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THE MALHAM MINES

by

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LIST OF ILLUSTRATIONS

Abbreviations used in the references:

BGS	British Geological Survey.
BSA	British Speleological Association
LRMM	BSA, Lord Ribblesdale mining manuscripts.
NYCRO	North Yorkshire County Record Office, Northallerton.
MT	Malham Tarn House documents.
NT	National Trust
OS	Ordnance Survey.
TNA	The National Archives, Kew.

THE AUTHORS

Mike Gill is interested in all aspects of mining history, especially (but by no means exclusively) in Yorkshire. He has been an active member of the Northern Mine Research Society since 1965 and has written over 45 papers on aspects of mining history. This is his tenth book. He is currently working on a study of the mining population of the Grassington area, and an interactive CD-Rom and book on "Mining in Cornwall and Devon: Mines and Men".

Mike Squirrell grew up at Gilling West surrounded by Anglo-Saxon and mining history remains, with nearby mines at Middleton Tyas and Billy Banks. His main interest is in the origin of mineral fluids, particularly those associated with the Askrigg and Alston Blocks. He has recently joined the N.M.R.S. and, since retiring, has helped at the Yorkshire Dales Mining Museum at Earby. Current research includes mineralisation in the Permian around the Harrogate area.

AREA COVERED

This monograph covers part of the Craven District of North Yorkshire (formerly in the West Riding), in the Yorkshire Dales National Park. It includes the whole of Malham and Malham Moor, at the north end of Kirkby Malhamdale. For completeness, small parts of the neighbouring manors of Settle and Giggleswick, both in Ribblesdale, have been included because, as at Malham, veins occur on the north side of the Mid-Craven Fault. This is especially so in the Stockdale area which abuts Pikedaw.

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PREVIOUS RESEARCH AND PUBLICATIONS

The society has published eleven monographs on coal and lead mining in the ancient area of Craven and neighbouring parts of Lancashire since 1987.[1-11] The only significant gap in this coverage, around Malham, is filled by this volume. These publications, which are much more detailed than earlier works, made a significant contribution to our understanding of mining history in the area. They also established a new datum from which future research can advance. It is, nevertheless, important not to lose track of earlier works on minerals or mining at Malham. Of these, the following are the most important.

The first published reference to minerals from the Malham area was by Dr John Woodward (1665-1728) who, in 1729, listed specimens of azurite and terra verta (pale green Malachite) from Malham and Winskill near Langcliffe.[12] Emanuel Mendes da Costa's 1757 discussion of blue ochre (his name for azurite or copper carbonate) were based on Woodward's specimens.[13] The samples yielded from one to two thirds of their weight in copper. Clearly, the veins were known, probably through the efforts of lead miners.

Richard Pococke, Bishop of Ossory (1756–65), travelled through the area in August 1760 and remarked, *'To the north towards Peictel head [Pikedaw] are lead mines called Richgrove'*.[14] He was guided by Dr Robert Taylor, who was said to come from Settle but may have lived in Newmarket Street in Skipton. Taylor corresponded with Mr Mendes Da Costa in the 1750s and sent him samples of minerals and fossils from the area. Although only *'a humble admirer of the Fossil study'*, he knew the mines of Grassington, Greenhow, Buckden, Ingleton and Middleton Tyas. He also corrected some of Da Costa's misconceptions.

Thomas Hurtley, the son of a local farmer called William Hurtley, was the schoolmaster at Malham and his 'A Concise Account Of Some Natural Curiosities In The Environs Of Malham', published in 1786, is a strange mix of one-quarter natural curiosities and three-quarters a history of John Lambert's activities in the Civil War.[15] Nevertheless, this oft quoted but never questioned source refers to copper mining and to the oldest smelt mill at Malham.

Thomas Whitaker's 1805 'History of Craven' reflects his distaste for all things industrial by telling us little about mines, restricting himself to *'In mining for Lapis Calaminaris, two caverns have lately been discovered near the tarn'*.[16] Whitaker has, however, been relied on by subsequent authors as an aid to untangling some of the ownership history.

