 yd. by 5 yd., eight to ten feet in height, with 24 ft. chimneys.[13] The bellows and hammer would be worked by undershot wheels. Altogether, it had a more efficient lay-out than the Crimple works. For convenience, the officers' terms of forge and ironworks will be used here. John Wright, the bloomer, and William Collins, the hammer man, managed the iron production. Wright moved to Brougham from Cartmel with his wife Jane and daughter Ann, then aged four. The earl allowed him four kinegates and one horsegate with the draught oxen in the Little Park, £3 a year for hay for his kine, and £1. 6s. 8d. for his firing and getting elders, besides conveyance of turf, ling and peat from Whinfell Park.[14]

None of the ironstone smelted was from Knock, unless it was one of the 'other places' from which some was obtained. The local sources discovered were at Bewley, Colby and Reagill. The latter manor was owned by the earl's brother-in-law Philip, 3rd Lord Wharton, Bewley by the bishopric of Carlisle, and Colby by the Warcops.[15] There is no evidence of either agreements with the owners to work their properties or a claim to seignorial mineral rights such as the earls enjoyed in Craven. Yet Earl Francis was obviously free to mine these deposits as he wished. The recorded costs are for extraction, washing and breaking of the ironstone and carriage to Brougham, without payment of royalties or tithes. One of the miners, William West, was paid five shillings as overseer at Bewley and for searching for ore. Earl Francis built a house for him there.[16] One of his senior officers was at hand to keep an eye on the mining. John Ecton gent., his Westmorland receiver, lived at Bewley Castle, and with John Taylor also supervised Goodgion's management of the whole project.

The miners were paid daily rates, not by measure, until June 1622. The earl provided all the equipment, including tools, mine tubs, ropes and canopies. The Bewley production, measured by the earl's servants, can be gauged by five weeks' work getting 140 bushels capacity of ironstone at 15d. a bushel, about ten and a half tons for £8. 15s. Leading it to the forge cost 7d. a bushel in 1622. By 1630, when all the ironstone smelted was from Colby and Bewley, the carriage costs were 6d. a bushel from Bewley, 8d. from Colby. William West was then still 'overseer of the iron stone getters'.[17]

The local ores were adequate, yet not the best available. The superior quality and

richness of the red Furness haematite ore has long been recognized. This was smelted at Brougham from the beginning. Its greater yield was reflected in John Wright's terms, which allowed him £2 for every ton of iron made, with 5s. extra per ton from Bewley ore. To start up the Brougham works, Wright used Cartmel ore, being paid £40 in cash and £12. 4s. in iron to make twenty tons at £4 a ton 'to be laid at the forge.' Thereafter, all the Furness ore smelted came from Adgarley, a manor owned by Earl Francis's nephew, William, 15th earl of Derby. Again there is no record of an agreement with Derby but the Adgarley miners probably had long-term contracts with Derby, with freedom to find their own customers, as in much of Furness. This, however, is the earliest documentary evidence so far of mining in the manor.

Adgarley ironstone is considered the richest in Furness. Large, easily reached deposits meant certainty of supply and low labour costs. Earl Francis paid as little as 3s. 4d. a quarter capacity (5d. a bushel) at the Adgarley pits. Whether the ore had already been washed, broken up and roasted on site is not made clear. It would certainly have been hammered into small nodules for ease of carriage. The low price and high yield of this Adgarley ore offset to some extent the higher transport costs compared with Bewley. Conveyance was by packhorse to Windermere, boat up the lake to Ambleside, then via packhorse ways over Shap to Brougham. Two separate bargains illustrate the cost and the route. In one, carriage from Adgarley to the forge was agreed at 14s. 4d. a quarter; in the other, from Adgarley to the 'hawse' only (the 'horse hause' on the packhorse way shown on Norden's map) was 11s. 8d. a quarter. Boating, loading and unloading in each case cost sixpence a quarter. Adgarley ironstone, in total, cost 18s. 6d. at the forge, compared with Bewley's 14s. 8d., though the latter price excludes the £19. 1s. 9½d. cost of searches, which would raise it by a few pence. As James Keir remarked, with the cheapness of water carriage and the food and fodder of the carrier and his pack horse, it was economic to transport Furness ore long distances. Few routes were as awkward as that to Brougham, but for the high production in the early years Adgarley ore was probably essential, at least in Wright's judgement.[18]

