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YORKSHIRE SMELTING MILLS
PART 1 : THE NORTHERN DALES

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This paper discusses lead smelting sites in Wensleydale, Swaledale, Arkengarthdale and their tributaries. A second paper will deal with smelting sites in the southern part of the Dales and north-east Lancashire, which encompass: Wharfedale, Nidderdale, Airedale, Craven and Rossendale.

In the last thirty years most lead smelting remains in the Yorkshire Dales have deteriorated significantly, but a few have been consolidated by the Yorkshire Dales National Park, English Heritage and the Earby Mines Research Group. The latter work reflects the growing interest in all aspects of smelting, not least in much needed archaeological field work, which was also shown at the Historical Metallurgy Society's seminar on Boles and Smeltmills, in May 1992.[1]

Anyone new to the subject is, however, faced with a series of confusing statements on the dates and sometimes the locations of smelting sites in the published sources. These chronological and spatial conflicts have arisen because of the haphazard way in which the subject of mining history has evolved during the last forty years or so. In an attempt to resolve matters, therefore, this paper re-examines the evidence for each site and presents an outline of its history to complement other works.

In addition to an unpublished thesis, these include two major studies of the lead industry in the Dales, both of which are now dated in their approach. Bernard Jennings' thesis, however, remains a landmark in the study of lead mining in the county and, despite its age, cannot be ignored.[2] Its influence has, therefore, been wide. The first study, by Robert Clough, was primarily an architectural survey of Yorkshire smelt Mills.[3] Most of the field work for it was done in the late 1940's and the 1950's, when many mills were fairly complete, but Clough's drawings lack the precision required for modern archaeological records. Moreover, because little or no work had been done on the history of lead mining and smelting at the time of his survey, Clough's text has many deficiencies. Nevertheless, for all its faults, his book remains the only comprehensive survey of Yorkshire's smelt mills.

The second study, which confined itself to Wensleydale, Swaledale and Arkengarthdale, was by Dr Raistrick, and was published in 1975. For the first time, Dr Raistrick attempted to establish a chronology for the region's mills, and relate it to the development of the mines. He corrected some of

Clough's mistakes but also perpetuated others. Moreover, as his text was intended as a narrative for the general reader, it lacks much of the detailed argument required for a definitive work. Nevertheless, for the area covered by this paper, the current model for the history and location of smelt mills is that proposed by Dr Raistrick, in his Lead Industry of Wensleydale and Swaledale: The Smelting Mills.[4]

During the 1890's, however, many old assumptions have been questioned by testing them against detailed evidence. This has led to the emergence of new models.[5] In the case of Yorkshire, much of this new work has also been designed to set the lead industry in a much wider context, and to relate it to other rural industries.[6,7] With specific reference to the area concerned, monographs have recently appeared on the mines of Arkengarthdale and Marrick, and a paper on the AD Lead Mines in Swaledale.[8, 9, 10] This influx of new research to our data base has led to the formation of an increasingly reliable chronology, and this has stimulated a new generation of questions. For example, the application of this data to one aspect of mining in Swaledale, namely the supposed involvement of the London Lead Company in the eighteenth century, showed that it was impossible at most of the proposed mines.[11,12] With that in mind, therefore, it would be opportune to re-examine the spatial and chronological elements of Dr Raistrick's model.

EARLY SMELTING SITES

Bales, which were wind blown hearths, built on exposed hillsides, have been recognised throughout the Pennines, where there is also much place-name evidence for them. There is, however, an interesting and as yet unexplained difference between Derbyshire, where they are called Boles, and the north, where they are always called Bale or a variant of it (Bail, Bayle, Baal etc.). Lawrence Barker, who made a pioneering survey of bales in Swaledale and Arkengarthdale, reported a radiocarbon date of AD 1464 +/- 25 years for charcoal associated with one of the Calver bales.[13, 14] Bales were widely used until the late sixteenth century, when they were replaced by smelt mills with ore-hearths.

A few early smelt mills are recorded elsewhere, but none are known in the area being studied until the late sixteenth century, when mills were built at Marrick and Clints, in Marske. There have been at least 37 mills in Swaledale and Arkengarthdale, plus seven others in Wensleydale, and three copper mills at Middleton Tyas. It is also possible that a few early mills remain unrecognised on the eastern fringe of the lead mining area. For example, the base of an ore-hearth was found at Downholme, where no mill is known.

WENSLEYDALE

The history of mining and smelting in Wensleydale is probably about as long as that of Swaledale but, because most of the mines were small, it is far more obscure. Nevertheless, its antiquity is shown by grant, made in 1145, by Alan, Count of Brittany, giving Jervaulx Abbey liberty to dig ores of iron and lead. The next references are not until the seventeenth century, however, when the Marquess of Winchester, leased some mining ground on the north side of the River Ure near Castle Bolton. The Marquess, later Duke of Bolton, lived at the castle and also had mining interests at Grassington and Marrick.

At the same time, there were several small mines in Bishopdale and Waldendale, on the south side of Wensleydale. These were served by the Burton smelt mill, in Waldendale.

BURTON MILL

Burton cum Walden **SE.019854**

This, the first known mill in Wensleydale, was working by 1684 and was the only mill on the south side of the valley.[15] It is shown on Jeffrey's map of 1773 but is described as 'Old Smelt Mill' on the first edition O.S. 1/10560 sheet. According to Dr Raistrick, however, it was refurbished in the 1847 to smelt ore from the Braithwaite, West Burton and Bishopdale Gavel Mines. The flue was added then. Dr Raistrick also dated the mill's closure to 1870, but the mines supplying it were all closed two or three years earlier.

SARGILL MILL

High Abbotside **SD.898926**

In 1797, the manor of Wensleydale, which was split into High and Low Abbotside from 1723, passed to James Archibald Stuart Wordey Mackenzie who was created Baron Wharncliffe in 1826.[16] The manor included the Sargill Mine which was almost certainly driven in the early nineteenth century, when the mill was built. The mill appears to have closed with the demise of the Sargill Mines Co. around the mid 1860's.

THE MILLS OF THE LORDS BOLTON

The following five mills were in liberties owned by the Dukes and Lords of Bolton, but remarkable little is known of them. Hitherto, each mill has been treated as unique, thereby ignoring the potential role of the Mineral Lord in providing a mill for his lessees. In the absence of evidence to the contrary, therefore, it might be more appropriate to view the Bobscar, Apedale, and

the second phase of the Cobscar mills as part of a sequence of mills. The first phase of Cobs car, Preston (probably) and Keldheads mills were, on the other hand, built by mine owners for their exclusive use.

BOBSCAR MILL
Castle Bolton **SE.026939**

Very little is known about this mill, which was in Lord Bolton's East and West Bolton liberty. According to Dr Raistrick, mines were leased in this area from 1657, and the mill may, therefore, date from the seventeenth century. It is shown on Teesdale's 1828 map, but was a ruin by 1854.

APEDALE MILL
Castle Bolton **SE.031941**

This mill is shown on a plan of the Grinton Mine, dated 1768, when the Apedale mines were being worked by Chauncy Townsend.[17] The latter's lease began around 1759, and the Apedale mill was probably built soon after. The mill appears to have been working when the survey for the first edition O.S. 1/10560 sheet, of 1854, was made, and is assumed to have worked until the closure of the Apedale mine, in 1884. Nevertheless, it never had a flue and was probably closed when Lord Bolton refurbished the Cobscar mill, in 1848.

COBSCAR MILL
Preston under Scar **SE.059920**

James Plews leased Cobscar Rake and built this mill a little before 1762(18). In 1823, however, it was noted that: "the mines here are nearly exhausted but calamine and coals is produced in great plenty".[19] It is likely, therefore, that the first Cobscar mill closed just before or during the slump of 1830-31, and it is shown as 'Old Smelt Mill' on the first edition O.S. 1/10560 sheet, of 1854. Nevertheless, a stone dated 1848 (see Clough), above the door leading to the roasting hearth, records when Lord Bolton had Cobscar mill refurbished, and a flue added, in order to replace the Apedale mill. Cobscar mill is also shown on a plan of Lord Bolton's mines dated May 1851.

The date of closure is problematic but, besides the neighbouring mines, the mill probably served others in Lord Bolton's liberties. Of these mines, Bolton Park worked until 1870; Wet Groves until 1879; and Apedale mine until 1896, all in a small way. Clough suggested that the mill closed about 1890.

Further to the mention of calamine above, a building on Cobscar Rake, at NGR SE.051920, was described as a smithy in 1762, but was marked as

'Calamine House', on the May 1851 plan. Its ruined walls are now used as a sheepfold.

PRESTON or KELD HEADS OLD MILL
Preston under Scar **SE.078912**

Dr Raistrick's suggestion that this mill was on the east bank of Keldheads Gill, in Leyburn township, was wrong. His proposed site for the mill is actually in Wensley. Nor was Preston mill on the site of the later Keldheads mill. It was on the west bank of Keldheads Gill, which is in Preston, near the Stokoe condenser.

