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# GREENHOW HILL LEAD MINES SURVEY

By Martin Roe

This paper is a summary of the Greenhow Hill Lead Mines Survey, undertaken by the author on behalf of the Northern Mine Research Society. The work was commissioned by the Nidderdale AONB, using money from the Aggregate Levy Sustainability Fund, administered by English Heritage.

## Introduction

This project was an archaeological evaluation to assess the nature and scope of mining remains around Greenhow Hill village. This comprised a rapid GPS (Global Positioning System) mapping of shafts and other excavation features, dressing areas, buildings, spoil tips, and water management features, a brief text description of features (i.e. shaft mound 4m diameter, 1m high, dressing area 10m x 6m), and a photographic survey of key features in order to produce a RCHME level 2 survey.

This survey has recorded multi-period lead extraction, ore dressing and smelting sites around the village of Greenhow Hill, in the parish of Bewerley, North Yorkshire centred on N.G.R. SE113 642. The land is currently used for agricultural purposes ranging from enclosed pasture to unenclosed moorland: part of the survey area is an active limestone quarry.

## Survey Statistics

Area surveyed	1.7km <sup>2</sup>
Distance walked	>129km
Number of data points	>5500
Archaeological features identified	1048
Shafts	>485
Levels	6
Ore dressing areas	38
Smelting sites	3

## Historical Background

Lead mining at Greenhow Hill is documented back to the early medieval period, but two finds of lead ingots bearing Roman inscriptions suggest an earlier origin. Although not proof of mining and smelting in the area, these Roman ingots form a very significant portion of the evidence for Roman mining in Yorkshire and make the area regionally significant.

The first written reference to mining in Nidderdale dates from 1151 when Roger de Mowbray granted Fountains Abbey **“All copper, iron, lead and every kind of metal and stone in his forest of Niderdala in whatsoever place found, below ground or above...in shafts, mines, and minerals”**. This grant included the township of Bewerley which includes the area which would become the village of Greenhow Hill. A further grant gave land in the dale to

Bylands Abbey and included “iron ore and a 10<sup>th</sup> of my lead-house, through all my forest of Nidderdale” It therefore appears that both Abbeys were granted the same right to mine lead over an ill-defined area and this led to a number of disputes which generated much of the surviving documentation from this period and provide glimpses into the scale and nature of medieval mining.