Goodgion was not concerned with the making of iron, so the amount of ore consumed and the yield per ton may only be surmised from other information he gives. On the basis of Wright's terms, eighty percent of the ore smelted during the first three years or so was Bewley and Colby, and twenty percent Adgarley.[19] The total cost of the ore used was £664. 11s. 10½d. A rough estimate would put the ironstone consumption at 412 tons of Bewley and 103 tons of Adgarley. The 515 tons of ore produced 175 tons 13 cwt. 19 qr. 18 lb. of bar iron, a ratio of just over a third, similar to other recorded yields, though well below the highest known from Furness ore. For the coming year's smelting, Goodgion in July 1623 had stockpiled £52. 4s. worth of Adgarley ore, about 42½ tons.

In contrast with the raw material, the fuel for smelting was entirely within Earl Francis's control, nearby on his own lands and managed by his officers. Whinfell was the Cliffords' demesne deer park, enclosed and still heavily wooded. The earl had protected it during Countess Margaret's jointure, restricting her felling by litigation to only what she needed for her own use. He began regulated, commercial felling as soon as he took over in 1617. From this he could expect over £200 a year profit. The diversion to iron smelting was a deliberate choice of an alternative use for much of his Whinfell timber.

In the first three years and three months of the forge's operation, up to July 1623, George Goodgion records that 1,799 oaks and 1,480 birches were felled. Only the

oakwood, stripped of its bark, was used for smelting. The best, too, was reserved for the earl's use. Valued at £1. 16s. 5d., it was cut up into boards for his houses and other buildings, including wainscotting for Brougham, Appleby and Skipton Castles. Five hundred of the birches had been sold, the rest lay uncut. The earl's income from sales of wood and bark fell from £232 in 1619, to £136 in 1620, £154 in 1621, and £121 in 1621. This potential income was not written off, because the value of the timber used in the smelting was included in the calculation of the cost of iron produced in these years. Nevertheless, to burn prime trees was wasteful if, at this stage, unavoidable. So a new spring was ditched and fenced at Hawkbriggside at a cost of £17. 0s. 10d. to provide a cheaper, more easily renewable substitute for the oaks. How far this saved felling the mature trees is not clear from Goodgion's accounts.[20]

The clerk laid out in his accounts the process and the costs of the provision of fuel. Each tree cost 4d. to fell, and stripping the bark one penny for five and a half trees. Cutting them into cords cost just over 9½d. [9.6d.] a cord for the longwood, 1d. a cord for the topwood, one tree making two and half cords on average (longwood only reckoned). Wheeling from the woods to the collier was priced at 3s. the score of cords. When coaled, two and half cords (one tree) made marginally under one load of charcoal, the collier charging 2s. a load for his work. When Goodgion on one occasion had to employ outside carriers to lead charcoal to the heap at the forge, he had to pay them 16d. a load. This, he reckoned, was what it cost the earl when the charges of his draught oxen and their feed, wages and carts were taken into account.

Only as an afterthought does Goodgion note how much fuel was used in making the iron. After his account was closed, he records that 2 tons 6 cwt. 2 qr. of iron was produced from 18½ loads of charcoal made from 47 cords 2 qr. of timber; in effect from 19 trees. One load of charcoal (one tree) therefore was burnt in making 10 qr. weight of iron. Elsewhere, the clerk notes that 105 trees made 262½ cords, which the collier coaled into 100 loads of charcoal; similarly confirmation of his earlier analyses.

