An early 17th-century blast furnace at Furness Mill Farm, Hunwick, Co Durham

Tim Gates

ABSTRACT: New documentary evidence is presented which indicates the existence of an early 17th-century blast furnace beside the river Wear, near Hunwick, Co Durham (NZ 1988 3316). The furnace was built in or before 1632 by the Whartons of Gillingwood, North Yorkshire, who are better known for their later involvement in the lead industry. Ironstone was brought to the furnace from surface workings 2km distant, near Constantine Farm. After the death of Thomas Wharton in 1641 the furnace was sold, in 1647, to Thomas Bowes of Streatlam Castle and Charles Vane of Raby Castle. After the Restoration it was briefly used by the Bishop of Durham. In the 1670s or 1680s the furnace was replaced by a fulling mill.

Archive references to a blast furnace at Hunwick early in the 17th century

Amongst the Strathmore papers in the Durham County Record Office is a document, dated 22 December 1632, which records the building of a 'furnace' at Helmington near Hunwick. The document concerned is an indenture of bargain and sale by means of which Humphrey Wharton of 'Gillinwood', Yorkshire, and Thomas Wharton, his son and heir, purchased for twenty four pounds

> 'all that parcell of ground contayning by estimacion one acre or thereaboute beinge parcell of a close comonlie called & knowne by the name of Marke Comyns Ridinge & as the said parcell of ground is now divided from the residue of the said Ridinge & is sett lyinge & beinge within the townshipp & territories of Helmedon aforesaid & now in the tenure & occupation of the said Humphrey Wharton & Thomas Wharton or their assignes & upon a parcell whereof there is lately erected & builded a new furnace & through the said parcell of ground there is a race cut for makinge a water course ...' (DRO D/St/D14/21).

The vendor of the land was An[n] Comyn, the widow of Marke Comyn, yeoman, of 'Helmdon' in County Durham.

Helmedon, or Helmington, lies immediately adjacent to Hunwick, a former colliery village situated *c*4km NW of Bishop Auckland (Fig 1), which today consists of a loose agglomeration of old farm buildings, terraced houses and industrial premises spread across sloping ground at elevations between 100 and 150m OD. To the E the ground drops steeply down to the river Wear which runs within 1km of the village at its closest point. In the past, Hunwick and Helmington – now represented only by Helmington Hall (reputedly a manor house) at the northern edge of Hunwick – formed a single township of *c*1560 acres within the manor of Bondgate in the parish of St Andrew Auckland.

The existence of a blast furnace somewhere in 'Lower Weardale', possibly though not certainly in the vicinity of Hunwick, has long been suspected though until now

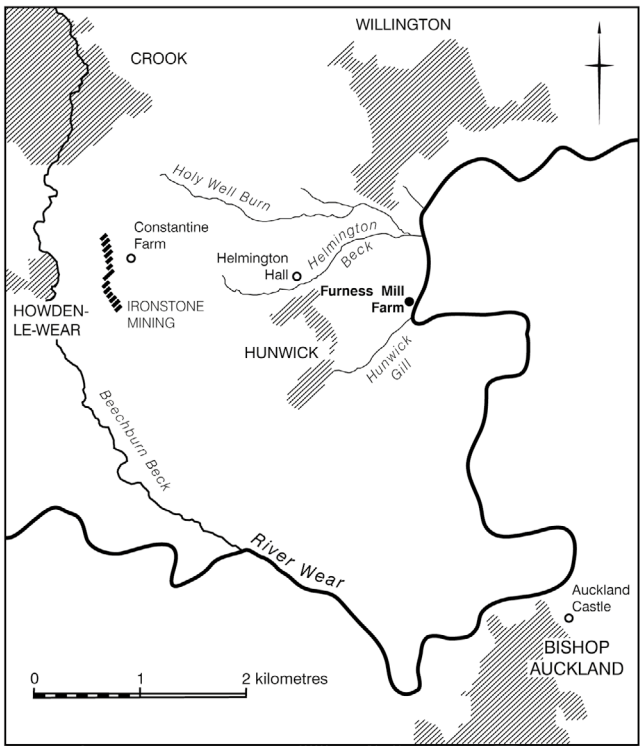

Figure 1: Map showing places mentioned in the text.

its location has remained elusive (Riden 1993, 129; King 2004). Before the significance of the 1632 indenture was recognised, identification of this putative furnace with a location at Hunwick rested principally on a document in Durham University Library (DUL MSP 91 fol 100). The document is an account, dated 16 August 1664, in which John Hodshon renders his account of the profits and expenses of an 'iron furnice' to 'my Lord', who is evidently John Cosin, bishop of Durham from 1660-72. Even though it has been printed twice before, this document is of key importance and so has been newly transcribed here (Ornsby 1872, 318-19; Page 1907, 280-281; see Appendix 1).

Although apparently straightforward, some features of this document are ambiguous and require clarification. For example, as Hodshon owes the bishop £10 for a year's rent, it might be thought that the bishop himself was the owner of the furnace. Yet this is problematic as there is nothing in the bishopric accounts, or indeed in Cosin's own survey of the bishopric estate undertaken in 1662, to suggest that this was the case. On the other hand, as we shall see, the post-Restoration ownership of the furnace has not yet been firmly established, so the possibility that Cosin was indeed the owner cannot be dismissed out of hand, though if he was it is more likely to have been in a private, *ad hoc* capacity rather than *ex officio*. Whatever the case may have been, Cosin was evidently an investor, or perhaps even a partner, in the enterprise, contributing quantities of raw ironstone, iron scrap and wood. Although none of the payments itemised by Hodshon appear in the formal bishopric accounts, at least insofar as they survive, we may note that it was to Cosin's personal steward, Edward Arden, that such payments were made (Ornsby 1872, 332n). Arden's involvement is further attested by the fact that the account is written in his, Arden's, own hand as will be apparent if the document is compared with another miscellaneous account in the bishopric archive, dated 1661/62, which is explicitly described as 'Edward Arden's account' (DUL CCB B/141/9). If, as for this reason seems likely, Hodshon's account was written or transcribed by Arden himself, or perhaps by someone working under him in the bishop's exchequer, that only goes to emphasise the close working relationship between Hodshon and the administration of the bishopric which is in any case already evident in the wording of the document itself. Given the state of administrative chaos that must have existed in the period immediately after the restoration of the temporalities to the palatinate in December 1660, it could well be that some informal or temporary arrangement between Hodshon and the bishop regarding the working of the furnace might have been the order of the day, at least until such time as matters could be put on a more regular footing.