Johnnie Gray's 1891 book 'Through Airedale from Goole to Malham' is useful in that it rounds off our story by referring, albeit briefly, to a very late period (1887) of lead mining at Rich Groove, on Pikedaw, which is not recorded elsewhere.[17]

The major advance in research came in the mid 1940s when the Ribblesdale papers, which are the primary source of information on mining at Malham, were made available to Tot Lord of Settle. They are mainly letters and accounts sent to Lord Ribblesdale by his agent, the Rev. Dr Thomas Collins, and cover the period 1780 to 1815. Lord loaned

MINERALISATION

This review is biased towards attempting to understand the genesis of mineralisation. Descriptive accounts can be found in References 1 and 2. This area has not attracted a great deal of research compared to the Derbyshire Platform and the Alston Block.

a. Dolomitisation and silicification

The Stockdale Farm, Chapel House, Kilnsey, Malham and Alston formations all show evidence of dolomitisation and silicification. Later metasomatic replacement of Asbian and Brigantian carbonates occur as wall-rock alteration. One phase is usually dominant e.g. the replacement bodies in the Pikedaw/Grizedale area and a small exposure at High South Bank are mainly silicified. In the High Hill and Scaleber areas carbonates are mainly dolomitised. Arthurton et al.[2] reported the presence of hydrothermal saddle dolomite fabrics. Gawthorpe[4] suggested that dolomitising fluids, predominantly derived from the Bowland Shales, migrated towards the basin margins along beds such as the Pendleside Limestone and Sandstones. Hollis and Walkden[5] investigated the timing of dolomitisation in the Bowland Basin and southern part of the Askrigg Block, stating that, volumetrically, dolomite is much more abundant in the Bowland Basin but becomes far less so towards the NCF.

There is a lack of geochemical data on the Bowland Shales compared with the shales adjacent to the Derbyshire Platform where it has been proposed that magnesium-rich fluids formed an early 'flush' prior to base metal rich fluids. This leads to questions such as: will the current exploration for shale gas have an added benefit of gaining a better understanding of the geochemistry of the Bowland Shales in relation to mineralisation, or what role was played by evaporites, e.g. in the Stockdale Farm formation and the sabkha environments that existed in Permian times?

Abundant free quartz, the 'Malham Diamonds', occurs in spoil and washings associated with the dolomitised and silicified areas. According to Dunham, the 'restrictive' occurrence of quartz in a North/South belt west of the main areas of mineralisation on the Askrigg Block, e.g. at Mallerstang, Great Sleddale and Malham, follows a similar pattern on the North Derbyshire platform and the Flint/Denbigh area. The gangue of most veins in this area contains quartz, which is not the case with the richer veins of the rest of the Askrigg Block orefield. This gives rise to more questions such as, what was the source of these silica rich fluids that caused the free quartz and limestone replacement bodies and what created the acidity to dissolve silica? The fluids appear to follow fault and joint patterns similar to those of the magnesium rich fluids, suggesting a similar source. Evidence in the Pikedaw Hill/Grizedales suggest that silicification occurred later than dolomitisation.[2]

Overall, wall rock alteration of the limestones comprises dolomitisation with minor ankeritisation, followed by, or in conjunction with, a silica rich phase, possibly from the Bowland Shales. Later, oxidisation has produced some limonite. This was then followed by base metal and sulphide rich fluids flowing into the area, giving rise to the vein and disseminated mineralisation discussed in the next paragraphs.

THE MALHAM MINES

We do not know when mining began at Malham, but it is tempting to speculate that the prehistoric populations were aware of the mineral veins, many of which have little or no cover from the thin limestone soils. Was the ochre, known to have filled some caves and joints, exploited by them? Were they attracted by the bright blues and greens of the copper carbonate ores or similarly the shiny blue-grey of galena?