Goodgion lists the dates and quantities of the 'wrought merchantable iron' delivered to him by Wright and Collins. This is a reliable guide to the monthly and yearly production, from which the periodic blowings and forgings may be surmised with caution. The figures in Table I are given as Goodgion entered them, minor discrepancies included. The slight decline to 50 tons in the third year and a lower level later in the 1620s, which will be commented on below, probably reflects the restriction of the market to the Eden Valley region within range of the main roads both because of transport problems and competition from the several ironworks then operating in west and south Cumbria. In July 1623, 26 tons 2 cwt. 3 qr. 27½ lb., more than half a year's production, remained unsold in Goodgion's hands. The first two years probably were the peak of the Brougham works' output.

At the close of his account, the clerk abstracted for the earl's benefit a detailed estimate of the production costs thus far. His method was to subtract from his total expenditure on each item that part which did not strictly relate to the making of the 175 tons of bar iron. What remained was the cost of each item. Added up, they gave the total expense. There are inconsistencies in his calculations, which led him to overestimate the production costs. His major error was to include a large number of the birches in the cost of felling and stripping the trees, and other stated costs do not quite square with his apparent outlay. What follows here is a corrected analysis of his figures so far as it can be given.

TABLE I
Brougham Wrought Iron Production 1620–1623

Date		Tons	Cwt.	qr.	lb.
1620					
April	12	2	0	0	0
May	27	3	9	1	4
May	30	0	9	3	11
June			nil		
July	15	7	1	1	26
Aug.	16	6	3	0	14
September			nil		
Oct.	24	8	13	3	1
		2	0	2	5
Nov.	30	4	8	3	9
		1	16	3	11
Dec.	21	2	11	1	5
		0	16	1	13
1621					
Jan.	20	1	18	1	25
		0	5	0	22
	27	1	12	3	10
Feb.	14	2	7	2	6
March	1	1	18	0	4
	24	2	14	1	26
		1	4	2	18
	30	0	13	1	9
		0	5	0	21
April	28	3	1	0	19
		1	8	0	13
First year's output		57	7	3	20
May	18	1	8	0	5
		0	9	0	10
June	8	3	6	3	12
		1	3	3	18
	24	2	0	3	7
		0	12	3	16
July	5	1	5	0	24
		0	5	0	6
	16	1	8	0	27
		0	12	3	0
	24	0	12	0	16
	30	1	6	0	0

Date	Tons	Cwt.	qr.	lb.
Aug. 20	3	16	0	23
Sept. 19	4	13	0	4
Oct. 19	1	11	0	21
	1	19	1	10
26	3	4	1	9
Nov. 21	6	4	1	1
Dec. 19	4	17	2	25
1622				
Jan. 21	3	15	2	22
Feb 27	3	17	0	10
March 12 & 23	2	9	2	22
April 19	4	6	2	16
Second year's output	55	5	3	24
May 22	4	8	1	25
June 6	6	1	1	7
July 24	3	4	1	0
Aug. 28	1	7	2	0
	4	1	0	21
September			nil	
Oct. 5	6	7	2	9
9	2	5	3	20
Nov. 2	1	19	2	1
19	2	10	0	27
29	2	6	2	22
Dec. 12	2	1	0	22
1623				
Jan. 24	4	4	1	22
Feb. 10	1	8	0	0
	3	6	0	0
March 6	1	6	1	10
28	2	5	1	25
April 10*	1	5	0	0
Third year's output	50	8	0	15
May 30	4	5	1	23
June 20	3	0	2	2
July 19	3	2	3	12
	2	2	2	5
Three months' output	12	11	1	14
Total Production	175	13	1	17

*The output for April 10 was omitted in the account. This figure brings the total into line with Goodgion's 175 tons 13 cwt. 1 st. 17 lb.