The account cited above does not allow us positively to identify the John Hodgson who became involved with the Hunwick furnace in the 1660s. There is, however, circumstantial evidence to suggest that he was a member of the Hodshon (otherwise Hodgshon or Hodgson) family resident at 'the Fitches' in the parish of Hamsterley, several of whom were parties to property transactions of one kind or another at various times in the 17th and 18th centuries. For example, in 1600 'John Hodgson of Fitches' was party to the sale or mortgage of Witton Castle and its estate of over 800 acres (Surtees 1924, 22-23), while in 1654 'John Hodgshon the elder' and 'John Hodgshon the younger', both of the Fitches in Hamsterley, bought a half share of an unexpired lease of coalmines at Thornley, near Tow Law (DRO D/Br/D 3373-4). And on three occasions between 1664 and 1669 a 'John Hodshon of Fitches', or a 'John Hodshon the elder' (possibly though not necessarily the same person), was party to the sale of tithes or other property in Hamsterley (DUL DJ 5/2-5/4). However, until such time as further documentation comes to light, it is not possible to be sure that any of these individuals was the person named in the Hunwick furnace account.

With regard to the location of the furnace, Hodshon's account provides two important clues. Thus £20 is owing to the bishop for 'iron stone which lay upon the

Hunwicke Moore' and a further £50 for '1000 cord of wood which he [presumably John Hodshon] tooke out of Bedbourne or Birtley wood'. This wood was presumably converted into charcoal at source or after transportation to the furnace. As large lumps of charcoal are required to fire a blast furnace, and as such pieces are fragile and subject to degradation by friction during transport, the wood is perhaps more likely to have been coaled after it had arrived at its destination.

The 1647 Parliamentary survey of the Bishop of Durham's estate identifies Birtley Wood (160 acres) as demesne land belonging to Auckland Castle situated adjacent to the river Wear (Kirby 1971, 4). The first edition of the OS 1:2,500 map, surveyed in 1856, depicts 'Birtley Forest' as a woodland on the left bank of the river Wear, 1.5km SE of Hunwick, and centred at *c*NZ 200 316 in an area now all but entirely denuded of trees (OS sheet XXXIV.14). 'Birtley Lane' survives as a place name on the modern 1:25,000 map at NZ 196 322, leading northwards from the former woodland in the general direction of the furnace site. If by 'Bedbourne wood' was meant a wood near the hamlet of Bedburn, 2km NW of Hamsterley, then it is surprisingly distant from the furnace and the wood must have been carried across country (or brought down the river?) for a distance little short of 10km.

The topographical setting

Hunwick Moor, otherwise known as Hunwick Edge, was a large tract of common land formerly belonging to the manor of Bondgate. It extended W of Hunwick village as far as the Bitchburn (or Beechburn) Beck and was enclosed in or soon after 1761 following a private Act of Parliament passed in the previous year. An enclosure map dated 1761 shows a number of 'ancient enclosures' but makes no mention of any ironstone quarry (DUL DHC 6/II/10). The accompanying award states that a survey was made 'on or before 1 Nov 1760' by which it appeared that the common contained 1007 acres (DUL DHC 6/I/8).

In answer to article 4 of the 1647 Parliamentary survey of Bishop Auckland, which asked 'Are there any common lands?', the jury stated that Hunwicke Moore contained by estimation 400 acres (Kirby 1971, 5). At first sight it is difficult to reconcile this statement with the figure of 1007 acres given by the 1760 inclosure survey. However it must be remembered that the Parliamentary survey was only enquiring into demesne land belonging to the bishopric estate. So one possible explanation for this apparent paradox might be that the bishop either owned an ancient enclosure on the common or else claimed certain exclusive rights over a part of it. Alternatively the traditional estimate of the size of the common may simply have been wildly wrong. In any case Bishop Cosin's own survey of his episcopal estate undertaken in 1662, less than two years after the restoration of the bishopric, records that 'within the precincts of the manor [of Bishop Auckland] there be 6 moores or fells' one of which was Hunwick moore occupying 400 acres (DCL Sharp 167 fol 2). The same survey records that the bishop had 'one mine for iron at Hunwick' within the manor of Bishop Auckland. As neither the Parliamentary survey of 1647, nor Bishop Cosin's survey of 1662, mentions any iron furnace belonging to the bishopric at or near Hunwick, or indeed anywhere else within the manor of Bishop Auckland or its component townships, the furnace was clearly not owned by the bishopric in either 1647 or 1662.

Further evidence of the bishop's ironstone mine is to be found in one of the many books of enrolled leases preserved amongst the records of the former palatinate. Thus an entry dated 13 June 1636 states that Thomas Wharton of Gillingwood Hill [Hall] in Yorkshire leased from bishop Thomas Morton 'All those his iron mines iron ure and iron stones lying and being in and under the common wast or moore called Hunwick moore in the county of Durham', together with full power and liberty to 'delve worke winne and gett the said iron iron ure and iron stones in the said common wast or moore' for a period of thirteen years at an annual rent of 20 shillings (DUL CCB V/1/7 fols 15-16). Additionally, the transumpt (account) books of the bishopric for the years 1636/7 and 1637/8 also record two annual rent payments, each of 20s, made by Thomas Wharton, farmer of the iron, [stone] tile and stone mines 'apud Hunwicke moore' (DUL CCB B/37/114-115). No record of an iron mine on Hunwick Moor belonging to the bishop has been found prior to 1636, whether in the books of enrolled leases dating back to 1543, or in the transumpt books and the accounts of the clerk of the great receipt which have been searched back to the 1570s. Nor has any alternative source of ironstone been identified in the vicinity of Hunwick from which ironstone for the Whartons' furnace may have been obtained. On the other hand the bishop did lease out coal mines on Hunwick Moor to tenants other than the Whartons at least as early as the 1620s and it is not impossible that a supply of ironstone could have been obtained as a by-product from these mines in the early years of the furnace's operation (DUL CCB V/1/4 fols 422-428).

Hunwick Moor or Edge, where the ironstone mines

leased by Thomas Wharton from the bishop of Durham were situated, is within 3km of Helmington, so there is no problem in identifying the furnace described as newly built by Thomas and Humphrey Wharton in 1632 as a blast furnace for the smelting of iron ore. Indeed this is made explicit in a subsequent indenture, dated 1 May 1647, which records the sale, by Humphrey Wharton of Gillingwood esquire to Thomas Bowes of Streatlam Castle and Charles Vane of Raby Castle, of an acre of ground, part of a close commonly called 'Mark Comyns Rydings', in 'Holmeden', 'upon parcell whereof there is now erected and built a furnace for making of iron, and through the said parcell of ground there is a race cutt for a water course' (DRO D/St/D14/23). In other words the 'new furnace . . . lately erected and builded' on an acre of ground bought by Thomas and Humphrey Wharton from Ann Comyn in 1632, is the same 'furnace for making of iron' sold to Thomas Bowes and Charles Vane fifteen years later in 1647.