The earliest record of Kell Heads (Preston) mill is a map dated 1723, and there is nothing to add to its early history, except to remark that if the Lords Bolton had an earlier mill, this is a good site for it. The suggestion that Preston mill was replaced in 1840 is wrong, however, because it was still standing in 1851, when it is shown as 'Old Smelt Mill' on a plan of Lord Bolton's mines.[20]

KELD HEADS MILL
Preston under Scar **SE.078910**

This mill was built by the Keld Heads Mining Company soon after May 1851. Probably because of its proximity to good farming land, the latter company paid particular attention to cleaning the fumes from its mill. By 1859, therefore, the flue had been extended to a length of 3.3 kms, making it the longest in Yorkshire, and a Stokoe condenser was added before 1862.[21,22,23]

A plan of the surface layout of Keldhead mine, made in 1866, shows the smelt mill, which was much more complex than Clough's drawings.[24] For example, there were two more flues, both of which joined those shown by Clough. One ran from the northern end of the slag mill and probably served another slag hearth. The other ran from a small building, adjoining the eastern end of the smelt mill proper, which probably housed a roasting furnace. Nevertheless, Percy's account of the smelting regime at the mill in 1868 tells us that the ore was no longer calcined before being put in the ore-hearth.[25]

It is not known when the mill closed. It was still working in 1882, when the Keld Heads Mining Company appeared in a list of smelting and metal extraction companies published by the Mining Journal.[26] Dr Raistrick's closure date for the mill, of about 1888, appears to be based on that for the closure of the mine, but it is more likely that the mill closed around 1884, because only the mine's ore returns are recorded thereafter.[27]

The site of the two Keld Heads Mills, the peat house, condenser, flues etc. would amply repay further detailed fieldwork.

SWALEDALE

The principal Swaledale mills are a group of eleven associated with what became the AD lead mines in Muker, Melbecks and Reeth. Six of them, of which three date from the seventeenth century, plus one other, are on Barney or Old Gang Beck. The current model for the history and location of this group of mills was proposed by Dr Raistrick, in his Lead Industry of Wensleydale and Swaledale: The Smelting Mills. This splits the four early mills between Philip Lord Wharton and his brother Sir Thomas Wharton, as follows:-

NAME OF MILL	DR RAISTRICK'S NAME
High or Ray Gill	Sir Thomas Wharton's High
Smith's	Philip Lord Wharton's High
Low	Philip Lord Wharton's Low
New	Sir Thomas Wharton's Low

I have been unhappy with this model for some time, hence my calling the mills Old Low, New and High, as per the available documents, in my paper on the AD Lead Mines. Nevertheless, I retained the spatial and chronological elements of Dr Raistrick's model. This paper, however, proposes a major reinterpretation of the pre-nineteenth century smelt mills on Barney Beck. It also suggests an alternative model for some nineteenth century developments.

On careful re-reading of the documentary sources for the late seventeenth century, most of which have been published by the North Yorkshire Record Office, it is clear that Raistrick's model was seriously flawed.[28] Firstly, the accounts only refer to three mills on Barney Beck. These were the Low, High and New mills.

Dr Raistrick correctly placed the Low and New mills near the nineteenth century smelt mill at Surrender, but he put the High (or Ray Gill) mill, which he called Sir Thomas Wharton's High mill, near the Old Gang mill. This is incorrect, because there is ample evidence that the High mill was near the foot of Ray Gill. The fourth mill was Smith's or Philip Lord Wharton's High mill, which is shown on the 1857 O.S. map. It does not appear in records relating to the Wharton mines and it was not until 1738 that Thomas Smith, its owner, purchased the estate. Contrary to Dr Raistrick's suggested date of 1670, therefore, Smith's mill was built much later.

Other aspects of the model's spatial accuracy are also in question. There is a clear distinction between Lord Wharton's and Sir Thomas Wharton's mills in the accounts. The former are always referred to as the high and low hearths in Swaledale, whilst the latter are just Sir Thomas Wharton's high and low hearths/mills.[29] Moreover, it is clear from the accounts that Sir Thomas's mill was in the manor of Ravensworth, which he purchased in 1675 from Leonard Robinson, who was the owner of one of the mills used between 1671 and 1674. Sir Thomas's mills will be dealt with later, under Whashton and Gilling.

HIGH MILL
Melbecks **NY.978003**

Also called Raygill mill, it was the highest of the late-seventeenth century mills on Barney Beck. Dr Raistrick called it Sir Thomas Wharton's High mill and placed the mill at Raygill Well (sic = Mill Well), near the Old Gang mill. As will be shown, both interpretations are incorrect.

Field walking has failed to reveal the mill's precise location because the valley is strewn with flood debris and mining waste. A leat, which runs down the south side of the gill from the beck, now ends about 55 metres upstream from Raygill. There are also some slags at this place, but they may well come from the Old Gang mill, a little further upstream.[30] Nevertheless, evidence (cited by Raistrick) to the assizes at York, during 1772, states:-[31]

"Lord Pomfret's water race to his high smelt mill in Raygill from the beck to the wheel 441 yards (403 metres) in length and from there to the tail of the race 40 yards (37 metres). From the said mill to Mr Smith's weir 100 yards (91 metres). Mr Smith obliged now since the destruction of the weir to fetch the water about 40 yards further than the weir from the beck to his mill. Distance from Mr Smith's mill to Lord Pomfret's Low mills 1000 yards (914 metres)"

These distances, and the first edition 1/10560 Ordnance Survey map, are invaluable guides to determining the locations of the old mills on Barney Beck. Lord Pomfret's Low mill was at Surrender, and the 'site of old mill', on the O.S. map, is 900 metres from it. The latter is, therefore, Smith's mill. Moreover, the likely course of the latter's leat is given by the 1200 foot contour, which runs through the mill site. The intersection of this contour with Barney Beck is, therefore, the approximate site of Smith's weir. By measuring a further 91 metres upstream, one arrives at a point 134 metres downstream from Ray Gill.

The O.S. map also shows a sluice, and a leat running from it down the south side of the gill, but going nowhere (see above). This race most probably served the High mill, and by measuring 403 metres along it, one arrives at a point 180 metres downstream from Ray Gill.

Whilst the foregoing places are 46 metres apart, neither is remotely near to Dr Raistrick's suggested site at Mill Well. That the mill was nearer Ray Gill is also supported by a plan of the Manor of Healaugh, made in 1770, which shows Ray Gill mill near the foot of Ray Gill.[32]

There were no smelt mills on Barney Beck in February 1668/69, when Swale and Barker leased the mines from Philip Lord Wharton.[33] They undertook to build one, however, if the produce of the mines became great enough and Lord Wharton desired it. Dr Raistrick suggested that they did this almost immediately but, between 1671 and 1674 at least, their ore was smelted at the following mills in lower Swaledale:-[34]

Gilling
Clints
Marrick
Capt. Ro[binson]

This delay can also be explained as a way of conserving capital, which was needed to develop the mines. At the end of August 1674, however, Lord Wharton gave instructions 'That there be a tally kept at Swaledale Mill as the rest'. Thus, the first mill on Barney Beck was built in 1674, but we cannot tell whether it was the High mill or the Low mill at Surrender, however.[35] Whichever it was, the other mill was built by December 1682, when a valuation of lead in stock refers to Lord Wharton's mills in Swaledale.[36] A slag mill, later called the New mill, was also built at Surrender during 1685.

Philip Swale died in 1687 and left his interests in the Swaledale mines to John Chaytor and another three executors. The Chaytor's continued mining, and the Duke ofWharton had renewed their lease by 1719 when they made repairs at the High mill.[37] The Duke's estates were placed in the hands of trustees during the 1720's, however, and the events leading to this have been outlined by Tyson and Gill.[38] Moreover, the High mill was not working by 1736, when the trustee's accounts only name the Old Low mill and the New mill, which were both at Surrender.[39] According to Dr Raistrick, "In 1740 the Raygill (= High) mill was noted as being an old one".[40] The trustees were using the High mill again by 1750, however, and they were possibly

rebuilding the New mill between 1752 and 1754, when it appears to have been out of commission. From 1755, there were, therefore, three mills on Barney Beck connected with the AD mines. These were the High mill, the New mill and the Old mill. The last two were generally called the Low mills. As shown above, the High mill featured in a dispute between Lord Pomfret and Mr Smith, and it smelted until around 1806.