Goodgion's outlay on getting, leading and searching for the iron ore came to £664. 11s. 10½d. The felling of the 1,437 oak trees actually consumed as fuel cost £23. 19s., stripping, leading and piling the bark £1. 2s. For cording the longwood into 3,592½ cords at 16s. the score the charge was £143. 14s.; for the topwood £14. 19s.; and wheeling the cords to the collier £26. 19s. The collier was paid £132. 2s. for coaling them into 1,321 loads of charcoal, which with a gratuity of £1. 1s. 6d. from the earl and £2. 5s. for carrying them to the heap, amounted to £135. 8s. 6d. Finally, Goodgion estimated that the timber, if sold at 2s. 6d. a cord, would have brought in £412. 16s. 0d. The fuel charges altogether came to £758. 17s. 6d., which brought the total of raw materials to £1,423. 9s. 4½d.

Much the largest of the other items was the £385. 15s. 8d. paid to Wright and Collins at £2. 3s. 11d. a ton for making the commerciable iron, from which they paid their workers' wages. They got recompense also for when they could not smelt for lack of ore and water, a reminder of the obstacles to continuous production most forges and smelt-mills experienced. Goodgion's wages, £20 a year, and the wainmen's wages for leading the earl's draught came to £96. 11s. 0½d. The oxen's feed was worth £51. 1s. 3d., and £6. 16s. had been paid to others to lead charcoal when the earl's draught could not cope. The clerk had spent £52. 13s. 1d. on 'necessaries' for the work of the kind mentioned above. Repairs to the waterworks and buildings accounted for the rest; £19. 15s. 10d. to the carpenter; £6. 19s. 8d. on the earthworks and floodgates; and £4. 0s. 2d. on leading clay to them. The £623. 12s. 8½d. outlay on these items brought the earl's total expenditure to £2,047. 2s. 1d., Goodgion's own calculation being slightly higher at £2,062. 6s. 3¼d.

The cost per ton of £11. 13s. against the valuation of £15. 10s. for that sold or used by the earl or still in stock gave a profit of £3. 17s. a ton. In fact, the profit was somewhat higher. Goodgion reckoned the value of that taken by the earl or in stock at only £15 a ton whereas he was selling at £15. 13s. 4d. The earl could be well satisfied at this stage with his ironworks. Even when the capital investment of searching for ore at Knock and elsewhere and building the works is included in the overall expenditure, he had made a profit of about £1 per ton in the production up to July 1623. Thereafter, as running costs fell, his net profit would be appreciably higher.[21] True, in purely financial terms he would have employed his capital better by reducing his London debts. But an ironworks gratified his entrepreneurial interest and added usefully to the Cumbrian economy, neither of which can be reduced to mere accounting considerations.

Goodgion's only other extant account covers the nine months from March 1631 up to his death in November. He received in this period 17 tons 13 cwt. 2qr. 26 lb. of iron, an annual production now of about 20 tons, similar to that of other Cumbrian ironworks. He had sold 15 tons 13 cwt. 2 qr. 26 lb., and used a further 5 cwt. 19 qr. 21½ lb. to mend instruments at the forge. There is no mention of John Wright, who had either died or moved on. William Collins is still the hammerman, and one of his fellow workers named Brown was allowed a cowgate by the earl. With this much reduced level of smelting, there had been a reversion to the pre 1620 emphasis on direct woodsales as the bigger source of profit with some income too from surplus charcoal.

From Goodgion's posthumous account may be gleaned the extent of the operations at Brougham in 1631. His expenditure on ironstone, now only from Colby and Bewley, was £46. 11s. 7d. for the mining and £27. 14s. 9d. for leading it, at 8d. a bushel from Colby,

6d. from Bewley. Granted equal quantities, this gives 951 bushels, or 71 tons of ore, in line with the stated production. Felling trees cost £5. 18s. 8d.; cording, now higher at 'generally' 10d. a cord for longwood and 1d. for tops, £26. 2s. 9d. and £2. 13s. 10½d. respectively. Wheeling the 600 cords at 1½d. each came to £3. 15s. The collier received £24. 4s. 1½d. for burning them into 278 loads of charcoal at the higher rate now of 21d. a load.