Fuel supply for a furnace

As we have seen, in 1664 John Hodshon obtained cord wood from woods at Bedburn and Birtley which, we assume, was converted into charcoal to fuel the furnace. Now that it has been established that the furnace was built by Thomas and Humphrey Wharton of Gillingwood in 1632, it could well be relevant to our enquiry that in June 1637 Thomas Wharton purchased 'all wood and underwood in Helm Park in the Lordship of Thornley and Greenwell Hill' (Surtees 1926, 28). Helm Park Wood is marked on modern maps at *c*NZ 123 360, some 8km NW of Furness Mill. It may therefore be that wood taken from Helm Park was destined for use as fuel for the blast furnace at Hunwick. Given that it has been estimated that even a modest-sized charcoal-fired blast furnace and forge would require 1,600 to 2,000ha of coppiced woodland to supply it with fuel, it would not be surprising if supplies of wood were obtained from a wide variety of sources, even at locations as far distant as Helm Park (Crossley 1990, 153).

Location of the blast furnace

While the iron furnace was unquestionably somewhere in or near Helmington [Helmdon, Helmedon, Holmeden], in neither of the 1632 or 1647 indentures are the bounds of 'Mark Comyns Ridinge' described so as to allow us to pinpoint its location. On the other hand the mention of a 'race' or leet, which appears to be contained within the acre of ground bought from Ann Comyn, implies that the furnace was situated not far from a stream or river, as in any case would be expected. Certainly the furnace would require a source of water that was both seasonally reliable and of sufficient capacity to turn a waterwheel and work the bellows so as to produce a continuous blast which might be required to last uninterrupted for several weeks or even months. Whereas there are several small streams in the vicinity of Hunwick which drain eastwards into the river Wear, such as Hunwick Gill and Helmington Beck (Fig 1), all are of small volume with a tendency to run dry at times of low rainfall. Indeed the only reliable source of water anywhere in the neighbourhood is the river Wear itself.

The place name element 'ridding', meaning a clearing in a wood or a piece of land cleared of trees, or possibly of stones, is not unusual in the North (Wright 1961). While the land bought by the Whartons was formerly owned by Mark Comyn and, after his death, by his wife, no other records of the Comyns of Helmington, or of their property, have come to light that might help to locate the furnace more precisely. This is a question to which we shall return in due course.

The Wharton operations

The Thomas Wharton who built the iron furnace was the son of Humphrey Wharton (d 1635) who migrated across the Pennines from Kirby Thore in Westmorland to Gilling near Richmond in North Yorkshire where he bought the manor of Gillingwood and built Gillingwood Hall in the second decade of the 17th century. The Whartons of Gillingwood were distant relatives of the better known family which counted amongst their number two prominent politicians, Philip, fourth baron Wharton (1613-1696), and Thomas, first marquess of Wharton (1648-1715), who owned large estates in Swaledale.

From the 1620s until the end of the century, three successive generations of the Whartons of Gillingwood, notably Thomas Wharton (d 1641), Humphrey Wharton (1626-1694), and Anthony Wharton (d 1702), were major players in the lead industry in the North, operating mines and/or smelting mills in Westmorland, Swaledale in North Yorkshire, Weardale in Co Durham and the Derwent valley in Northumberland. As 'moormaster' of Weardale from November 1632 until his death in 1641, Humphrey Wharton had charge of the bishop of Durham's lead mines there (TNA C2/ChasI/N28/47). After the Civil War, when the temporalities of the bishop were restored, Humphrey Wharton succeeded his father in the same role (Blackburn 1994). The fact that Thomas Wharton's initial appointment was made at approximately the same time as he and his son built the

Hunwick furnace is further evidence of the Whartons' entrepreneurship.

In 1628, the Thomas Wharton we are concerned with obtained for himself the reversion of the potentially lucrative office of Receiver of the Land Revenues of the King in Northumberland, Durham and the Archdeaconry of Richmond, a position to which he was finally appointed in April 1636, two months before he leased the ironstone mine at Hunwick (Sainty 2004). However, only five years later, on 17 September 1641, Thomas Wharton died unexpectedly young in his middle or late forties leaving four children – two sons, Thomas and Humphrey, and two daughters, Martha and Barbarye – all under the age of majority.

In his will, dated 3 September 1641, Thomas Wharton placed most of his property in the hands of trustees for the benefit of his second wife, Mary, and his children. Amongst his other property there were leases of coal and lead mines in Yorkshire, Northumberland and Durham, as well as lands and tithes, and shipping on the river Wear. Thomas expressed great concern for the future welfare of his children urging his executors that his eldest son, Humphrey, 'be vertuously educated and followe his learning as hitherto hee hath done' and that 'when itt shall please God that hee be ready to take a wife [his trustees] wilbee a means to match him in an honest and a religious family according to his rank and quality' (TNA PROB 11/196, fol.13). Seven months after his death, an inquisition post mortem held at York Castle on April 9 1642 before Mark Shaftoe esq, escheator, listed Thomas's possessions, which included an acre of land in the parish of Brancepeth, Co Durham, commonly called 'le Rydinge' with 'an iron furnace' built on it (TNA WARD7/96/106 and C142/620/75). The statement by the York jury that Thomas Whartons' furnace lay in Brancepeth parish is certainly an error and was probably the result of confusing the township of Helmington with another township called Helmington Row which, though adjacent to Helmington, lies in Brancepeth parish rather than the parish of St Andrew Auckland. There is in any case no reason to suppose that the Whartons ever owned a second blast furnace, either in this neighbourhood or anywhere else.

Unfortunately for his heirs, Thomas Wharton died massively in debt, owing £4,000 to the King on account of his receivership and smaller but still significant sums to those who had stood surety for him at the time of his appointment. Fortunately for historians, however, his creditors took action to recover their debts in the court of exchequer against Humphrey Wharton, Thomas's eldest son, filing their bill of complaint in Michaelmas term 1649 (TNA E112/268 Ebor 653). In the course of these proceedings interesting facts emerge about Thomas Wharton's entrepreneurial activities, including his ownership of the Hunwick iron furnace. For example, in his answer to the creditors' bill of complaint, Humphrey Wharton reveals that his father owned a 'small parcel of ground in Helmedon [Helmington] … upon which a furnace for making of iron was erected and builte' and that after his death he, as his father's eldest son and heir, sold the furnace to Charles Vane and Thomas Bowes, esquires, by a conveyance dated 1 May 1647, thereby confirming what has already been said above. At the time when Humphrey made his answer, in late 1649, he believed that the furnace was still in the possession of Vane and Bowes (TNA E112/268 Ebor 653).