SMITH'S MILL

Reeth **NY.982002**

A track to this mill, on the north side of the valley from Surrender Bridge, and the remains of stonework are still visible. It is also shown on early O.S. maps. Dr Raistrick called it Philip Lord Wharton's High or (later) Smith's mill but, as will be shown, it cannot possibly have been the former's mill. It does not appear in records relating to the Wharton mines and, in 1738, the Duke of Wharton's trustees sold the manors of Healaugh and Muker to Thomas Smith, of Gray's Inn, for £10,500.[41] The sale reserved mines oflead, copper and iron ore in all the common and waste lands for the use of the Trustees but, in 1739, Smith laid claim to minerals under an area called Beldi Hill, near Keld, which he alleged was enclosed.[42] In 1742, he leased it to two brothers, John and Thomas Parke, and Leonard Hardey.

Ore from Beldi Hill was smelted at the Spout Gill mill, which belonged to The Company of Mines Adventurers of England until around 1757. Smith, who had been the company's Principal Agent in Yorkshire, then claimed the mill as part of his purchase (see below) and his lessees continued to use it until around 1770, when he lost it. Contrary to the suggested date of 1670, therefore, Smith's mill was not built until 1769.[43] Why Smith had it built so far from the Beldi Hill mines is not clear, but it was more convenient for his lessees at Fryer Intake, and he probably expected more veins to be found under the Healaugh enclosures. Nevertheless, the mill was destroyed in a riot (instigated by Lord Pomfrets agents) in 1770-71, and the agent for Smith's estate was scavenging slate and wood from it in 1784.[44]

LOW MILL

Reeth **NY.991999**

This mill was near the beck, immediately to the south-east of the (later) Surrender mill. It was one of the three mills built by Philip Swale and Robert Barker under their lease of the mines from Philip Lord Wharton. As noted above, their first two mills (the High and Low mills) were built in 1674 and 1682, but we do not know which of them was built first.

NEW MILL

Reeth **NY.991999**

This mill was at the north-western end of the (later) Surrender mill. It was built as a slag mill, during 1685, under the terms of Swale and Barker's lease from Lord Wharton, and, contrary to the implication of the name Sir Thomas Wharton's Low mill, given to it by Dr Raistrick, it had nothing to do with Sir Thomas Wharton. The relationship between the New and Low mills is confirmed in a letter from John Renshaw to Lord Wharton:-[45]

"In order to a slagg harth milne, hee hath beefore hee come away, levelled & brought the watter from Blackeberye Gill, & layed the foundation of the milne, wich watter macks greate helpe to our other milne."

This water course can still be traced. It runs from the very point where Blaeberry Gill crosses the boundary between the Reeth and Arkengarthdale liberties, to a reservoir on the hillside immediately behind Surrender mill.

As noted above the New mill was probably out of commission between 1752 and 1754, when it may have been rebuilt. It was working again in 1755, however, when it is both mentioned as the New mill and as part of the Low mills. In the early nineteenth century New and Low mills became either the Old, Low or Surrender mills. Both were closed when the new Surrender mill was built around 1840.

SURRENDER MILL

Reeth **NY.991999**

The Surrender company's Low and New mills grew increasingly dilapidated, but their replacement had to wait until after September 1839, when a new lease stipulated that the lessees should build a new mill and 500 yards (457 metres) of flue within two years. This was apparently done in 1841, when the mill accounts record that only 53.67 tons of lead, and no slag, were smelted.[46] The first flue ended at a chimney 470 metres from the mill but, some time after 1854, it was extended to a total length of 745 metres. Another chimney, shown on the 1854 O.S. sheet, 200 metres behind the mill may have been a condenser.

Apart from an entry in a list of smelting companies (Exors of G.W. Denys), published by the Mining Journal in 1882, no alternative has been found for Dr Raistrick's suggested closure date of 1880 for the Surrender mill.

NEW MILL (at Old Gang)
Reeth **NY.975005**

Until 1975, when a second mill was recognised, it was thought that only one mill stood on this site. This is reflected in Bernard Jennings thesis which records that Pomfret and Denys' new mill had four ore-hearths standing in line. He was clearly referring to the later Old Gang mill. In 1975, however, Dr Raistrick pointed out that an earlier mill had been incorporated into the flues of the later mill.

Nevertheless, despite this great advance in our understanding of the site, its chronology is still very confused. For example, Jennings, who only ever refers to one mill, wrote that it was in partial operation before 1801. Clough, again only referring to one mill, stated 1790, whilst Dr Raistrick dated the oldest mill to around 1770, and had the later one built "by 1805".

The AD accounts for this period are not particularly clear, and often lump all the smelting capacity together as the AD mills. They do, however, refer to smelting at the New mill in December 1801. For example, in the following year:-

MILL	Pcs	Fthr	Cwt	Qr	Lbs	SMELTING
New mill	6600	416	20	2	21	January to March
Old mills	5000	316	19	0	7	January to June
	11600 = 807.19 tons.					

The Old mills included the: Old, Middle, Tail and West mills, but their locations are only surmise. For example, if Old and Tail were at Surrender, the Middle was the former High mill, and the West mill was probably Lownathwaite. The New mill was at Old Gang. By September 1806, the AD Company wished to engage all the old mills, which had 4 hearths and a calcining oven.[47]

The propensity to name everything AD is another source of confusion, and a brief explanation is necessary. The above AD Company worked the Surrender mine from 1792, and was comprised of William Chaytor and his son; John Breare; and the lessors (Pomfret and Denys), who had a quarter share. Pomfret and Denys' mills are called the AD mills throughout, and from 1873 to 1887 there was the AD Lead Mining Company Ltd, in which Sir George Denys had a share. There was also the Arkindale and Derwent Company which is sometimes called AD, but had no connection with the Swaledale mines. Instead, this worked in Arkengarthdale from 1812 to 1817.

By 1800, Chaytor's Surender mine was prospering, and Pomfret and Denys were seeking to let more of their mines on lease. Apart from the Lownathwaite

mill (discussed below), however, all the AD mills dated from the seventeenth century and were becoming outdated. A new, more efficient, mill was needed to give extra capacity and to smelt ore from their other mines. This was the New mill, which started smelting in late 1801.

Examination of the site tells us much about this mill. For example, instead of building it on the ample space where the later Old Gang mill stands, it was cut into the hillside to accommodate a short flue which left the mill at roof height. The weight of the flue was supported on retaining walls and an arch. This innovatory arrangement was copied at many later mills. The flue, which probably ran to a chimney on the top of the ridge overlooking the mill, was not the first in Yorkshire, but it was the second. There was a shorter one at Grassington cupola from the 1790's. Moreover, when the Octagon mill, in Arkengarthdale, began smelting in the spring of 1804, its hearths were served by a much longer flue. Developments at the Arkengarthdale mines probably forced the pace at the New mill, where the flue was extended by 100 metres in 1805; 55 metres in 1806; and 550 metres around 1829. This took it to the site of the present chimney on Healaugh Crag.

There is nothing in the accounts which indicates precisely when the New mill was replaced by the Old Gang mill, but it is possible to make a reasoned guess.

OLD GANG MILL
Reeth **NY.975005**

Interestingly, whilst the Old Gang mill was one of the largest in the area, a search of the archives has failed to reveal either when it was built or closed. Nevertheless, there are some clues. For example, the mill is shewn on the first edition of the O.S. 1/10560 sheet for the area, which was surveyed in 1854. Moreover, because the Old Gang mill's flues unite before being led into the old flue via the New mill's southern hearth, the Old Gang mill could be built without interrupting smelting. The New mill would have to stop working, however, when the connection was made and any openings were sealed up. The only detectable break in smelting was between February and April in 1846 which, in the absence of evidence to the contrary, is the date proposed for the transfer of smelting to the Old Gang mill.[48]

As with many similar ventures, the mill was not suddenly closed but it limped on for around fifteen years. Dr Raistrick wrote that it had stopped serious smelting by 1885, which is reasonable, but gave no date of closure. Clough, on the other hand, noted that, according to Mr Hannam Place, "the last ore was smelted in 1898, but for several years prior to this date very little work

had been done". The Government mineral statistics show that the Old Gang mines ore yielded about 74 per cent lead until 1888 and it was only 54 per cent thereafter. This change coincided with the demise of the Old Gang Mining Company and the start of the Old Gang Mining Company Ltd, which also sold parcels of its ore to outside smelters. Nevertheless, the mill smelted in small way until at least October 1899, and possibly until 1903.[49] By 1913, however, the mill had closed and the mine was selling its ore to John Walton & Co. at Castleside.

Old Gang and Surrender were the largest AD smelt mills, but there were another five mills in the AD liberties. These were as follows.

SPOUT GILL MILL
Muker **SD.931956**

From around 1730, a company of national importance took a lease of the Trustees of the Duke of Wharton's lead mines on the south side of Swaledale, between Spout Gill, Keldside and Sleddale. This was the Company of Mine Adventurers of England, which was a joint stock company, established in 1698, with extensive mining interests in Cardiganshire and Montgomeryshire.[50] The company had its own smelt mill at Spout Gill, a drawing of which, dated 1735, is preserved in the Egerton MSS.[51]

The company gave up its lease around 1757, but Spout Gill mill did not close because Thomas Smith, the owner of Smith's mill on Barney Beck, claimed that it was part of the Lordship of the manor of Healaugh, which he had purchased in 1738.[52] Under this pretext, the lessees of Smith's mines at Beldi Hill smelted at Spout Gill until June 1769 when Lord Pomfret's agents took forcible possession of it.