Other details are briefer than in 1623 because all the items were now familiar to the earl and the auditor. The wages of Goodgion and William West, who now had charge of the draught as well as the mining, came to £26. 3s. 10d., those of the workmen who made iron, paid directly by the earl instead of as in 1623 via Wright and Collins, £38. 19s. 8d. This sum included 'playing wages when the workmen wanted stock'. Fodder for the draught oxen together with mowing and making hay and tithe gathering were lumped under the one title at £6. 16s. 10d. The rest of the expenditure went on upkeep of the ironworks. Repairs to the earthworks, dam, water races and forge chimneys amounted to £7. 8s. Goodgion had spent £8. 18s. 9½d. on necessaries such as nails, oil, tallow, leather baskets, tubs, keys, and on measuring the ore, mending tools and other things. His entries, however, are too imprecise to estimate accurately the cost per ton of bar iron at this time.[22]

Goodgion's accounts throw light on the market for the Brougham iron in the 1620s. First call was to meet Earl Francis's own needs. These were not inconsiderable, and it must be remembered that there were no ironworks close to any of his Westmorland, Craven or East Riding residences. Besides making instruments at the forge, the iron he reserved went into ranges for Appleby and Skipton Castles and the Newbiggin in Carleton Park in Craven. Much more was used to repair his water corn mills at Bongate in Appleby, Bewcastle in Cumberland, and his new mill at Weighton in the East Riding. For the latter, two gudgeons of iron, a spindle and rind were made at Brougham in November 1620, and carried there by oxen and carts via Skipton, Harewood and York. More of the iron was worked at Londesborough by Simondes Topcliffe into trundle leads, spindles and nails for the mill, and for eighty pairs of clogs he made for the men employed on the mill's construction.[23]

Goodgion did not name all the purchasers of Brougham iron, but his list of over sixty who together owed £175. 16s. 1d. at the close of his accounts in July 1623 would be almost complete, because the debts were mainly instalments not yet due. He made similar entries for 1630 and 1631 in his later account. Prominent purchasers, as Table II indicates, were the earl's officers, servants and tenants. The Skipton men would bespeak iron, and some co-operated in both purchases and carriage south. They included Richard Hughes the Skipton Castle steward, William Taylor the receiver in Craven, William Petty another officer, and Goodgion's relative William. John Smith of Grassington and John Naylor of Austwick – a hamlet on one of the regular routes from Appleby to Skipton – were two Yorkshire blacksmiths who bought the iron.

Earl Francis' Cumbrian officers included Sir William Hutton, Anthony Page gent., Edward Birkbeck gent., Richard Rigg gent., Anthony Bainbridge yeoman of Carlisle, and Edward Guy gent. of Appleby. Mrs Grimston of Carlisle was the widow of the earl's receiver in Cumberland. John Hilton gent. of Hilton in Westmorland had been one of Earl George's officers. Wright, Collins, Cartledge, John Jackson, Riveupal and Cowper were all employed at the forge. The biggest local customers, not surprisingly, were the

TABLE II

Brougham Iron Purchasers 1620–1623, 1630–1631

Purchaser	Location/Other details	Money Owed 1620–23 £	s.	d.	1630–31 £	s.	d.	1631 £	s.	d.
Thomas Jackson	Brougham	0	2	0						
Stephen Wastell	Warcop	1	4	0						
Mr Richard Rigg	Little Strickland	0	17	6	0	17	6			
John Stallard & Mrs Grimstone	Carlisle / Carlisle: widow of Receiver	3	6	0	1	5	4			
John Stallard		0	14	8						
William Knagg & Anthony Bainbridge	Carlisle ? blacksmith / Carlisle: officer	1	0	0	1	0	0			
Mr Anthony Page	Steward of Penrith	0	2	6	0	2	6			
Anthony Varey	Strickland	0	5	9	0	5	9			
Richard Guy	Penrith	0	19	9	0	19	10			
John Shepherd	Natland	0	17	6						
John Dixon	Skipton	10	10	0						
Edward Bentham	? Ribblesdale	0	2	0						
Thomas Lycocke	Brougham/Cliburn	0	3	6						
Mr John Wood	? Appleby	0	11	0	0	11	0			
Thomas Smith	Penrith ?smith: purchased wood	54	15	6	4	16	0			
Leonard Warcop	Skipton	0	2	3	0	2	3			
James Kagg	? Appleby	2	4	10						
John Nelson	Penrith	0	5	10						
John Alderson	? Ravenstonedale	0	8	4						