More details of the furnace are revealed in the depositions of witnesses who, in September and October 1650, gave evidence to commissioners appointed by the court. Responding to an interrogatory which sought information about 'the furnace for yron and the yronworks att Helmedon in the county of Durham', Nicholas Lodge, gentleman of Gilling, confirmed that Thomas Wharton owned the furnace and that one George Dobson was his tenant 'for three or four years', paying rent for it at the rate of ten or twenty marks a year, though he thinks that it would now be worth more. He likewise confirms that Humphrey Wharton sold the furnace to Bowes and Vane for £80 'or thereabouts' and that there was 'a great quantitie' of ironstone at the furnace when it was sold (TNA E134/1650/Mich12, mem ii recto). George Wharton of Eppleby in Yorkshire, the deceased Thomas Wharton's brother, deposed to similar effect though claiming that Thomas Bowes paid £100 or £120 for the furnace (TNA E134/1650/Mich12, mem ii recto). George Dobson of Burneston in Yorkshire testified that he was formerly Thomas Wharton's tenant at the furnace and that he was succeeded by one Talbot Ribton, another of Thomas Wharton's servants, adding that at the time of Thomas Wharton's death there were two heaps of ironstone, one at the furnace itself and the other 'at the delfe upon Hunwicke moore', together valued at £30, plus a variety of tools and equipment (which he itemises) all of which were afterwards sold by Humphrey Wharton (TNA E134/1650/Mich7, mem ii recto; see Appendix 2). In his turn Talbot Ribton 'of Hunwicke furnace' deposed that he was a servant of Thomas Wharton's after whose death Humphrey Wharton came to his house, 'hard by the furnace being part of the same land that the furnace was on', and asked him to remain in possession there. This he did for a year or so after which he was replaced by George Dobson who paid £10 a year in rent until Humphrey sold

the furnace and the land for £120 or thereabouts. At the time of Thomas Wharton's death Ribton claims there was one load of ironstone at the furnace worth £22 10s and another heap 'at the delfe' which was sold for £69 7s 6d. Talbot Ribton further deposed that after Thomas Wharton's death George Dobson took possession of an 'iron stone delfe on Hunwicke edge holden by lease from the Bishopp of Durham' which he valued at £20 per year (TNA E134/1650/Mich7, mem ii recto). Another witness, John Evans of Evenwood Park in Co Durham, said that there had been 400 loads of ironstone at the furnace and the delfe and that the ironstone at the latter was worth 3s 2d a load and 3s 10d a load at the furnace, the difference in value (8d a load) presumably representing the cost of transporting the ironstone from the quarry to the furnace (TNA E134/1650/Mich7, mem ii recto). Unfortunately we are not told the weight of a load, nor whether it was a pack horse or a cart load that was involved.

Independent confirmation of Talbot Ribton's residence at Hunwick at this time is provided by the parish registers of St Andrew Auckland which record the baptism of two daughters of 'Talbott Ribden of Hunwick' in November 1637 (Margaret) and August 1642 (Dorothie) (DRO microfilm M42/640). In May 1647 Humphrey Wharton appointed 'Talbot Ripton of the Ridinges in the county of Durham, gent' to act as his attorney to deliver seisin of the furnace to Thomas Bowes and Charles Vane (DRO D/St/D14/23).

Allowing for the fact that some of this witness testimony is clearly hearsay, and that some deponents may have deliberately underestimated their valuations of Thomas Wharton's assets out of loyalty to the family, their evidence is consistent on certain key points with what has already been learned from the other sources. Thus there is agreement that a furnace (with a house for its tenant) existed at 'Helmedon' and that ironstone was obtained from a 'delfe' or quarry on Hunwick Moor. While the furnace had been built on land owned by Thomas Wharton, the ironstone quarry was leased from the bishop.

Later evidence

From the 1640s onwards the documentary history of the furnace becomes more sketchy. As we have seen, in May 1647 Humphrey Wharton sold his father's furnace to Thomas Bowes and Charles Vane. It then appears that the same Charles Vane of Raby Castle sold a parcel of ground in Hunwick 'whereupon there is a furnace for ironwork' to the acquisitive Sir Arthur Hesilrige, politician and Parliamentary soldier, who used his power and influence to enrich himself with large estates in the North, including the manor of Bishop Auckland which he bought in 1647, before eventually falling from grace at the Restoration (Kirby 1971, 175; Denton 1997; ODNB 2004).

Evidence of the sale of the furnace in 1649 is contained in an unattributed note which refers to a conveyance from Charles Vane to Sir Arthur Heslirige dated 15 February in that year (Anon 1894, 186). Details of the conveyance were said to be taken from 'a catalogue of original charters of W B Bickley of 39 Trafalgar Road, Birmingham'. W B Bickley was a prolific and well known writer on the history of the Midlands and an avid collector of manuscripts. Unfortunately, enquiries at the Birmingham Archives and elsewhere have so far elicited no information about the present whereabouts of this conveyance.

After the fall of Sir Arthur Hesilrige and his subsequent death in the Tower in 1661, the ownership of the Hunwick furnace remains obscure and all we know of its subsequent history is what can be inferred from rent payments for the ironstone mines, recorded in the bishopric accounts, and documentary references showing that the furnace was replaced, first by a fulling mill and ultimately by a corn mill. Thus, in October 1687 Sir William Bowes of Streatlam Castle is said to have sold a house and fulling mill, called Furnish Mill, together with a close called Comyns Ryddings, to John Hodgson, gentleman of Witton le Wear, and John Harrison, a miller. This John Hodgson could well be the same man who submitted his bill to the bishop in 1664 or else another member of the same family. In August 1690, Furnish Mill was sold again, this time by John Harrison to Thomas Blackett who had already purchased Helmington Hall and its estate in June 1686 (Surtees 1923, 7). By the mid-19th century the fulling mill had evidently been converted to a corn mill, for the first edition of the OS 1:2,500 scale map, surveyed in 1856, identifies it as 'Furness Mill (corn)', while Fordyce likewise mentions 'a corn mill called Furnace Mill' in the chapelry of Hunwick (Fordyce 1857, 593).