LEAD MINING

It has been proposed that in the first millennium but after the Roman period, there was lead mining on the Clowders.[1] If so, the veins at Dew Bottoms and Flock Rake are likely to have been known too. No dateable material has yet been recovered but fire-set shafts have been identified on the Clowders, where coal/coke was used.[2]

Dew Bottoms

On Malham Moor, the first recorded mining was at Dew Bottoms in the 1670s. Until 1803, this was part of the manor of Darnbrook, owned by the Lowthers. Dew Bottoms Vein runs from north-east to south-west, in the Lower and Upper Hawes Limestones, as do practically all the veins on the Clowders. It has been worked by shallow shafts and some opencasting over a length of 200 metres. Near the centre of the workings are the remains of a coe and three spreads of dressing waste. A very obvious prospecting trench crosses the south-western end of the vein.

Dew Bottoms Mine was working in 1677 and it is likely that most of the veins in this area had at least been tried by then. The mine was worked by Lord Lowther, who spent £122 9s 0d on it between 1 March 1677 and 30 April 1679, with a further £49 2s 0d by 10 November 1679.[3] The greatest single expense was the £37 16s 0d paid to Rowland Snow and Michael Joy for work at the groves (mines) but £15 0s 0d was spent on wood. Some ore was raised, and Snow's wife was paid 6s 0d for dressing it. Another item is £1 2s 6d for *'brayinge* [crushing] *ye oare'*. The dressed ore was then smelted at John Lambert's smelt mill near Janet's Foss, in Malham.[4]

By far the most interesting feature of this otherwise unimportant lead mine, however, is the use of blasting powder. This was the first known use of gunpowder for blasting in Yorkshire and came only five or six years after the first authenticated use in a British mine, at Ecton in Staffordshire.[5] There is, however, strong circumstantial evidence for its use a decade earlier during 1662-1663 in driving Longe Sough, or Cromford Sough, in Derbyhire. Ralph Greatorex appears to allude to the boring of shot holes in limestone and chert in the mid- to late-1660s, possibly those at Longe Sough, where his brother John was a partner.[6] On the continent, however, gunpowder blasting was recorded at Le Thillot Mine in eastern France by 1617.[7]

Blasting has been shown not to have caused the major changes that are sometimes claimed of it.[8] The early method of blasting required miners to drive iron wedges into the borehole, after it was charged with powder, which sometimes resulted in premature explosions.[9] The men demanded higher pay for this dangerous work, thereby obviating any advantages. Ore was seldom broken by blasting in the 18th century because it was