KELDSIDE MILL
Muker **NY.879016**

Keldside mill, at the head of Swaledale, has been dated to between 1835 and 1839. When Henry Jackson & Company leased the Lane End, Keldside and Little Moor Foot mines, in 1829, one of the covenants of the lease was that a mill would be built when there was enough ore to yield six marks (31.4 tons) of lead.[53] Because the industry was entering a massive slump, however, no lead was made until August 1835.[54] The former date can be proposed with some confidence because there is nothing to suggest that the ore was smelted elsewhere. The mill was working in 1859, but it is generally held to have been closed around 1868, when the Kisdon Mining Company gave up the Sir George Level.

The latter company produced very little ore, however, and if the mill was used, it was only sporadically. Interestingly, in 1882, the Mining Journal published a list of smelting companies which included the Swaledale Lead Company, at West Swaledale. This would have been at Keldside but nothing is known of the venture.

Dr Raistrick rightly pointed out that, by comparison to many Dales mills, Keldside mill had a short life (about 24 years) but his statement that it "cannot be regarded as being very successful" is potentially misleading because it really applies to the mines. We simply do not have the data to assess the mill's efficiency.

SWINNERGILL MILL

Muker **NY.912012**

There is some confusion about the date that this mill was built. For example, Dr Raistrick quoted apparently unassailable evidence from the Beldi Hill dispute to propose that Swinnergill mill was built in 1769.[55] Nevertheless, this evidence was not specific and the witness simply stated that 'he carried ore across to the east side of the beck [Swinnergill] where Lord Pomfret is now building a mill'. There is, however, ample evidence that Swinnergill mill was built by Thomas Hopper and Co., who leased the adjoining mines in 1804.[56,57] Some of Hopper's lead was smelted at the Beldi Hill mill in 1806 and 1807, but Swinnergill mill was also working by the end of the latter year.[58]

The mill was already abandoned in 1830, when Edward Broderick visited it, and in 1832 James Littlefair, the AD agent, reported that it "has not been in use for most part of 20 years. The horizontal chimney is much out of repair, also the roof of the mill".[59] This suggestion that the mill closed around 1812 is wrong, however, and Swinnergill mill worked until at least 1818, when it was noted as Mr Hopper's mill, and probably 1819.[60] In support of Littlefair's statement, it seems certain that only part of the Swinnergill ore was being smelted there after 1814. Messrs Hopper worked the mine until 1832 and presumably carted their ore to the Lownathwaite and Blakethwaite mills for smelting.

LOWNATHWAITE MILL

Muker **NY.935006**

Where then was Lord Pomfret building a mill in 1769 if, as is almost certain, Swinnergill mill was built by Messrs Hopper? The answer can only be at Lownathwaite, which is linked by a track to Swinnergill. This is confirmed in 1784, when Lord Pomfret leased Lownathwaite mine to George Jackson & Leonard Raw and allowed them to use his mill nearby.[61]

It appears that the mill was used for smelting ore raised at Lownathwaite, Blakethwaite, Lane End and maybe Swinnergill until at least 1824, when it was replaced by Blakethwaite mill.

BLAKETHWAITE MILL
Melbecks **NY.937018**

From 1806, when Thomas Chippindale & Co. leased the Blakethwaite mine, until May 1821, when the Blakethwaite mill began smelting, ore from, this mine was mainly smelted at Lownathwaite mill. In the summer of1820, the two mills were linked by an extension of the jagger road which runs to Lownathwaite from Gunnerside.[62]

The date of closure is problematic. For example, Jennings, quoting a letter from J.R. Tomlin to G.W. Denys, wrote that the AD Lead Company (1875-80) at first smelted at Blakethwaite mill, but closed it around 1878 because it was in bad repair and inefficient.[63] Clough and Raistrick favour Jennings' suggested date. The Mining Journal, however, credits the Company as working the Blakethwaite mill in 1882. Nevertheless, the mill is listed, in the AD Proprietors' accounts, as the High Mill or Mills from 1830 until July 1868, when the last lead was recorded.

Having discussed the AD Mills, we can move on to other mills in the area, beginning near the head of Swaledale.

BELDI HILL MILL
Muker **NY.909005**

This mill was built because of a protracted dispute, about the ownership of minerals at Beldi Hill, between Thomas Smith, Lord of the manor of Healaugh, and Lord Pomfret, owner of the minerals under the unenclosed lands.[64] Until 1768, ore from Beldi Hill had been smelted at the Spout Gill mill, which Smith claimed was his as the result of his purchase of the Wharton estate lands. Smith had another smelt mill on Barney Beck. In 1768, however, John Scott and Richard Smith, sub-lessees of Beldi Hill mines from Messrs Parke, found a rich mine, which Pomfret claimed. Smith successfully defended his title but, in 1770-71, Beldi Hill mill, or Swinnergill mill as it was then called, was built on land which was undisputedly his.[65]

Smith's new mill, which had a single ore-hearth, clearly demonstrates the durability of the modular design which was typical of dales mills. This enabled Thompson & Co., lessees of the mines from 1838, to expand by simply building another mill, with a slag-hearth, onto the east side of the first one. A detached building, housing a roasting furnace, was also added.

The Beldi Hill mill (R. Milner & Co.) was also included in the Mining Journal's 1882 list of smelting companies, and the company smelted its last parcel of ore in the following year. An inventory made in 1878, however, suggests that its equipment was already in a poor state.[66]

ARKENGARTHDALE

Ore from Arkengarthdale was smelted at bales in the manor of Clints until the late sixteenth century, when Conyers' mill was built there (see below). This arrangement continued into the eighteenth century, although some ore may have been smelted at Farndale mill, in which Charles Bathurst had a share and eventually bought outright in 1729.[67] This was adequate whilst the bulk of the ore came from Windegg and Tanner Rake, but the growing output of ore from Moulds Side, on the west side of the dale, meant that mills were needed there.

MOULDS HIGH MILL

Arkengarthdale **NY.989019**

This mill, near Moulds Bottom, also had a stamp mill but it is not known when either of them was built. In May 1741, however, the Grassington Barmaster, Soloman Bean, and Stephen Barrat visited Swaledale to see a stamp mill.[68] Despite this reference to Swaledale, however, it is likely that Bean went to High Moulds, because no other mill in the area is known to have had stamps so early.

The mills were supplied with water from a nearby reservoir which, in turn, was filled by a le at from Wetshaw Bottom. Smelting at High Moulds continued until 1804, when Easterby Hall & Company's Octagon mill began work.

MOULDS LOW MILL

Arkengarthdale **NY.992010**

This mill stood in Bleaberry Gill, near the boundary with the AD liberties in Swaledale. It is not known when it was built, but it supplemented the High mill, and also closed when the Octagon mill began smelting in 1804. The High and Low mills are both shown on a plan of the manor made in 1799.[69]

OCTAGON MILL

Arkengarthdale **NY.996036**

Clough wrote that the Octagon mill was built by the Bathurst family in 1700, and Jennings believed that it was built in the first half of the eighteenth

century. Tyson, however, demonstrated that the Octagon mill was built in 1803, and began smelting in the spring of 1804. The latter date was also given Dr Raistrick.

The mill's internal layout has also become confused. For example, Dr Raistrick agreed with Clough's reconstruction of the furnaces, which shows only four ore-hearths. Nevertheless, contemporary sources refer to six hearths and, Tyson notes that, "there were seven arched openings in the walls, giving direct access to the six hearths".[70] These flues, which were built with the mill, terminated at a chimney about 810 metres away. The Commissioners of the Greenwich Hospital built a long flue at the Langley mill in 1801, and this probably influenced the Easterby Hall company, which also had mines in Northumberland.[71] The Octagon had the first truly long flue in Yorkshire, however, and the AD New mill's flue was extended soon after.