As noted above, the bishopric accounts record that Thomas Wharton paid an annual rent of 20 shillings for the ironstone mines on Hunwick moor in the years 1636/37 and 1637/38. Thereafter there is a gap in the financial records from 1646, when the Palatinate was abolished, until 1660 when the temporalities were restored to the bishop. For this period we have only one brief reference to the Hunwicke ironstone mines in the 1647 Parliamentary survey of Bishop Auckland

when the jury, in answer to interrogatory 9, 'Are there any mines or quarries of stone, lead, iron or coal or any salt pans?', found 'there is a myne of iron stone upon Hunwicke moore yielding no profit to the Lord' (Kirby 1971, 5). This may indicate that the mines, and therefore presumably the furnace, were not in use at this time. After the Restoration, the Hunwick ironstone mines reappear in the bishopric accounts, as shown by receipts of rent in the books of transumpt and various receivers' and collectors' accounts over the period 1660/61 to 1668/69 (DUL CCB B/127/1,4,5,9-11,13-16; CCB B/141/1,9,13,14; CCB B/111/5,8). During this time the mines were held in trust for the bishop by one or both of two trustees, Samuel Davison and Richard Neile, an arrangement confirmed by Cosin's survey of 1662 (DUL Cosin's Survey fol 178). As the mines were held *in manibus domini* during this time, no rent was payable to the bishopric. According to Cosin's survey Davison and Neile held the Hunwick ironstone mines in trust for the bishop by a lease dated 7 April 1663 for a term of twenty one years at an annual rent of twenty shillings. Richard Neile was the grandson of Richard Neile, Archbishop of York, and an attorney. Soon after the Restoration he was employed in the bishop's service and in 1668 he was knighted. Samuel Davison esq of Wingate Grange, Co Durham, married bishop Cosin's second daughter, Elizabeth, in December 1662. He died sometime before April 1671 (Pask 2011, 13).

It has been claimed that after Auckland Castle was transferred by parliamentary commissioners to Sir Arthur Hesilrige the chapel was blown up with gunpowder and its materials re-used in the construction of a newly-built mansion house though the extent of the damage caused by Sir Arthur has been disputed and it may be that the chapel was already in poor condition before the Civil War (Hodgson 1896, 145). The 'View of the Estate of the Bishoprick of Durham' carried out for Bishop Cosin in 1662 lists the cost of repairs resulting from damage sustained in the Civil War. Here the cost of repairing Durham and Auckland Castles, 'which the usurpers, Sir A Haselrig and others had ruined', was estimated at no less than £7202. Included in this sum was a figure of £410 'in iron and smith's work' (BodL MS Tanner 92 fol 10r-11r; Ornsby 1872, 94). In these circumstances it is quite possible that Cosin's interest in the Hunwick furnace, as revealed in John Hodshon's account, can be explained, at least in part, by his need to acquire materials for these repairs. A series of letters written by Bishop Cosin to his secretary, Myles Stapylton, over a period of several months in 1670, also contain references to materials necessary for carrying out repairs, including quantities of lead supplied by Humphrey Wharton, who is politely referred to as 'my kinsman' (Ornsby 1872, 237, 251, 253-4). In any event Cosin's demand for iron for building repairs would be negligible compared to the production from a blast furnace which will have been of the order of a ton a day when in blast. Moreover, as wrought iron rather than cast iron would have been needed for most purposes except gun-casting (unlikely after the Restoration), the existence of a finery forge somewhere in same general area may be inferred. A finery forge is likewise implied by the phrase '3 Tunne [of iron] drawne into Barrs' in Hodshon's account (see Appendix 1), and again by an entry in the parish records of St Andrew Auckland which notes the baptism of a daughter (Eleonora) to William Tyler 'de la forge' in December 1667 (DRO microfilm M42/640). As four other children of William Tyler (or Tiler), described either as 'de la Furnace' or 'of Hunwick', were baptised in the years between 1665 and 1672, there seems little doubt that there was indeed both a forge and a furnace at Hunwick.

Taking account of all the evidence recited above, Furness Mill Farm emerges as by far the most likely location for the 17th-century iron furnace built by the Whartons in 1632. The buildings which now occupy the site are shown on contemporary OS maps on the left bank of the river Wear at NGR NZ 1986 3316, less than 1km to the E of Hunwick village. Buildings on the same site are depicted on the 1843 tithe map for the township of Hunwick and Helmington where they are named 'Furnace Mill', a place name which itself would be sufficient to alert us to the possibility that this was the site of the furnace which the documentary evidence presented here shows to have existed in this vicinity (DUL DDR/EA/TTH/1/135M). The identification of the site of the later fulling and corn mills with that of the iron furnace is further strengthened by the text of the tithe award which records three parcels of the land lying immediately adjacent to the mill on the north side, and between it and the river to the east, as freehold land named 'High Ridings', a name which must ultimately derive from the 'Marke Comyns Rydinge' mentioned in Thomas Wharton's 1632 deed of purchase (DUL DDR/EA/TTH/1/135A). From 1856 onwards successive editions of OS maps name the same mill as either 'Furnace Mill', 'Furness Mill', or 'Furness Mill Farm'.

Evidence for the furnace in the modern landscape

When visited in November 2011 the former corn mill was a roofless ruin, though with one internal wall still standing to a height of approximately 5m at the ridge.

Otherwise the surviving elements are essentially as they were portrayed on successive editions of the OS 1:2,500 scale maps, from the first (1856) edition onwards (Fig 2). Thus, at the SE end of the building, the wheel pit, though half filled with debris and rubbish, was clearly identifiable. The flow of water into the headrace had been controlled by a sluice gate situated immediately upstream of a substantial dam built of stone blocks and revetted on both the upstream and downstream sides with horizontal timbers held in place by vertical stakes. On the opposite (SE) side of the river, the dam ends on a bank of sand and shingle which at times of high water becomes an island separated from the river by a narrow channel to the E of it. Immediately upstream of its point of contact with the dam, the river-facing (western) side of this sandbank is reinforced with a breastwork of horizontal timbers, again held in place by stakes. The entrance to the overflow channel on the far side of the sandbank has at some time been controlled by a sluice and upstream of this the river bank itself is protected from erosion by a line of large stone blocks placed on the gravel close to the water's edge. Below the mill, the tailrace can be traced for a distance of approximately 100m before it rejoins the river close to a fording place. Notes and a sketch plan of the mill and its races have been lodged by the writer with the Durham County HER.