Purchaser	Location/Other details	Money Owed 1620–23 £	s.	d.	1630–31 £	s.	d.	1631 £	s.	d.
Thomas Bullock & William Taylor gent.	Skipton ? blacksmith / Skipton Receiver-general	8	0	0						
Jenkin Howe	Carlisle	4	0	0	4	0	0			
William Goodgion	Skipton	0	12	0						
Thomas Busby	? Penrith	0	10	0						
Mr William May	Vicar of Cliburn	0	5	6						
Edward Bland & Hotherd	? Brougham Forge	0	2	6						
Alexander Liddell & Mrs Grimstone	Carlisle iron merchant / see above	2	0	0						
Robert Wells	Shap	0	3	6						
William Collins & Cartledge	Brougham Forgeman / ? Forgeman	0	5	10						
Michael Barnes		1	16	0						
Christopher Potter & Mr [George] Warwick	Vicar of Melmerby	0	12	0	0	2	0			
George Hawden	? Kirkby Thure	33	14	4						
John Wright	Brougham Forgeman	1	10	3						
Edmond Beck	Kendal carrier/Appleby	3	0	0						
Jenkin Howe	see above	1	12	6						
William Robinson	Appleby	1	3	0						
Cuthbert Bradley	Vicar of Ninekirks, Brougham	1	5	8						
Anthony Remy & Anthony Cooper	? Forgemen	0	10	0						
Sir William Hutton	Hutton Hall, Penrith	0	5	10						
John Jackson	? Brougham	0	8	0						
John Wright	see above									
John Wasse	Local man: purchased wood	2	15	8						
Riveupall & Cooper	? Forgemen	0	6	4						

William Smith & William Teasdale	? Milburn ? Milburn: purchased wood	0	11	10						
Edward Tompson	Orton	0	11	6						
Symond Pattison	Brougham	0	1	2						
Mr John Hilton	Hilton	1	0	10						
Stephen Parker	? Temple Sowerby	1	12	6						
Mr Edward Birkbeck	Hornby Hall: purchased wood	0	4	6	0	18	0			
Lancelot Hodgeson	Skipton	0	15	0				0	12	2
Ibid								7	5	0
John Smith	Grassington smith	7	15	10						
Mr Richard Hughes	Skipton Castle Steward									
William Taylor gent.	see above									
John Naylor	Austwick: ?smith	7	17	6	7	17	6			
Rowland Hewgill	Reagill	1	4	0						
George Lowgh	Brougham	0	0	10						
William Leadman	? Brough Sowerby	1	2	0						
John Lambert	? Cliburn	1	11	6						
Sir Christopher Dalston	Acorn Bank: purchased wood	0	6	4				0	7	0
Edward Knewstropp & Richard Leadman	? Crosby Garrett ? Brough Sowerby	1	3	6						
Thomas Varey	Brougham/Penrith	0	15	0						
Thomas Atkinson	Newbiggin	0	11	0						
William Petty	Skipton: officer	0	12	3						
Mr Richard Hughes	see above	0	4	6	0	4	6			
Edward Watt		0	16	0						
John Dennison	Brougham	0	4	2						
Mr Edward Guy	Appleby: Receiver	1	13	4				1	11	6
Henry Meason	? Penrith	0	10	0						
Edward Beachampe	? Little Croglin				0	2	4			
Robert Wells	see above				0	2	6			
Jenkin Howe	see above				1	2	0			
Anthony Bainbridge	see above									