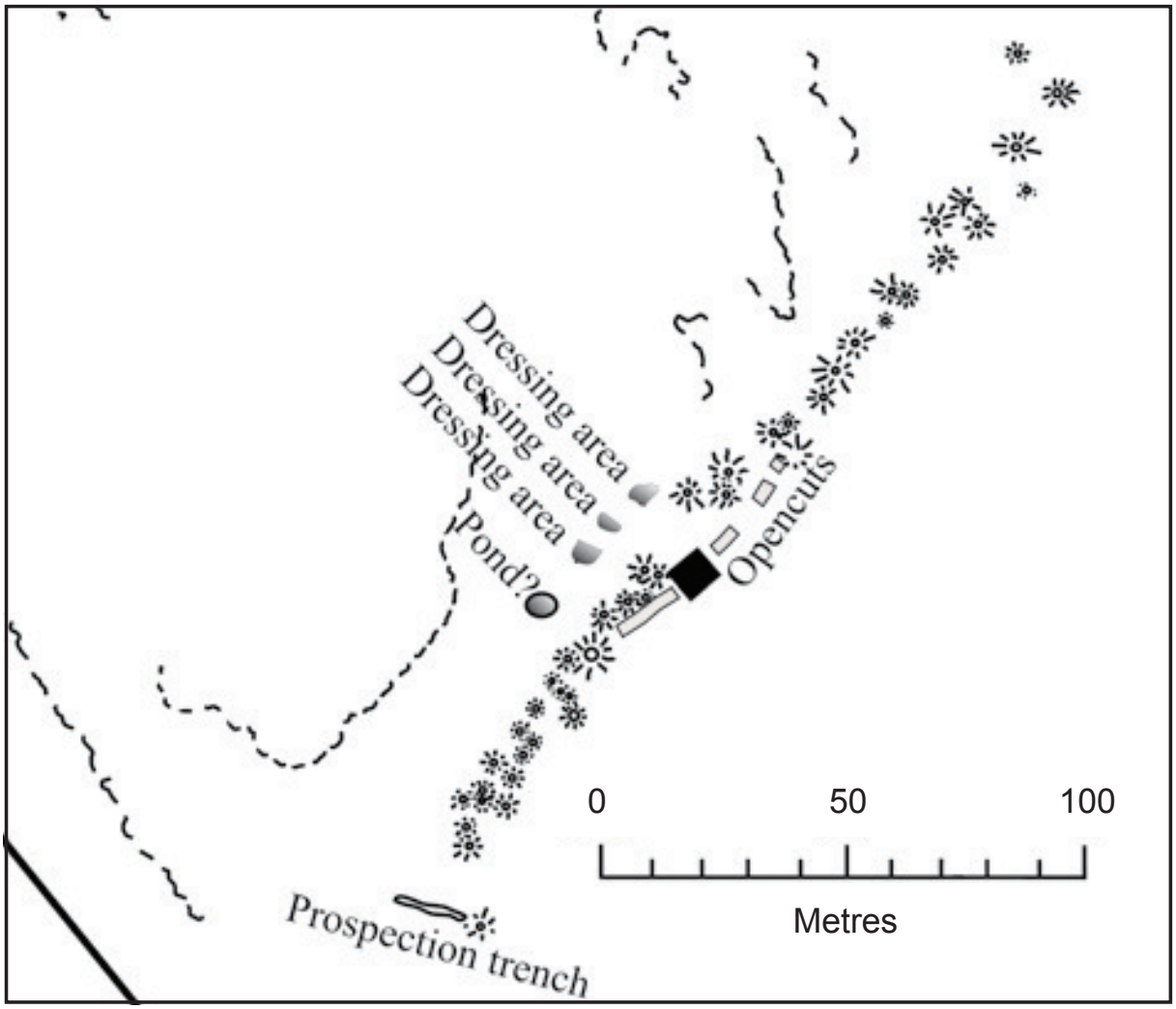

Figure 6. Detail of Dew Bottoms Mine from Figure 5.

the practice to cut out the vein on one side of the rib of ore, which was then broken off in lumps. This kept the product as clean as possible, by preventing the ore and its gangue from mixing and made dressing easier and cheaper.

Around 1683, Dew Bottoms was leased to a partnership headed by William Anderson, who noted that two of his partners lived far away and had already speculated heavily in lead mining. Problems arose in the spring of 1684, however, when a new tenant took over at Darnbrook. Anderson complained that the new tenant had broken down the coe door at Dew Bottoms and generally hindered his works.

In October 1697, John Lord Lowther Viscount Lonsdale of Westmorland leased all his mines in Darnbrook to John Lambert, of Calton near Malham, for 21 years in return for every tenth dish of ore free from all charges. Lambert's death, on 14 March 1702, probably ended that venture.

The mines are next recorded in November 1746, when Thomas Marshall, John Jackson, Leonard Marshall and William Jackson wrote to Lord Lowther's agent asking for a

Nevertheless, whatever the precise timing of those events, by late January it had been decided to sink the New Shaft on to Cavern 44 near the centre of the New Ground. Because the system ran down dip, to the north-east, this shaft would be deeper than the one serving the Old Ground. It would, however, cut out the link with the Great Shake which Myers described as being *'through a very awkward and restricted sumped passage below Sump Top, which led into what the miners called the New Ground'*. Collins remarked, *'The men's roads into the chasm are extremely dangerous as well as difficult'*.[25] It order to fix the site of the New Shaft, it was necessary to have an accurate survey of the caverns, using that route. Then shaft sinking could begin with a reasonable expectation that the shaft bottom would be where it was supposed to be - in Cavern 44.