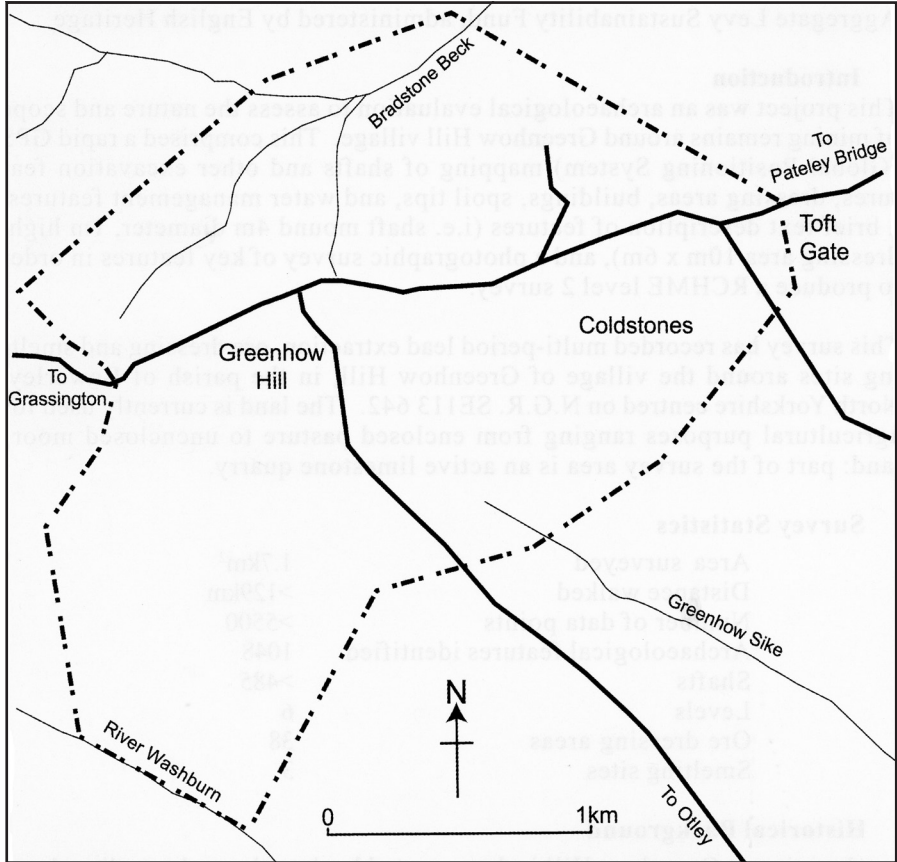


Figure 1. Location map of survey area.

A legal document from 1225 mentions lead mines at Kaldstanes and le Feldberg. Kaldstanes is interpreted as Coldstones Hill and le Feldberg (an unenclosed low hill) as Greenhow Hill; these are prominent topographic features in Greenhow Hill village. A later document states that around 1600, mining was confined to the summits of Greenhow and Coldstones Hills, which suggests that the early mining was confined to the outcropping limestone that forms these hills. Lead from the area was used on prestigious medieval buildings such as Windsor Castle, which was supplied with 168 pigs of lead weighing a total of 20 fother in 1363. Although there are variations in the

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weight of a fother, it was commonly equal to 22 cwt. This gives a total of 22.4 tons, which would represent a respectable yearly output for a small 19<sup>th</sup> century mine.

As with the medieval period the early post medieval period is poorly documented, however, at the end of the 17th century just less than 3000 tons of lead from Greenhow passed through York between 1692 and 1699. It is likely that most of this was mined from outcropping veins of Coldstones and Greenhow Hills but it is possible that by this date the miners had begun to follow the veins where they disappear under drift and had probably therefore discovered the important Cockhill / Waterhole Vein system. This is confirmed by a set of accounts from Sir Thomas White's mines in 1707 that mention mining at Galloways (south of Greenhow Hill), Lumb (part of the Cockhill Vein west of Greenhow Rake), as well as Coldstones.

From the mid 18th century a series of deeper shafts were sunk, and name evidence suggests that some were equipped with horse powered winding engines, known by various names such as whim, gin, and engine. These shafts mainly accessed veins in the limestone beneath shale cover, sometimes by crosscuts driven through barren rock from the foot of the shafts.

The Cockhill and Gillfield Levels were driven in the 1780s from Brandstone Beck to the north of the village - initially to the Cockhill and Water Hole Veins but both were continued so that they eventually drained most of the veins under the village. These levels were driven as horse levels and equipped with rails to enable ore mainly, but not exclusively, from stopes above the levels to be taken directly to mechanised dressing floors adjacent to smelt mills. Both Cockhill and Gillfield Levels have branches that run under Coldstones Hill and continued in use throughout the 19th century and during twentieth century fluorspar mining operations.<sup>1</sup>

### **Geology**

The Greenhow mining field consists of limestones overlain by the shales and gritstone of the Millstone Grit Series. In this respect the Greenhow area is similar to other mining areas of the Yorkshire Dales, however, here the strata are not found in nice regular horizontal beds but have instead been distorted by an east to west anticlinal fold known as the Greenhow Anticline. This has resulted in two outcropping islands of limestone, Greenhow Hill and Coldstones Hill, surrounded by gritstone and shale beds.

The beds of limestone are of the Yoredale series, but here the intervening beds of grits and shales are thinner than elsewhere, which Dunham considers to be a direct result of the thickening of the limestone beds. This has left an almost continuous bed of limestone where oreshoots have been proved over a height 500ft. Oreshoots are mainly confined to the limestone with a little ore in the gritstone where the veins approach the North Craven Fault.

The area is therefore defined by the Craven Cross Basin to the west and the North Craven Fault to the south. To the north, the edge of the mineralisation is marked by the Waterhole Vein, and to the east the veins die out beyond Coldstones Hill.