Purchaser	Location/Other details	Money Owed 1620–23 £	s.	d.	1630–31 £	s.	d.	1631 £	s.	d.
Mr Thomas Littell	Londesborough Steward				2	8	0			
Anthony Bainbridge	see above				0	1	3			
A Smith	Ingleton				1	12	3			
William Owthwaite	? Orton				0	2	6			
Mr [Christopher] Fetherstone	Parson: ? vicar of Bentham				1	9	4			
Mr Symon Musgrave	Musgrave Hall				0	7	6			
George Birkbeck	? Appleby: purchased wood				0	2	9			
Ibid					0	3	6			
Ibid					0	2	2	0	2	2
Hugh Coltesworth	? Appleby				0	2	0			
Anthony Pattison	Brougham/Carlisle				0	6	2			
Mrs Birkbeck	Hornby Hall				0	1	4	0	6	4
Ibid					0	1	3			
Mrs Ecton	Bewley, widow							1	4	0
Matthew Doddesworth	Skipton							0	5	2
Mr Edward Birkbeck	deceased: see above							0	12	3
Mr William Currer	Kildwick: Earl's solicitor							1	16	0
John Hetherington	Kirkby Thure							0	3	10
William Borebank								0	10	0
Ibid								4	10	0
Thomas Dawson	? Cliburn: ? blacksmith							7	12	2
Christopher Martin	? Appleby							0	3	6
Lancelot Smith	Langwathby: ? blacksmith							2	5	0
John Stafforth	? Appleby							1	13	0
	Totals	£175	16	1	£33	1	4	£31	0	1

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Penrith Parish Register.

P.H. Reaney, *Records of Queen Elizabeth's Grammar School, Penrith* (CWAAS Tract Series X, Kendal, 1915).

M.A. Faraday, *The Westmorland Protestation Returns 1641/2* (CWAAS Tract Series XVII, Kendal, 1971).

J. Nicolson and R. Burn, *The History and Antiquities of the Counties of Westmorland and Cumberland* (2 vols, 1777).

local smiths and carriers. Alexander Liddell was a prosperous trader in ironmongery in Carlisle.[24] Otherwise, purchasers ranged from Sir Christopher Dalston of Acornbank in Westmorland to parish gentry and clergy, townsmen and villagers within a thirty mile radius of Brougham. For all these, the earl's forge was a handy source of malleable bar iron for their houses and farming equipment.

George Goodgion's death brought a predictable change of policy by Earl Francis from direct management to leasing. His felicitous choice as lessee was William Wright, hammerman and forgeman, probably John's brother, and as Dr Phillips has described, the greatest of the Cumbrian ironmasters of that time. Besides Brougham, William leased or built ironworks at Burnbarrow in Cartmel by 1615, Cunsey in 1618, Muncaster Head in 1637, and also at Hacket and Milnthorpe.[25] He moved to Brougham between 1632 and 1633 and in effect became the earl's officer at Brougham. In addition to leasing the ironworks for £30 yearly rent, he took most of the castle demesnes on a six years' lease on 1 April 1633 for £114 rent, and the tithes of the demesnes for £12 a year. He also became, through the iron smelting, the biggest purchaser of the earl's Whinfell timber. The leases were renewed on the same terms in 1639.[26]

He probably had chambers in the castle, signifying his rise into the ranks of the minor gentry because in his 1636 agreement with William Pennington Esq. to build the Muncaster works he styled himself 'William Wright of Broham Castle gent'. From the profits of his ironworks and farming he could afford £680 to buy two-thirds of Brougham Hall and manor on 19 April 1637, no doubt leasing the other third to make it his residence, until he purchased it outright in 1645. He re-married on 14 August 1638, to Elisabeth Page of Penrith, either the widow or daughter of Anthony Page, Earl Francis' former officer.[27]

Wright's tenancy suited the earl and Lord Clifford, freeing them from direct responsibility for an estate remote from their Yorkshire seats. Wright had charge of all the operations at the forge, except for the felling and cording of the Whinfell trees. He bought the corded timber for coaling from the earl's Westmorland receiver, Edward Guy, as much as £148 worth in 1635 and £145 in 1636, probably at 3s. a cord as in 1638.[28] Even a cautious interpretation of these figures indicates iron production under Wright's management closer to 1623 than 1631. Dr Phillips has suggested that Wright obtained high quality haematite ore from West Cumberland to smelt at Brougham.[29] But his management of the earl's ironworks is otherwise obscure.