Collins had little or no knowledge of mining and he had not seen the new works, having been *'advised by no means to go down in ye present shaft but wait till the new one is sunk which will set one in the heart of all the curiosities and riches'*. Nevertheless, he was thinking of how to deal with water in the mine, some of which was thought to come from a small stream which ran along the wall dividing *'Kirkby Fell and Grizedales before sinking in the Great Shake Hole'*. He considered driving a level from the nearby valley to the foot of the New Shaft, which he wrongly estimated to be about 90 metres away. It was nearer 130 metres!

A party led by George Tennant began the survey by 2 February 1806 but they were troubled by water, which had probably refilled the sump and the results were delayed. Raistrick and Myers have both written about what followed. The former emphasised the number of surveys made and the differences between them to produce a rather embellished story. The latter pointed out the former's weaknesses and made a more dispassionate analysis of what transpired. It is an instructive series of events, and well worth revisiting.

Tennant had not produced a survey by 20 February, when Collins advised Ribbledale that he had *'sent to a clever dialler from Grassington country and George is to bring him on Monday and then send me his trial. But he seems quite confident of being right and says knows nothing at all even of ye use of ye dial at top of ye ground and never went below.'*.[26] The last sentence is puzzling, as it suggests that Tennant did not know how to survey! That is reinforced further on in the letter, when remarks by Johnny Binns, Collins' man, are reported, viz. *'a man must be a mathematician as well as understand arithmetic thoroughly before he could know anything of dialling and as there's nobody hereabouts he would go himself. So he set off with a new invented dial of Master Bramley's & his spirit level with compass &c. &c. &c and lo he could not understand ye mode of their proceedings underground and durst not go down. He now designs to send John Hodgson with ye same apparatus, which he says he understands as well as himself and can venture down below'*. This may have been a joke, because Hodgson was a labourer from Trenhouse, on Malham Moor.

Neither the Grassington dialler, a man called Ellerton who actually came from Arncliffe, nor Tennant had produced their surveys when, on 6 March, Collins wrote that he had sent to Mr Hargreaves, asking him to send his dialler to Malham.[27] Hargreaves was a colliery owner at Burnley and his man, whose skill was well respected, also worked for