The Octagon mill passed into the hands of the Arkindale and Derwent Mines Company in 1812. The latter company gave up the mines in 1821 and, for some unknown reason (probably relating to ownership of the Octagon mill or its site), the lessors undertook to build a new smelt mill within nine months of the new lessee (Jaques & Co.) taking over.[72]

NEW or CB MILL
Arkengarthdale **NY.996034**

The lessors' new smelt mill was called the New or CB mill, and the confusion over the chronology of the Octagon mill has also affected the interpretation of its history. According to Jennings it was built by Easterby Hall, and remodelled around 1824.[73] Clough repeated the foregoing, but Dr Raistrick noted the provisions of the 1821 lease, and went on to suggest that a deed of covenant, dated 1824, and a new lease granted in 1830, somehow point to the mill not having been built until 1824.[74] In support of this, there is also a copy of an unprovenanced drawing of the "New Smelting Mill, Langthwaite, built 1824 by messrs Gilpin", in the NMRS Records.[75] Nevertheless, even if we accept that the mill had recently been completed, it was almost certainly built in the previous year because the deed was signed on February 17th 1824. Likewise, because the first lease was signed on June 1st 1821, the nine months allowed for building a mill meant that smelting could hardly have started until 1822. We are, therefore, left with the years 1822 to 1823 in which the New mill began work.

Both Jennings and Clough held that the mill had six reverberatory furnaces. This is wrong, however, and, as Dr Raistrick realised, the mill had ore-hearths. Moreover, Clough's drawing differs significantly from the one in the NMRS Records. For example, whilst the layout of the waterwheel, central

arched passage, and the six hearths are the same, on the latter drawing the fume hoods cum flues are less complex, and the roof is pitched north-south as opposed to east-west. Photographs in Clough's book support his roof layout, but the flues are not clear. It is known that the flues were extended after 1854, and that by 1872 the hearths had also been modernised. It looks, therefore, as though one or both episodes was associated with a major rebuilding of the structure which took the fumes into the flues, and a realignment of the roof.

When the CB mill began smelting, its fumes were vented through a 160 metre long flue into the one from the Octagon mill. This gave a total length of 714 metres to the chimney. Sometime after 1854, however, a new chimney was built high on Moulds Side, 1470 metres from the mill. This new flue was also linked to the old chimney by a 136 metre long detour.

Dr Raistrick gave the closure date as July 1901, but the smelting ledger does not end until the end of October that year, and the mines did not close until the following year. When Stang & Cleasby Lead Mines Ltd worked part of the Arkengarthdale mines, between 1907 and 1911, it sold all the ore raised.

GRINTON, FREMINGTON & ELLERTON

To date our understanding of the history of the Grinton mines and smelt mills has been very patchy. Readers are, however, advised that a monograph on the topic is in preparation and this is expected to bring forth much new material and coordinate this with the knowledge we already have to present a more complete account.[76]

The minerals in Grinton were Crown property until 1876, but long before then they were separated from the other manorial rights. This division of ownership is also reflected in the history of the mills. Until 1582, the mines were worked under grants and the ore raised was smelted at bales which, for example, have been found at Blue Hill, on Harker Side; and at the Smeltings, near Grinton Youth Hostel. From 1582, however, the Crown leased the mines to local landowners who took their ore to their own or other mills for smelting. For example, Arthur Phillipe (1582-1613) had a mill at Clints, and Humphrey Wharton (1628-49) had a mill at Gilling.

There have been a number of disputes about the ownership of the minerals in the manor but the Crown won them all. In 1692, for example, under such a pretence of ownership, Philip Swale granted a lease, to Philip Bickerstaffe & Company, in which they "agree(d) to put up £20 each to finance the works". The phrase 'works' has been taken to mean a smelt mill but, whilst that may

have been intended, subsequent grants etc. show that one was not built. Reginald Marriott, who was working the mines under a lease granted to George Tushingham by the Crown in 1696, disputed Swale's claim and won. If Bickerstaffe & Co. had built a mill, therefore, Marriott would have seized it too, but his ore from Grinton was smelted at the Duke of Bolton's mill at Marrick in 1692, and at Marrick cupola in 1704.

Marriott, who was also Lord of the manor of Grinton, leased the mines in his own name in 1727. Dr Raistrick drew attention to a proposal by the London Lead Company to purchase the manor and lease of the mines with smelt mill in 1733, but the note of this has since been lost. When Marriott died in 1736, the manor and the rights to the Crown lease were inherited by his son, Hugh, who quickly demised the remaining term of the mining lease to Edmund Moore for an annual rent of £100.[77] Hugh Marriott kept the manor and it passed to his widow, Lydia, on his death. She conveyed it, along with the smelt mill and other buildings on the waste of the manor, to Caleb Readshaw in May 1756.[78] This is the first reliable mention of a smelt mill, and its inclusion with the manor suggests that it was built by Marriott, probably soon after his lease was granted in 1727. The mines were on veins which cross Grinton How, and the smelt mill was built on the side of Cogden Beck, just over a kilometre to the east.[79]

HOW MILL
Grinton **SE.049964**

The history of this mill has been confused by its claimed association with the London Lead Company. A recent paper, however, argued convincingly that the latter company was never involved with the Grinton mines.[80] As noted above, the first mill was probably built by Reginald Marriott, a little after 1727.

How Mill was used by subsequent lessees until 1820 when, for two years, beginning in 1820, all the ore from the Grinton How mines was smelted at neighbouring mills whilst it was modernised.[81] Such a long break in smelting suggests that the old mill was demolished and completely rebuilt. It is also likely that a flue was added then. By 1854, the flue had reached its full length of 300 metres, and ended at a chimney on Sharrow Hill.

There are the usual range of dates for the closure of this mill. Clough suggests about 1886, and Dr Raistrick wrote that the Grinton Moor Company worked the mines and the mill until 1893. The latter company gave up in 1872, however, but one of its successors, the Grinton Mining and Smelting Company Ltd (1888-95) repaired the flue, and put in new hearths and a roasting furnace in 1890.[82] This company gave up working the mines in 1893, thereby supporting Dr Raistrick's date.

The manor of Grinton had another three mills in Grovebeck Gill, which served the mines on Grovebeck and Harkerside, and one at Summer Lodge. The oldest of them was Grovebeck mill.

GROVEBECK
Grinton **SE.028970**

The history of this mill remains vague. Dr Raistrick argued that "we shall probably be justified in assuming that Grovebeck had been the smelting mill for Harkerside from the second quarter of the seventeenth century when those mines were being worked by Humphrey Wharton". He was right to view Grovebeck as the smelting mill for the Harkerside and Whitaside mines but, as will be shown, Wharton had a mill on his estate at Gilling and probably did not need another. Tyson, on the other hand, argues that Grovebeck mill was built soon after 1692, when Sir Solomon Swale granted a 31 year lease of Harkerside mines to Bickerstaffe (Pers com).

Nevertheless, Grovebeck mill must be much later if the argument developed above, that Marriott built the first mill, and it was still the only one in 1765, is correct. This idea is supported by an agreement to settle a dispute about smelting at Grinton mill between the Lord of the Manor, Caleb Readshaw, and the Crown lessee, Mrs Moore.[83]

It also appears that the development of the Grovebeck mines was quite late because Mrs Moore granted blocks of meers there in 1761, and George Jackson records that Grovebeck Vein was discovered by Thomas Dunn in 1762. Part of Mrs Moore's grant was a promise to find the takers a mill, and a plan of the mines shews the area was an granted by 1768, and Grovebeck smelt mill had been built.[84] It is likely, therefore, that the mill was built between 1762-65.

As with many mills, the date of closure for Grovebeck mill is problematic. The smelting accounts record that Grinton ore was smelted there between 1820 and 1822, when the How mill was being rebuilt. In which case, closure was probably in the mid 1820's. It is not shown on a plan of Grinton liberty made in 1774, however, and a report on the mines in 1776 only refers to the How and New mills, from which the old lessees had sold the utensils (probably to the new lessees).[85] The Grovebeck mill that was working in 1820 may, therefore, have been the New mill, which was on Grovebeck.

NEW MILL
Grinton **SE.034971**

There is a paucity of documentary evidence for the New mill, which was about 550 metres downstream from Grovebeck mill. It is not shewn on

Jackson's 1768 map, but it was used by Mrs Moore, whose lease expired in 1774. This dates the mill to within six years, but it is possible to refine this further and to deduce that it was probably built between 1768 and 1770, when a rich strike was made.

It was not named as one of the mills used to smelt ore from Grinton from 1820 to 1822 but, as noted above, it may have been called Grovebeck mill by then. It is shewn as a ruin on the O.S. sheet of 1854.

SCOTT'S MILL
Grinton **SE.038973**

This mill was built by John Scott, a partner in the Beldi Hill mines and one of those ejected from Spout Gill mill following a dispute with Lord Pomfret. Scott was also a partner in 10 meers of ground on Grovebeck, leased to Robert Elliott, and appears to have built his mill in the late 1760's or early 1770's. Whilst ostensibly built by a Crown lessee, Scott's mill stayed in private hands and must, therefore, have been built with the permission of the Lord of the Manor. It would otherwise have reverted to the Crown and could not have been sold, as it was in 1854, by John Langhorne, of Reeth, to Marmaduke Wyvill, who had the Ellerton Moor mines.

At the latter date, we learn that Scott's mill had an ore-hearth, slag-hearth, and roasting furnace. Whilst otherwise unremarkable, Scott's mill is interesting because it never had a flue and yet continued smelting until 1868.