Despite careful examination, nothing has come to light that would suggest any of the existing structures could be of 17th-century date or be part of the iron furnace referred to in the documents described here. Most puzzling is that none of the glassy green slag of the type normally associated with an early blast furnace has yet been found in the immediate vicinity of the site or indeed anywhere else in this area, though quantities of black clinker and slag occur in the bed of the river and on its banks a short distance upstream, close to where Hunwick colliery (NZ 1995 3274) and an adjacent brick and tile works (NZ 1990 3260) were located until the colliery was closed in 1921. On the other hand there are strong circumstantial reasons to see Furness Mill as the location for the iron furnace which we know existed in the vicinity of Hunwick. As previously noted, the river Wear is the only source of water in the locality that is not prone to dry up in the summer and could therefore be relied upon to provide the power required to maintain an uninterrupted blast to the furnace, without which it could not function successfully. Likewise the existing dam occupies the most advantageous position for a dam available anywhere on this stretch of the river. As the cost of building and maintaining a dam represents a very significant input of capital and labour, it would be normal practice to retain it in its original position even should the associated buildings undergo a radical change of use. In these circumstances the dam and its associated races are likely to have been retained when the furnace was replaced, initially by a fulling mill and then by a corn mill.

From the point of view of the local topography, the proposed site of the furnace also has much to recommend it. For it is precisely here that the steep slope above the river bank draws back, leaving a narrow strip of flat alluvial land beside the river sufficient for the construction of the mill and its race, though still with a bank high and steep enough to support the furnace. Indeed it is a notable feature of the only two extant 17th-century furnaces in the North East, at Allensford and Wheelbirks (see below), that both are built into steeply sloping banks close to streams or rivers. In this way the furnace structure itself and, at Allensford, a calcining kiln too, are supported and stabilised by the surrounding earth while access to the top of the furnace for the purpose of charging it with fuel and ore is facilitated by the natural slope without

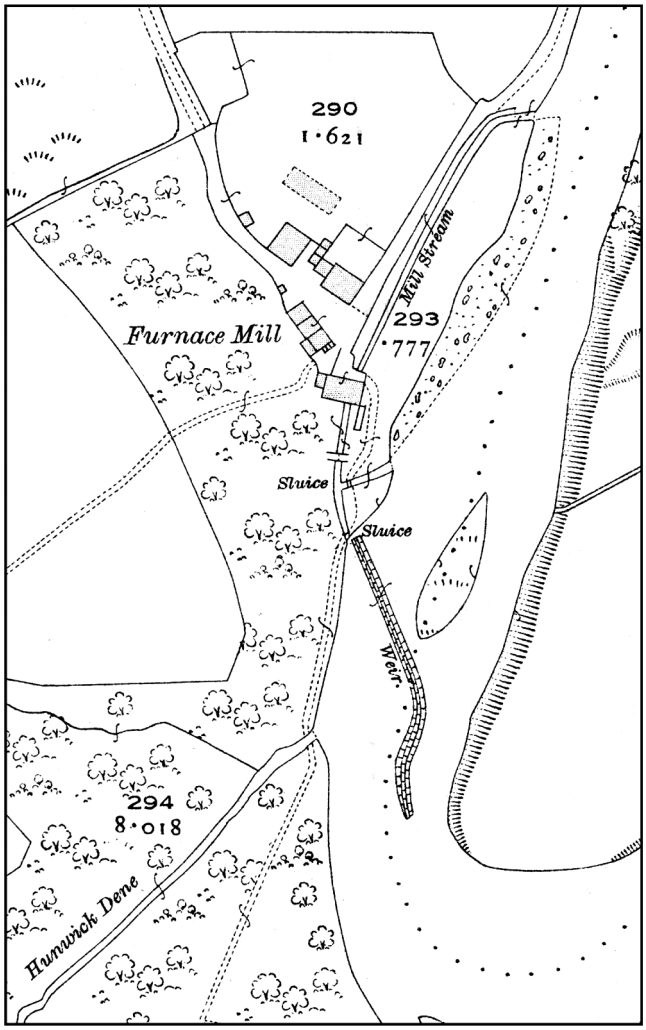

Figure 2: Extract from the 1920 edition of the Ordnance Survey 1:2500 map (surveyed 1896; revised 1915) showing Furnace Mill and its mill stream.

the extra labour and expense involved in making an artificial ramp. Even more important, the furnace is raised above the flood level of the river thereby preventing the catastrophic effects that would ensue if water were to enter the furnace when in blast.

Local ore sources

Having established the probable site of the blast furnace, what of the mines or quarries that supplied it with ironstone? As we have seen, in 1636 Thomas Wharton leased iron mines 'under the common wast or moore called Hunwick moore' from Bishop Thomas Morton, and in 1650, nine years after Thomas Wharton's death, three of those who gave evidence to commissioners appointed by the court of exchequer to investigate his debts – George Dobson, Talbot Ribton and John Evans – mentioned a 'delfe' for ironstone on 'Hunwick moore' or 'Hunwick edge' (TNA E134/1650/Mich7, mem ii recto).

Richard Richardson's 1761 'Plan of the moor or common called Hunwick Edge' marks the 'Delft Hills' towards the western extremity of Hunwick township, on the edge of a steep escarpment overlooking the Beechburn or Bitchburn beck, a little to the W of where Constantine Farm is now situated (NZ 1720 3360; Fig. 1) (DUL DHC 6/II/10). In the first volume of his 'History and Antiquities of the County Palatine of Durham', William Fordyce notes that 'At the north-western part of the township [of Hunwick and Helmington], there is an iron-stone mine, called Constantine, from a farm of that name, the produce of which, in consequence of its excellence, is transmitted both to adjacent and distant furnaces' (Fordyce 1857, 594). Taken at face value the use of the present tense may imply that ironstone was still being mined somewhere in this vicinity in the mid-19th century.

At present, the land around Constantine Farm has mostly been improved and any surface traces of mining that may once have existed in the immediate area have been obliterated by ploughing. However, to the W there remains a small piece of woodland, centred at NZ 1700 3352, where underneath the trees (mostly sycamore and beech) the ground is liberally pockmarked with hollows, 5-6m in diameter and 0.5-1m deep, which are clearly the product of some form of mining or quarrying carried out by sinking shafts or pits to relatively shallow depth. Apart from a certain amount of colliery waste which has been dumped here in the not too distant past, there is no indication of the type of mining involved though the general absence of coal on the surface round about suggests that these were not coal mines. Although there was a 19th-century drift mine for coal further down the slope to the W, those workings are quite distinct from the ones described here.