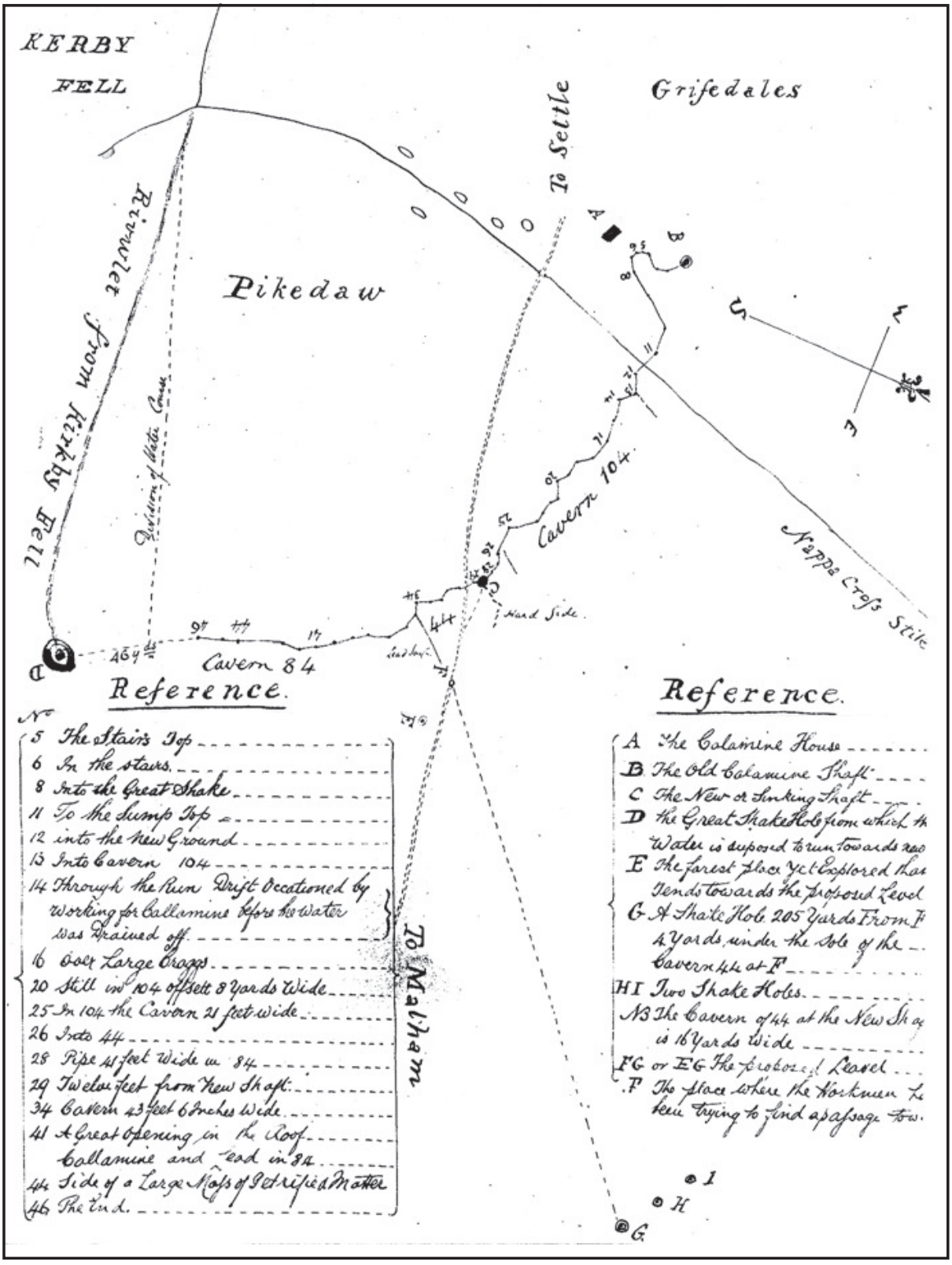

Figure 13. Pikedaw Calamine Caverns, the 1806 Plan.

the Lomaxes and Towneleys at their pits. These men were no doubt known to Collins, who was the Vicar of Burnley. He had taken this step because *'it is more requisite to have the experiment and trial of two or three of the best diallers & levellers than trust to any one of them'*. Both Raistrick and Myers ignored this, and concentrated instead on

MINERS AT MALHAM

Malham was principally an agricultural village and had no reservoir of skilled miners, so it has been useful to study the small number of men involved as an example of their mobility and ability to change occupations. Our knowledge of the mining workforce at Malham is split into two periods: 1748 to 1752 and 1788 to 1851, with information coming from parish registers, mine accounts and census returns. The Yorkshire Dales Mining Populations Project, which is collecting data on the entire populations of mining villages from parish registers and census returns, has been used to expand our knowledge of the people involved.[1]

The first period covers the search for copper, when John (1748-1752) and William Rosewarne (1750) were listed in the Kirkby Malham parish registers. The second period, between 1788 and 1851, was the one in which calamine and most of the lead was mined. The Kirkby Malham parish registers only record eight men as miners but others are listed in accounts from 1807 to 1816 and a further 14 lead miners and six colliers, living at Blishmire, are listed in the 1841 census and three miners in 1851.