SUMMER LODGE MILL
Grinton **SD.966950**

Dr Raistrick proposed that Summer Lodge was referred to as an old mill in 1770 and, therefore, was probably built before Moore's 1750 lease. Tyson, however, asserts that the mill was built by Josias Readshaw Morley & Co. in 1810, to smelt ore from the Summer Lodge Vein (Pers com.). It also smelted Grinton ore from 1820 to 1822, when the latter mill was being rebuilt.

Summer Lodge mill belonged to the Whitaside Mining Company in 1854, when the O.S. sheet was surveyed, and was apparently working. The latter company gave up in 1857, however, and the mines stood until 1862, when the Summerlodge Mining Company (1862-1867) was formed. Whilst it is possible that the mill smelted in the latter period, it was very outdated. For example, it never had a flue, but, as Scott's mill proved, that did not always force closure.

FARNDALE MILL
Fremington **NZ.019028**

On a plan of the manor of Arkengarthdale, made in 1718, Farndale mill is shown as a small building on the opposite side of the stream from the foot of Tanner Rake Hush.

It was working by 1625, when it is mentioned in the accounts of Storthwaite Hall, and, by 1729, Farndale mill was run as a jobbing mill by a company of six men who split it into twelve shares. Five of the partners held eleven shares between them, and Charles Bathurst had one. In August of the latter year, however, Bathurst bought out his partners and became sole owner. An interesting aspect of this sale is the inclusion of a peat house, when most other mills were still burning chopwood.

ELLERTON MILL
Ellerton **SE.069976**

Little can be added to the history of this mill which, as Dr Raistrick pointed out, was working by 1683, when it had an ore-hearth and a slag-hearth.[86] It is also shown on a plan of the Grinton lead mines made in 1768.

It remains to be proved when the mill closed but, contrary to Dr Raistrick's suggestion, it is highly unlikely that it worked into the time of the Ellerton Moor Mining Company (1874-1881). The mill is not shown on maps dating from the 1820's, and it is more likely, therefore, that it closed in the later eighteenth or very early nineteenth century. After the closure of Scott's mill, it appears that some ore from the Ellerton mines may have been smelted at Keld Heads mill (see Marrick Low mill).

MANOR OF MARRICK

There have been four mills in this manor, and each is of considerable importance to the history of British lead smelting. The High and Low mills are Scheduled Ancient Monuments, but their history has been the subject of some considerable confusion. For example, Clough went so far as to propose that the High Mill was built on the site of the Low mill's chimney! Clough also incorrectly states that both mills had reverberatory furnaces, when they plainly had ore-hearths. Dr Raistrick's interpretation of the mills has been closest. Nevertheless, his suggestion that the High Mill might have been built by the London Lead Company, which supposedly leased the Hurst mines from 1747 to 1778, is wrong. This lease has been the subject of a recent paper which, whilst noting that no evidence had been found to the contrary,

concluded that it was unlikely that such a major company could have worked the mines and yet remained so anonymous.[87] What ever is the case, it will be shown that the London Lead Company did not build the High Mill.

EARLY SMELTING SITES

Until 1574/75, ore raised in the Marrick liberty was carried to Fremington Edge, where it was smelted in bales situated to the east of the trigonometrical station. A plan, dated 1592, shows a line of four bales plus another, belonging to Marrick Priory, offset from them.[88] The ownership of at least some of the other bales is suggested by Adam Spensley's evidence in a boundary dispute between Roger Aske and Christopher Conyers, in 1502. Spensley related that "he hath seen the Askes and Bulmers, owners of the manor of Mar rick, cut down, carry away, and burn at their lead bales such wood as grew upon Hazelhow and Hawthorns.[89] This early example, of what was later the general rule in Yorkshire, shows that, unlike Derbyshire, the Mineral Lords regulated the lead industry by controlling smelting.

SAYER'S or LOW MILL

Marrick **SE.078994**

For lead smelters, the late sixteenth century was a time of rapid change, when water powered smelt mills, with ore-hearths, swiftly replaced bale smelting. Early ore-hearths were made entirely from large stones but, with the exception of Derbyshire where stone was still used in 1729, their parts, which were still called stones, were generally made from iron by the early eighteenth century.[90] The ore-hearth appears to have evolved on the Mendip, in Somerset, from a new type of smelting hearth, blown by a foot-blast, which was developed around 1540. The latter had evolved into the ore-hearth, with its characteristic work-stone, by the time the first of these hearths reached Derbyshire in 1571 or 72. That hearth was built by smelters from Somerset who were employed by Humfrey to re-equip his mill at Beauchief.[91] What was probably the first smelt mill in Swaledale was built by John Sayer, on the side of Dale Beck, where Marrick Low Mill now stands, sometime in 1574/5.[92] Sayer's mill was, therefore, contemporaneous with the very beginning of the change from bole smelting in Derbyshire. This tends to contradict claims that ore-hearth technology was simply diffused.[93] Whatever the mechanism that spread it, however, the ore-hearth reigned supreme in Yorkshire and most of the northern Pennines for the next three hundred years.

MARRICK HIGH MILL

Marrick **SE.079994**

By 1660, a second mill, the High mill, had been built, probably by Thomas Swinburne the new mineral lord, and Sayer's mill, now called the Low mill, was smelting slags recovered from abandoned bales.

Horse loads of slags (= 2cwts)	from	to
594	old smeltings	Low mill
331	Fremington Edge	Low mill
158	Skelton Moor	Low mill

One of the mills must have closed by 1705, however, as an agreement settling a dispute between Lord Powlett and John Hutton, over the boundary between Marrick and Marske, only refers to one mill.[94] The latter was probably the High mill, which was newest and is shown on Thomas Jackson's map of the Marrick Estate, made in 1782.[95] A small building on the site of the Low mill is not named. Nevertheless, Thomas Jeffrey's map of Yorkshire, surveyed between 1767 and 1770 refers to the mills in plural.

MARRICK LOW MILL

Marrick **SE.078994**

The present Low mill is in reasonable repair but no date has been found for when it was built. It is, however, shown on the 1854 O.S. sheet, when it had what looks like a short flue. Moreover, the High mill was described as beyond repair in 1861, when the Hurst Mining Company took over.[96] In the absence of evidence to the contrary, therefore, it is most likely that the new Low mill was built during the term of the lease granted to Jaques & Co. in 1828. Normally, one might expect such a development during the early years of the lease but, owing to the major slump in lead prices between 1829 and 31, the date of the building was probably nearer the end of the 1830's, when Queen's Level was driven.

The mill was seldom used by 1858, however, and most of the ore was sold direct to smelters. This lasted until 1862 when all the ore raised was smelted to give 111.70 tons of lead. A 20 foot diameter by 39 inches waterwheel was purchased from the Lane End Mines and preparations were made to install it in the Low mill during the winter of 1862-63. The flue was also extended to the High mill, which was sealed and the old furnace room used as a settlement chamber, with the fume venting from its chimney. A slag hearth was also added to the Low mill.

Nevertheless, this new arrangement was abandoned early in 1868 and the mines went back to selling to the smelters. Five tons of pig lead was sold in 1869, but this might have been from stock because it was from the last mark (letter T) smelted in early 1868. Another five tons was sold in 1871, and 0.2 tons in 1874. The latter parcel was probably made up of lead salvaged around the mills.

Clough's claim that pieces of lead from the Marrick mills were cast with ELLERTON, in sloping capitals on their top faces is highly unlikely. Strangely, the pig pan which he used to illustrate this point, was photographed "on the old flue at Preston under Scar", which is at Keld Heads.

CUPOLA MILL
Marrick **SE.063987**

The fourth mill at Marrick was the Cupola, at Reels Head. Dr Raistrick, faced with an absence of evidence, supposed that it was built around 1860 and worked for approximately twenty years. We now know, however, that building actually began late in 1700 and that the mill was smelting in 1701.[97] It was the only cupola in Yorkshire until 1792, when the Duke of Devonshire built one at his Grassington mines.