Ironstone mining: the geology of the Hunwick district

Geologically the rocks in this vicinity belong to the Westphalian (Coal Measures) sub-division of the Carboniferous period (Robson 1980, 23-28; Stone *et al* 2010, 136-148; Brian Young pers comm). Typically these rocks form rhythmically repetitive units, or cyclotherms, each of the order of 15m thick consisting of alternating beds of coal, shale, sandstone, mudstone and seat earth which follow one another in an orderly upward succession. Nodules or bands of ironstone, in the form of siderite (iron carbonate: $FeCO_3$), occur at intervals in these strata and 19th-century records of borings made in the Hunwick area occasionally mention 'ironstone girdles' at varying depths below the surface (Anon 1878-1897). Because of the gentle easterly dip of the rock strata hereabouts, any ironstone-bearing rock outcropping between Constantine Farm and the edge of the escarpment to the W would also outcrop at the surface on the slopes to the E, at distances of up to 600m from the farm. However, as mentioned above, intensive ploughing of the dip slope of the escarpment has removed all surface traces of any ironstone or other mining there may have been in this area. As the land around Constantine Farm is largely free of a superficial covering of boulder clay, beds of ironstone-bearing rock that outcrop at the surface could easily have been reached by shafts of no great depth (Brian Young pers comm).

Successive editions of OS 1:2,500 map sheets XXXIV.5 and 9, show a belt of woodland on the face of the escarpment to the W of Constantine Farm. Starting with the first edition, surveyed in 1856/7, and progressing through the revisions of 1896, 1915 and 1939, one can see the woodland shrink to no more than a narrow strip along the escarpment edge. Similarly, air photographs taken by the RAF and the Ordnance Survey at various dates between 1958 and 1993 show that the stand of trees mentioned above is only a surviving fragment of this once more extensive belt of scrub and woodland which formerly ran N to S along the crest of the escarpment to the W of Constantine Farm for a distance of at least 0.6km (NMR RAF/58/2654, frames 370-1; OS/74060 frames 131-2; OS/93167, frames 9-10). Over the period documented by these photographs most of the land cleared of trees and scrub was ploughed. While there is no proof, it is possible that this former wood and scrubland masked

a belt of shafts comparable to those still surviving in the one patch of woodland that is left. If so, it would be possible to envisage a bed of ironstone-bearing rock outcropping at or near the surface along the escarpment edge which was worked over a period of time by means of numerous shallow shafts or 'delves'. Certainly it does appear that ironstone was being worked hereabouts in the early 18th century as the geologist John Woodward refers to a specimen of 'plumose stoney spar, that lies next to the iron-stone got here. On Hunwick-moor, near Bishop's Auckland' (Woodward 1728-29). Nor need the distance of these putative mines from the blast furnace at Furness Mill, at around 3km, be an objection to this scenario as in the past ironstone or other heavy ores were commonly transported by horse and cart or packhorse over distances as great or greater than this.

Conclusion

The importance of Furness Mill lies in the fact that it is one of only a small handful of charcoal-fired blast furnaces dating to before 1700 that have so far been documented in the North East of England. Of these Wheelbirks on the Stocksfield Burn, 7km NW of Consett, is the earliest with an archaeomagnetic date for the final firing of 1570±20 (Linsley 1982, 69-72). The blast furnace at Allensford on the river Derwent, 3km WSW of Consett, is about half a century later than the construction of Furness Mill, having begun operations by *c*1690 with a final firing around 1750±10 (Linsley and Hetherington 1978, 1-11; Brown and Linsley 1979, 42). Two other blast furnaces, known only from secondary sources but also possibly of 17th-century date, have been reported in Co Durham, one near Gibside and the other 'about three miles west of Chester' (*ie* Chester le Street), though neither of these has yet been verified on the ground (Durham HER, monument 10657; Hutchinson 1787, 398).

The Hunwick blast furnace can be seen as fitting into a broader context in which the transition from bloomery to blast furnace began in the Weald in the mid-16th century and moved northwards, initially taking advantage of the occurrence of haematite ores lacking the sulphur and phosphorus content which so often marred cast iron (King 2004; 2005, 1-33). Later, the North-East, and in particular the Derwent Valley on the Durham/Northumberland border, became an important centre of the steel industry, using bar iron imported from Sweden via Newcastle, something reported on by R R Angerstein in his tour of England in 1753-55 (Berg and Berg 2001). It would seem that the English entrepreneurs were trying to improve the English primary iron industry so that they would not be so dependent on the import of bar iron from Sweden, which was why Angerstein took such an interest in the Derwent Valley. The Hunwick furnace was built before the Civil War but there was also a boost to blast furnace construction in the 1640s and 1650s to provide armaments, as for example in the Forest of Dean (Cleere and Crossley 1985; Cranstone 2008; Crossley 1990; Hayman 2005).

As there appears to be no contemporary 17th-century description of a working blast furnace in the north, the following note made by Thomas Baskerville in the course of a journey through Herefordshire and Gloucestershire in 1673 makes a fitting tailpiece to this paper:

> 'From Ross [on Wye] we went to a place called Longhope, and turning a little out of the road saw the furnace or kiln where they melt iron, the bellows, being very great, which give furious blasts to the fire, are driven like an over-shot mill with water, having a great wheel divers yards in diameter. The fire to melt the ore in the furnace made of stone, which may be 7 or 8 yards from bottom to top in height, is made of charcoal burning day and night for some months, viz:- so long as the water is but a small stream, and commonly dry in summer, doth last. The flame mounts fiercely a good height above the furnace; here is also at the bottom of the furnace a hole as big as that of an oven which lets the dross run away in fiery streaming flames from the melted metal or ore, which metal once in 4 hours is let run into bars or other forms of iron, but the dross when cold becomes a green glassy stone, of which they have vast mounds or heaps about the house and good for nothing but to mend the highways; the heap of charcoal was also great, and the men work day and night in their turns' (Historic Manuscripts Commission Report 1893, 293-4; King 2004 nos 474 and 476, Longhope I and II)).