MEN INVOLVED BETWEEN 1788 AND 1851

John Beecroft, described as a labourer, married Mary Hesletine at Conistone in 1797; they had two sons baptised there in 1798 and February 1801. They appear at Malham in July 1801 and had another son and three daughters there. Between 1801 and 1804 John was described as a labourer but in 1807 he was a miner and is listed as one in the Ribblesdale papers until 1816. An undated note records that the Beecrofts were one of three families boarded by Mr Molineaux.[2]

Matthew Beecroft, John's eldest son who was baptised at Conistone in 1798 was working for 1s 6d per day (experienced miners were getting between 2s 6d and 3s 0d per day) from 1813 to 1816.

James Boothman, about whom we know little, was an experienced miner who was expected to oversee the sinking of New Shaft in 1806.

Edward Brayshay, aged 35, was probably from the Malham area but no other trace of him has been found.

Thomas Broadley, of Littondale, worked at Fountains Fell Colliery in 1814.

John Brotherton Snr. married Sarah Leeming at Burnsall in 1777 and farmed on Hartlington Moorside until 1790. By 1791 he had moved his family to Malham where he farmed at Stangill, near Tarn House. He left the mines in early 1806 after a disagreement with George Tennant but soon returned to help sink the New Shaft when asked by Thomas Collins. He left the mines again in 1812 but quickly appears to have taken over responsibility for shipping the calamine and was still doing it in 1828. Brotherton was also overseeing mining operations in January 1818.[3]

ZINC ROASTING AT MALHAM

Calamine was of little or no value until the reign of Elizabeth when German technicians were encouraged to mine for and smelt English copper ores.[1] A market for it was established, however, when a parallel operation, the Society of the Mineral and Battery Works, was established to produce brass, which required calamine. The two monopolies had many shareholders in common. In 1566 a supply of calamine was found at Worle Hill, near Weston-super-Mare and the following year work began on building a brass works at Tintern. Brass making soon moved to the Bristol area but the Mendip area remained the centre of calamine production until the 18th century.

Brass was made using a cementation method, in which calamine, pellets of metallic copper and charcoal were placed in a sealed vessel. The latter, along with others, was put into a reverberatory furnace for around eleven hours and heated strongly. The charcoal maintained a reducing atmosphere and allowed the two metals to combine and form brass.

Despite being produced at Zawar in Rajasthan, North-West India, from the 12th century, metallic zinc, or spelter, was rare in Europe until the 1740s because, during smelting, the metal vaporised before it became molten and rapidly oxidised to a powdery material on contact with air.[2] William Champion, a member of the Bristol Brass Co., patented a process of manufacturing metallic zinc from calamine in 1738.

The following description of Champion's 'downward distillation' process is derived from undated scraps of information in the Tarn House and Bradfer-Lawrence collections.[3] They show that some consideration was also being given to making metallic zinc at Malham.

The process used four-foot-high crucibles or pots, made from the best fire clay and shaped like a large oil jar, with a round hole in the centre of the bottom, like a common garden pot. This hole admitted a long iron tube, of three inches in diameter, which ran up the inside of the pot for three-quarters of its height and was sealed with clay. The pot was then filled almost to the top of the tube with a mixture of powdered calamine and charcoal in equal parts by volume, before a tight-fitting lid of the same material was luted on with clay so as totally to exclude the air. Thus prepared, the pots were placed in the furnace and heat very gently applied until they reached a low red heat, which was held for three hours. The fire was then greatly increased in order to force the vapourised zinc down the tube into a vat of water where it condensed as metallic zinc.

The reverberatory furnace used was made of firebricks and its floor from fireclay tiles, some of which had a hole through their centre. This hole was the same size as those in the bottom of the pots and it allowed the pipe to pass through to the water vats where zinc particles collected before being melted and cast into ingots for sale.

Champion's process was essentially a scaled-up version of what had already been done at Zawar for many centuries and this has caused much speculation about possible influences on his work. He left the Bristol Brass Company in 1746 and established his own works at Warmley, now on the eastern edge of the city, where the process was carefully guarded.[3]