The first successful cupolas in Britain were used, in the 1680's, for lead and copper smelting near Bristol, and others, for lead, were built in Flintshire during the 1690's, where they were also later used by the London Lead Company at its Gadlys works.[98] In the north Pennines, the London Lead Company, in particular, had wide experience of the early use of cupolas for lead smelting. Nevertheless, they were never widely adopted and only Derbyshire and Flintshire became centres of cupola smelting. It was not until 1735, however, that the London Lead Company introduced them into Derbyshire, at its Bowers Mill.[99] Two years later, Richard Bagshawe used them at his Olda Mill, where they initially proved disappointing.[100] Nevertheless, the Bagshawe family and its associates were responsible for spreading the use of cupolas throughout Derbyshire where they superseded the ore-hearth by the 1780's.[101]

The Marrick Cupola was, therefore, the first in Yorkshire and one of the first in Britain. It is also interesting because unlike most Yorkshire mills, which served specific mines or liberties, it was a jobbing mill, which smelted parcels of ore brought from any mine. For example, in 1703 it smelted parcels of ore from Woodhall (in Wensleydale), Grinton How, Buckden Gavle and Kell Pasture. The Cupola was owned and worked by a company which included: John Blackburne, Emmanuel Justice, Reuben Orton, Mr Langstaff and Ralph Rowlings. Justice and Blackburne were partners in the Blew

Groves Mine, at Buckden, and, contrary to the terms of their lease, which stipulated that their ore was to be smelted at the Earl of Burlington's Grassington mill, they carted ore to Marrick. Nevertheless, the Cupola mill only worked for a few years before a dispute amongst the owners forced its closure. The mill was in ruins by 1725, when it was demolished.

MARSKE

Lead smelting in the parish of Marske is of considerable antiquity, and was centred on Clints. The Arkengarthdale mines supplied most of the ore, which was smelted in bales until the late sixteenth century, when the first of four smelt mills was built at Clints. Dr Raistrick described these mills, but his model can be refined as follows.[102]

CONYER'S MILL

Marske **NZ.089021**

When Christopher Conyers died, in 1504, his will included an item for all the lead which had been burned (smelted) in the manor of Marske. Likewise, the will of William Conyers, dated 1531/32, mentions a burning place at Clints. Both of the foregoing almost certainly refer to bales, but a smelt mill, with two furnaces, was working at Clints by 1589. Like Sayer's mill at Marrick, therefore, the latter was a very early mill.

The manors of Marske and Clints passed by marriage to Arthur Phillipe, whose son sold them to Timothy Hutton. In 1635 Dr John Bathurst married Elizabeth Willance, the daughter and co-heir of Brian Willance, whose family had acquired the manor of Clints and its smelt mill from the Hutton family around 1618. By this marriage, therefore, Bathurst gained possession of the Clints mill and was able to use it for smelting ore from the Arkengathdale mines, which he leased in 1654.

CLINTS MILLS (Nos. 1, 2 & 3)

Marske **NZ.092175**

By 1759, the old mill was in ruins, and three other mills had been built nearby to accommodate the growing output of the Arkengarthdale mines. Nothing else is known of them.

The estates passed to Charles Bathurst, and when he died without issue in 1740, they were split between his three married sisters, Mary Sleigh, Jane Turner and Francis Forster. In order to clear some debts, however, the manor of Clints was sold to Thomas Duncombe in 1754, but it was bought back by Charles Turner in 1761. He, in turn, sold it to John Viscount Dawn in 1767. The smelt mills appear to have closed around then.

THE MANORS OF RAVENSWORTH AND GILLING

As will be shown, Dr Raistrick's model has also proved an obstacle to understanding the smelt mills in this part of lower Swaledale. Apart from trials for lead at Applegarth and on Thorpe Edge, the principal workings were on a vein which runs from the parish of Marske into that of Whashton, at Feldom. The latter vein produced lead and some copper ores and two smelt mills were built. These were Whashton and Gilling mills, both on Smelt Mill Beck.

Between 1671 and 1674, Swale and Barker sent ore from their mines in Healaugh to be smelted at mills in lower Swaledale. The sites of three of them, at Clints, Marrick and Gilling, are well known, but, the other one, which belonged to Captain (Leonard) Robinson, has caused confusion. Careful reading of the Wharton accounts also raises questions about other aspects of the model's spatial accuracy. The accounts make a clear distinction between the mills, by describing Philip Lord Wharton's as the high and low hearths in Swaledale, whilst Sir Thomas Wharton's are simply the high and low hearths. It is also clear, however, that Sir Thomas's hearths were not on Barney Beck, as proposed by Dr Raistrick, but in the manor of Ravensworth, which he purchased in 1675.

According to Dr Raistrick, there were three mills in the manor of Ravensworth; Robinson's mill, which he felt was at Applegarth; Gilling (Hartford) mill and Whashton Copper mill. Taking them in order.

APPLEGARTH MILL (PUTATIVE)

Richmond **NZ.132018**

The site proposed for this mill is in a most unlikely place, on a steep hillside, and field walking has failed to reveal traces of slag etc. Moreover, the accounts only refer to the cutting of chopwood in woods at Applegarth and there is, therefore, no evidence that there ever was a smelt mill at Applegarth.[103]

GILLING MILL

Gilling **NZ.159057**

This mill, in the manor of Gilling not Ravensworth, was near the boundary with Whashton, where Lead Mill Lane crosses Smelt Mill Beck. It was built by Humphrey Wharton, who was Lord of the manor of Gilling and lessee of the Grinton and Fremington mines from 1628 to 1649. There is no evidence that Thomas Wharton had any involvement with Gilling mill.

Humphrey Wharton reserved the mill and a nearby wood when he apparently mortgaged his estates to Ronald Graham in 1658.[104] Moreover, the following Exchequer Deposition, made in 1697, suggests that he was still the owner.[105]

"Thomas Pearson of Gilling, who worked at the mill there, knew James Crathorne and Clement Chamber who worked for Humphrey Wharton. Wharton sent his lead there and he often heard his master at the mill say Grinton had the best lead brought to the mill".

The date of closure remains to be proved, but it was early in the eighteenth century. Until the 1750's, at least, lead from the AD mills was shipped via a store at Hartford to Stockton. Dr Raistrick believed that Gilling smelt mill was used as that store but the author has been unable to substantiate this. This leaves us with the question of the locations of Captain Robinson's mill and Sir Thomas's high and low hearths which, it will be shown were at Whashton.[106]

WHASHTON MILL

Whashton **NZ.144055**

This was near Copper Mill Bridge, on Sturdy House Lane, and is in the manor of Ravensworth, which Sir Thomas Wharton bought from Leonard Robinson in April 1675. Within days of his purchase, Wharton leased the lead and coal mines in the liberties of Feldom, Whashton, Applegarth, Thorpe and Thorpe Edge, all in the manor of Ravens worth, to Swale and Barker for thirteen years.[107] The lessors formed a partnership with a joint stock; which in the case of the company they formed to work the mines leased from Lord Wharton, in Muker, Nateby and Wharton was £300.[108] After working for ten years, Philip Swale remarked that the mines in Thomas Wharton's estates "have lost much money in tryall and given yet no encouragement" and that the joint stock was reduced to around £30.

What little ore was raised at the above trials was smelted at the Whashton mill but, in May 1685, soon after Thomas Wharton's death, Swale advised Lord Wharton that "what benefit it (the mill) made, it was by thy favour, for there was no oare but from thy work to imploy it, and without imploy it was worth nothing, but would require charge to keepe it in repayre."[109]

The location of Thomas Wharton's mill is confirmed by a list of Wharton's tennants, made in 1686, which records that "There is a peece of bad way in the pasture neare the smelt mill cald the Spring Pasture in Robert Reeveley's farming ...". The same document also tells us that Reeveley's farm was in Whashton, where three other tennants were smelters.[110,111] The latter men may, however, just as easily have worked at Gilling mill.

Smelting had been delayed by lack of water in July 1685, but a slag-hearth was being prepared to smelt " ... the quantity of slag about the mill, which must be smelted there because the oare hath beene smelted there that afforded that slag, and made Sir Thomas more profit then if the slag had beene smelted in his time would have beene ...".[112]

Nevertheless, the mill was unviable because it relied on distant mines, which increasingly had their own mills. In the early eighteenth century, however, it was used for smelting copper ore from a vein in Feldom and, in June 1728, Matthew Blackburne of Gales, in Kirkby Ravensworth, blacksmith, was indicted with breaking into the copper smelting mill at Whashton belonging to John Ward and John Appleby and stealing 4 iron bars worth 11d.[113] The mill probably closed soon afterwards.

STAINTON MILL

Stainton **SE.090952**

Apart from confirming Dr Raistrick's grid reference, nothing else has been discovered about this mill, which is shown on Greenwood's map of 1817. It was built in 1786, by Simon Scroope, and probably closed in the late 1820's. The building is shown, but not named, on the first O.S. map.

WAITWITH MILL

Hipswell **SE.171976**

This mill has not been found, and the above grid reference is only a guide. On the first edition 1/10560 O.S. map, that part of Rise dale Beck west of the A.6136 is called 'Lead Mill Beck'. Dr Raistrick placed the mill nearly 1km downstream, at Pleasant Dale, where he remarked that a dam, watercourse and slag heap used to be visible.

Very little is known of the mill's history, other than that it was smelting ore from Lord Wharton's mines in the early 1680's. The poverty of the few mines in this area suggest that the mill had a short life, and was sustained by importing ore. Further research is needed to clarify the ownership of minerals and land in this area, and to confirm the location of Waitwith mill.