However, a little is known about the use of the iron. It is quite conceivable that Wright equipped the Muncaster Head forge he built in 1637 with a hammer, anvil, hurst, two gudgeons, other iron gear and tools made at Brougham.[30] Lord Clifford employed Wright at the time of the Bishops' Wars to consult with the mayor of Carlisle on 'what great Iron works' about the gates and elsewhere were needed to strengthen the city's defences, and he may have supplied what was necessary.[31] Lord Clifford himself, as governor of Carlisle Castle, bought £23 9s. 4d. worth of iron (about one and a half tons) from Wright on 13 February 1640 to send to the castle for the same purpose. As before, the Brougham iron was used for the Cliffords' houses. In 1640, John Wilson obtained some to repair Appleby Castle. Wright was paid £23 5s.5d. for a pair of new gates and iron for grates and for dressing old guns on 18 February 1643 when the castle was the Royalist headquarters in Westmorland of Colonel Sir Philip Musgrave.[32]

The Civil Wars, with its demand for weapons and shot, may have stimulated rather

than disrupted iron manufacture at Brougham, which continued until 1648. Shortly before Earl Henry's death in December 1643, Wright agreed to pay £50 for 200 cords of wood – a commercial rate – and this would have been delivered to him with the approval of Musgrave, who was looking after the earl's interests in the county.[33] Two events led to the abandonment of the work. In July 1648 there was severe fighting as a Parliamentary force pursued Sir Marmaduke Langdale's Royalists through Whinfell to final defeat near Carlisle, in the process capturing Brougham Castle.[34] More important was the change of ownership. On Earl Henry's death, his Westmorland properties descended to his cousin, Lady Anne Clifford, although the ironworks and its implements legally passed to his daughter Elizabeth and her husband, Richard Boyle, 2nd earl of Cork.

Until Lady Anne travelled north in 1649 her agent, Sir John Lowther, allowed Wright to continue production and in 1647 sold him £80 worth of timber from the nearby Lowther Park, a matter of profit or goodwill perhaps rather than problems of supply from Whinfell. For Wright the end came with Lady Anne's decision to repair Brougham Castle and make it her chief residence in Westmorland. She would not have relished the noise and smells of an ironworks overlooked from her favourite chambers. But it was Cork's officers who wound up the operations. They assessed the goods at the iron mill in September 1650 as worth £15, and bound Wright to deliver them to Lady Anne for safe keeping. Wright sold his Brougham Hall property that year and moved to Milnthorpe where he continued his career as ironmaster.[35]

Whether Lady Anne exploited the metallic ores on her Westmorland estates is not clear. In her will, drawn up on 1 May 1675, she mentions 'royalties, mines of coale and lead, and other mines' without stating their location.[36] Morden's 1695 map shows lead mines in the steep Pennine gills above Knock and Murton, both manors inherited by her successors, the earls of Thanet. It may have been they who resumed profitable lead mining on the eve of the large-scale extraction in the following century. However, in the continuum of mining and smelting in the Eden Valley from the medieval to the modern eras Earl Francis's achievement had been to give a renewed impetus after a long period of neglect. His Stainmore pits and Brougham ironworks help fill out the picture of mineral extraction and consumption in Cumbria, and add to a growing awareness of the importance of the region in national terms in the seventeenth century.

Acknowledgements

I am grateful to the Duke of Devonshire and the Trustees of the Chatsworth Settlement for permission to use the manuscripts in the Chatsworth archives, and to the Librarian and Archivists at Chatsworth for their help, and to the Duke of Northumberland for the use of the archives at Alnwick.

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