Acknowledgements

For information and invaluable advice on early blast furnaces I am grateful to Dr Stafford Linsley who also accompanied me on a visit to the site at Furnace Mill in March 2012 where we searched (in vain) for remains of the furnace, before successfully locating the Hunwick Edge ironstone mines. On a separate occasion Alastair Oswald also looked over the site with me and made useful observations about the local topography and the probable date of the standing structures and accompanying water management system. For access then and at other times, and for his continuing interest in the history of his farm, I am grateful to Mr John Basey. I am

indebted to David Cranstone, David Crossley and Prof Marilyn Palmer who commented on an early draft of this paper and made helpful suggestions for improvement. For their unstinting help and patience in answering my questions I am grateful to staff at Durham University Library Special Collections, Durham Cathedral Archives, Durham County Record Office and the National Archives at Kew. Quotations from documents in the Durham County Record Office are reproduced by permission of the Strathmore and Brancepeth Estates and the Durham County Record Office. Dr Brian Young kindly provided notes on the geology of the Hunwick area. At a late stage in the research I became aware of Dr Peter King's work on the early iron trade and I am in debt to him for sharing some of his unpublished data with me. Trevor Pearson made a digital version of Figure 1. Last, but by no means least, a grant from the Marc Fitch Fund helped to defray travel expenses.

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Archive sources and abbreviations

BodL Bodleian Library

DCL Durham Cathedral Library
- Sir Cuthbert Sharp manuscripts (Sharp)

DRO Durham County Record Office
- Brancepeth Estate deeds (D/Br/D)
- Strathmore papers (D/St)

DUL Durham University Library Archives and Special Collections
- Church Commission Deposit of Durham
- Bishopric Estate (CCB)
- Dixon-Johnson papers (DJ)
- Durham Diocesan Records (DDR)
- Durham Halmote Court records (DHC)
- Mickleton-Spearman papers (MSP)

HER Heritage Environment Register

NMR National Monuments Record, Swindon

ODNB Oxford Dictionary of National Biography

OS Ordnance Survey

TNA The National Archives
- Chancery pleadings (C2)
- Exchequer pleadings (E112)
- Exchequer depositions (E134)
- Inquisitions post mortem (WARD7 & C142)

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Appendix 1: John Hodshon's account

(DUL MSP 91 f 100. Words in italics have been added in a different hand)

August : 16th 1664 John Hodshons accompt of
the profitts and charges of the Iron furnice

The charges

		ll :	s	d
Imprimis paid by John Hodshon for the Repaires of the furnice } as appeares by his accompt of the particulers thereof }		041	07 :	04
Item paid by him for the charges of <getting> iron stone and coales for } the Blast last somer, and the founders for casting the iron } and other charges as appeares by the accompt above said }		219 :	18 :	01
	Summe	261 :	05 :	05

The profitts

There was cast into rough iron last somer $43^{Tun:}$ - $2^{hund:}$ - $2^{qtrs:}$ } at 5^{ll} per tunne comes to }		215 :	15 :	00
Soe that John Hodshon was out of purse more } then the rawe iron was worth the summe of }		045 :	10 :	05
but he helps to repay himselfe by his haveing sold } 6 Tunne & a halfe of rawe iron at ii^{ll} <per Tunne> which was cast into } smelting hearths at the furnice and 3 Tunne drawne into } Barrs which will reimburce him about 40^{ll} when received }				

		ll :	s	d
into this stock my Lord putt in money		50 -	00 -	00
in Iron stone which lay upon hunwicke Moore		20 -	00 -	00
& 7 Tunne of Bulletts and granadoes		28 -	00 -	00
& a yeers Rent for the furnice & Iron stone		02 -	00 -	00
	Summe	100 -	00 -	00
& there is more due to my Lord this present } yeare 1664, for 1000 cord of wood *which he tooke out of Bedbourne & Birtley wood* }		050 -	00 -	00
and for a yeers rent of the furnice *this present yeere 1664*		010 -	00 -	00
	Summe soe due } to my Lord }	160 -	00 -	00

		ll :	s	d
of which paid by John Hodshon to Edward Arden and accompted } in his booke of disbursments page 242 }		050 :	00 :	00
& due from John Hodshon to be <paid> at Martinmass next		055 :	00 :	00
& more to [be] paid by him at Pentecost 1665		055 :	00 :	00
	which makes the summe	160 :	00 :	00

Appendix 2:

Extract from the deposition of George Dobson of Burniston [Burneston], Yorkshire, listing tools and iron ore present at the Helmeden [Helmington] blast furnace, in Co Durham, after the death of Thomas Wharton in September 1641. The deposition was taken at Piercebridge, Co Durham, in October 1650 (TNA E134/1650/Mich7, mem ii recto).

'... this deponent saith that he knoweth and did know a furnace for iron and iron works at Helmeden in the countie of Durham which furnace he became tenant to and tooke of Mr Nicholas Lodge then agent for Mr Humphry Wharton one of the defendants And he further saith, That the said furnace was taken from him by Talbott Ribton some tyme servant to the said Thomas Wharton, and at the tyme pretended servant to this defendant Humphry Wharton to whose benefitt and use the same came, And was afterwards as this deponent hath heard sold the same to Mr Thomas Bowes. And this deponent further saith, that there were at the death of the said Thomas Wharton two heapes of iron stone whereof one heape was at the furnace, and the other heape was at the delfe upon Hunwicke moore in the said countie of Durham to the valew of thurtie pounds, eight ringers to the valew of two and thurtie shillings, one paire of bellowboards with lether, and the tacklings thereunto belonginge five pounds, one iron timpe, three stone axes, one tweeare plate, and one iron soume to the valew of twelve shillings one waybalke with hookes and chaines sixtie colebasketts and sixteene mine basketts with other tooles and tacklings belonginge to the furnace to the valew of six and twentie shillings. All which utensells and worketooles were sold as this deponent hath heard by this defendant Mr Humphry Wharton …'

Glossary

The definitions below are abbreviated versions of those given in the revised Oxford English Dictionary.

Ringer: in mining terminology probably a crow bar. The previous earliest usage recorded in the revised OED is dated 1671.

Timpe: the mouth of the hearth of a blast-furnace, through which the molten metal descends; formed by an arch of masonry (*tymp-arch*), or a block of stone or iron (*tymp-stone*, *tymp-plate*), or by two of these together.

Tweeare plate: the tuyere plate is the iron plate through which the tuyere, or bellows nozzle, enters the furnace.

Soume: a soam, soum or sown is typically a Scottish or northern word meaning a short rope or chain attached to a draught animal and used to pull a tram or tub, especially in a colliery. Examples quoted in the OED date back to the later fifteenth century.

Waybalke: a weigh-balk is a steel-yard or balance.

The author

Tim Gates worked as a field archaeologist and aerial photographer for 40 years and now researches the history of the lead and iron mining industries in NE England.
Address: 23 Hampden Street, York YO1 6EA.
Email: tim.gates1@gmail.com