EASBY MILL

Easby **NZ.196003**

This, the least known mill in Swaledale, is shown on Jeffry's map of Yorkshire. The mill, near Brocken Brea Farm, is now the headquarters of the Brompton Caravan Park. There are no mines in Easby, however, and

more research is needed to determine any links between local landowners and the mines. For example, Thomas Smith, who purchased the Lordship of the manor of Healaugh etc. from the Duke of Wharton's trustees in 1738; and Ralph Lodge, who leased the Glebe mines at Middleton Tyas in 1775, both came from Easby.

Research by Richard Lamb, using the Easby Church Parish Registers, has shown various families living at the mill between 1741 and 1804.[114] This suggests that the mill either had accommodation or it had closed by 1741.

MIDDLETON TYAS

The last group of mills, a few miles to the east, were associated with Yorkshire's most significant copper mining area around Middleton Tyas. The following description is based on T.R. Hornshaw's account of Copper Mining at Middleton Tyas. As Hornshaw noted, however, identification of the three known smelting mills is difficult and the details given are, therefore, provisional.[115]

GLEBE MILL
Middleton Tyas **NZ.236055**

George Tissington came to Middleton Tyas, from Derbyshire, in the 1740's. At first, he worked Richard Shuttleworth's mines, but in 1750 he leased the Glebe copper mines, which were soon troubled by water. By leasing Kirk Bank Pasture in 1753, however, he was able to build an atmospheric pumping engine to drain the workings.

In April 1753, Tissington built a smelt mill at a cost of £500. Its location is in doubt, however. Hornshaw gives evidence that it was part of the complex in Kirk Bank Pasture, but warns that this area was not leased from Peacock until August that year. Tissington's mill had a reverberatory furnace. He used this to smelt the ore and make regulus, which he then sold on to be refined into copper.

HARTLEY'S MILL
Middleton Tyas **NZ.229059**

Leonard Hardey was a local landowner, whose copper deposits were worked under lease from 1736 onwards. By the 1750's, the mines were worked by his son, George, and his nephew, who was also called Leonard. The principal Hartley mines were just off the northern boundary of Middleton Tyas church, and were worked by their agent, John Ayre, from 1762 to 1766.

Hartley's smelt mill was built in 1754 and cost £40. Again, there is doubt

about its location. A document in the parish bundle, however, records the later acquisition by the parson of the area east of the Rookery, including Smelt Mill House, which he exchanged with George Hartley for another field. This suggests, therefore, that Hartley's mill was the one in the village. It was still working in 1784.

PARTNERS' MILL
Middleton Tyas **NZ.234059**

There were four partners: Lady D'Arcy, John Hutton, John Yorke and Andrew Wilkinson, of which Hutton and Yorke were Lady D'Arcy' s sons-in-law. Their agent, from 1742 to 1767, was Ralph Hutchinson, and their mines, in fields called South Mains and North Layberry's, were centred on Cow Lane. This was all land owned by the Shuttleworth family.

In 1744, the partners spent £107.75 on building a smelt mill and were refining copper by 1746. In 1754, however, the partners let their mill on lease to John Rotton at an annual rent of £10, which he paid until at least 1767.[116] All the evidence suggests that the partners' mill was the one at the southern end of South Mains, off Cow Lane. For example, according to Hornshaw, the slag found there, unlike that found elsewhere, is black, hard and contains very little residual copper. This suggests that it was from a refinery. We also know that Robert Shuttleworth, who worked his own and the Glebe mines, was smelting and refining copper between 1774 and 1780.

The partners' accounts refer to blasting 'furnace holes', which were usual for the ash pit and underneath the furnace sole. They were obviously cut into the rock and may well still be there, but more fieldwork needs to be done in this area.[117]

CONCLUSION

The thrust of this paper concentrates on the chronological and spatial aspects of the model currently used to understand the lead smelting industry in Yorkshire's northern dales. Chronological evidence was mainly restricted to the start and end of smelting at each site. Most of the major dating errors have already been corrected by others but, nonetheless, a few significant changes, and a host of fairly minor adjustments (in one case only three months), to the existing model have been proposed. Far more radical changes are proposed to the model's spatial aspects, however. New mills have been added, one has been removed, and others relocated.

Obviously many questions remain, and only a very small part of each mill's history is given. There is, therefore, an urgent need for further, very detailed

studies of each mill. The latter, however, should not be restricted simply to adding more historical detail, but should be accompanied by detailed field recording and analysis of the structures, their water and fuel supplies, and transport routes. Only by doing this will the next generation of questions arise.

ACKNOWLEDGEMENTS

No study of this broad nature can result from one person's work only. I am, therefore, particularly indebted to Les Tyson and Richard Lamb for reading and commenting at length on drafts of this paper, and also to Lawrence Barker for his comments and field visits.

Thanks are also due to the staff of the North Yorkshire Record Office; University of Leeds, Brotherton Library; and the Public Record Office, at Chancery Lane.

ABBREVIATIONS

DCRO Durham County Record Office, Durham.
NYCRO North Yorkshire County Record Office, Northallerton.
PRO Public Record Office, Chancery Lane, London.
ULBL University of Leeds, Brotherton Library.

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"The best wood for the supply of the smelt mill is in Applegarth, where Feldom servants was to have libertye of getting hedgboot; wood closes neare the smelt mill is another place that yields chopwood; the rest is some whins in the Spring Pasture while in Sir Thomas hand."

104. ULBL Yorkshire Deeds: Gilling. To be excepted Gilling Spring Wood. of 300 acres, Gilling Lead Mill. The manor house, orchards, gardens, barns thereto belonging. The High Field bought of Anth Lightfoot. A later entry has the smelting mills at Gilling and the Spring 80 acres of wood north – not formerly in any particular £100 0s 0d.

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106. This varies from my preliminary conclusions which were voiced in a letter to the editor of the Bulletin of the Peak District Mines Historical Society, 1992. I am indebted to Richard Lamb for discussing the issue of mills at Whashton and Gilling, and for raising well founded doubts about my original interpretation.

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YORKSHIRE SMELT MILLS
PART 1: THE NORTHERN DALES
LIST OF THE MILLS DESCRIBED

NAME	WORKING LIFE FROM	TO	APPROX. FLUE LENGTH	GRID REF.
Burton	pre 1684	c1867	10m	SE.018854
Sargill	early C19th	c1869?	25m	SD.898926
Bobscar	mid C17th?	late C18th?	-	SE.026939
Apedale	c1760	c1850	-	SE.031941
Cobscar	1761-62	c1890	180m	SE.059920
Preston	c1740	c1840	-	SE.078912
Keld Heads	1851	1884	3.3Kms	SE.078910
High or Ray Gill	1674 or 82	c1806	-	NY.978003
Smith's	1769	c1772	-	NY.982002
Low	1674 or 82	1840	-	NY.991999
New	1685	1840	-	NY.991999
Surrender	1841	1880	745m	NY.991999
New	1801	1846	550m	NY.975005
Old Gang	1846	c1902	560m	NY.975005
Spout Gill	1735	c1770	-	SD.931956
Keldside	1835	1868	200m	NY.879016
Swinnergill	1807	1819	20m	NY.912012
Lownathwaite	1769	1823	-	NY.935006
Blakethwaite	1821	1878-82	25m	NY.937018
Beldi Hill	1770	1883	10m	NY.909005
High Moulds	1730's	1804	-	NY.989019
Low Moulds	Mid C18th	1804	-	NY.992010
Octagon Mill	1804	1821-23	810m	NY.996036
CB Mill	1822-23	1901-02	1.5Km	NY.996034
Grinton How	c1728	1893	290m	SE.049964
Grovebeck	c1761	c1769?	-	SE.028970
Scott's	c1769	1868	-	SE.038973
New	cl770	c1825?	-	SE.034971
Summer Lodge	1810	c1857	-	SD.966950
Farndale	pre1718	?	-	NZ.019028
Ellerton	pre 1682	post 1768	-	SE.069976
Sayer's or Low	1574-75	pre 1700	-	SE.078994
Marrick High	pre 1660	c1838	-	SE.079994
Marrick Low	c1838	1874 50m	-	SE.078994
Cupola	1701	pre 1725	-	SE.063987
Conyer's	pre 1589	?	-	NZ.089021
Clints (3)	C17th	1767		NZ.092175
Applegarth	NO SUCH MILL EVER EXISTED			
Gilling	c1630?	c1700	-	NZ.159057
Whashton	prc1671	c1725	-	NZ.144055
Stainton	1786	1820's?	-	SE.090952
Waitwith	pre 1671	c1675	-	SE.171976
Easby	late C17th?	early C18th	-	NZ.196003
Glebe	1753	?	-	NZ.236055
Hartley's	1754	1784	-	NZ.229059
Partners'	1744	1780	-	NZ.234059

- denotes no flue.