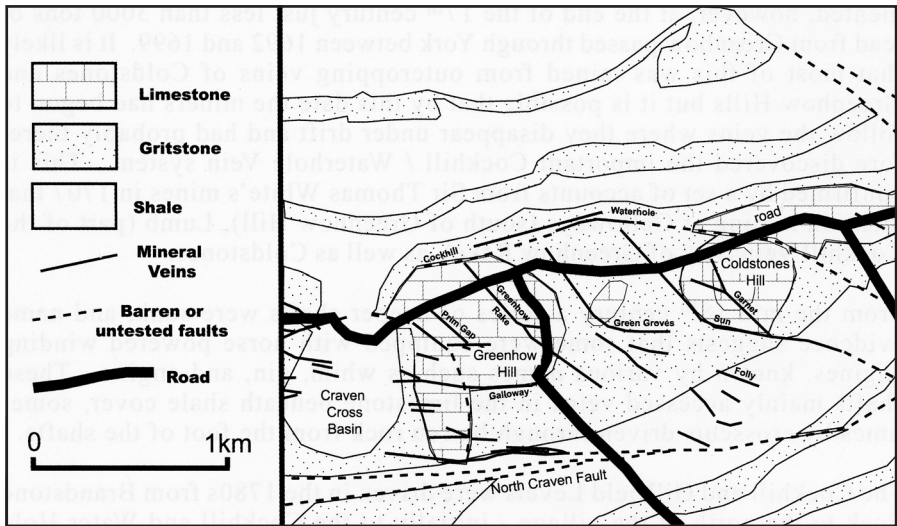


Figure 2. Geology of Greenhow Hill (After Dunham 1985)<sup>2</sup>.

### Survey Methodology

This survey used a Garmin Etrex Global Positioning System receiver (GPS) to record lead mining features. Features recorded were either point features, linear features or areas. Small shaft mounds under 5m diameter were treated as points, as were small pit features. Linear features such as open cut trenches, and water leats were recorded as a series of points. Area features such as dams; areas of dressing spoil, and the perimeter of larger shaft mounds were recorded with points taken every few metres. A brief text description of each feature was recorded and photographs were taken of key features. Descriptions were based on a list of site components developed from a list included in the Monument Protection Programme Lead Industry Step One Report.

After collecting the information in the field, the data from the GPS receiver was downloaded using Gartrip, a GPS utility. The points were also plotted and then exported into Adobe Illustrator where the points were assigned suitable symbols and produced as a scaled vector drawing. Field boundaries have been taken from available OS mapping and may not be representative due to recent changes to boundaries.

### Interpretation

The landscape around Greenhow Hill represents a long and complex history of lead mining. It is very difficult to date lead mining features simply from their form, however it is possible to recognise certain themes, which can be used to broadly identify different phases of activity. Unlike some former lead mining areas most of the shaft mounds and spoil heaps at Greenhow are grassed over and this places restrictions on the inferences that can be made about activities from examining the type of waste present on different sites.

### Extraction Features

Where limestone beds outcrop, veins also outcrop or are very close to the surface. Workings are present as lines of shallow pit features with little or no associated spoil or closely spaced shaft mounds - often so close to each other that the ring mound of spoil from one overlaps with the next. There is evidence that the lines of shallow pits are not pits but the top of backfilled opencut trenches (e.g. Plate 1), which suggests that any spoil from the excavation was used to backfill the trench on abandonment. One key characteristic of such lines of pits and shafts is that they only affect a narrow strip of ground in which all development and dressing waste is dumped. This suggests that mining was carried out under a form of customary mining law where the ground along each vein is divided into rectangular blocks of ground called meers.



**Plate 1. Backfilled opencut (SD 11253 63774)**

It is thought that meer working was carried out at Greenhow but documentary information is sparse and often inferred rather than proven. An early 19th century plan shows that at that time a meer of 21 yards was in use but by then was used to define square blocks of ground. A meer usually consists of a length of ground along a single vein with a space either side known as a quarter cord, which equals  $\frac{1}{4}$  of the length of the meer. In the case of a 21 yard meer the quarter cord would therefore be 5.25 yards either side of the

vein - a total width of 10.5 yards. Grants usually consist of blocks of meers and once established, the position of meers remained even if the ownership changed? Surviving mining laws from elsewhere suggest that miners were expected to confine all their activities within the quarter cord and were allowed to use this ground to stack their waste, dress ore, and construct buildings. Recent work at Grassington, where the working of meers is well documented and sets of customary mining laws survive, has shown that this is probably the case even when not specifically mentioned in the laws.<sup>4</sup>

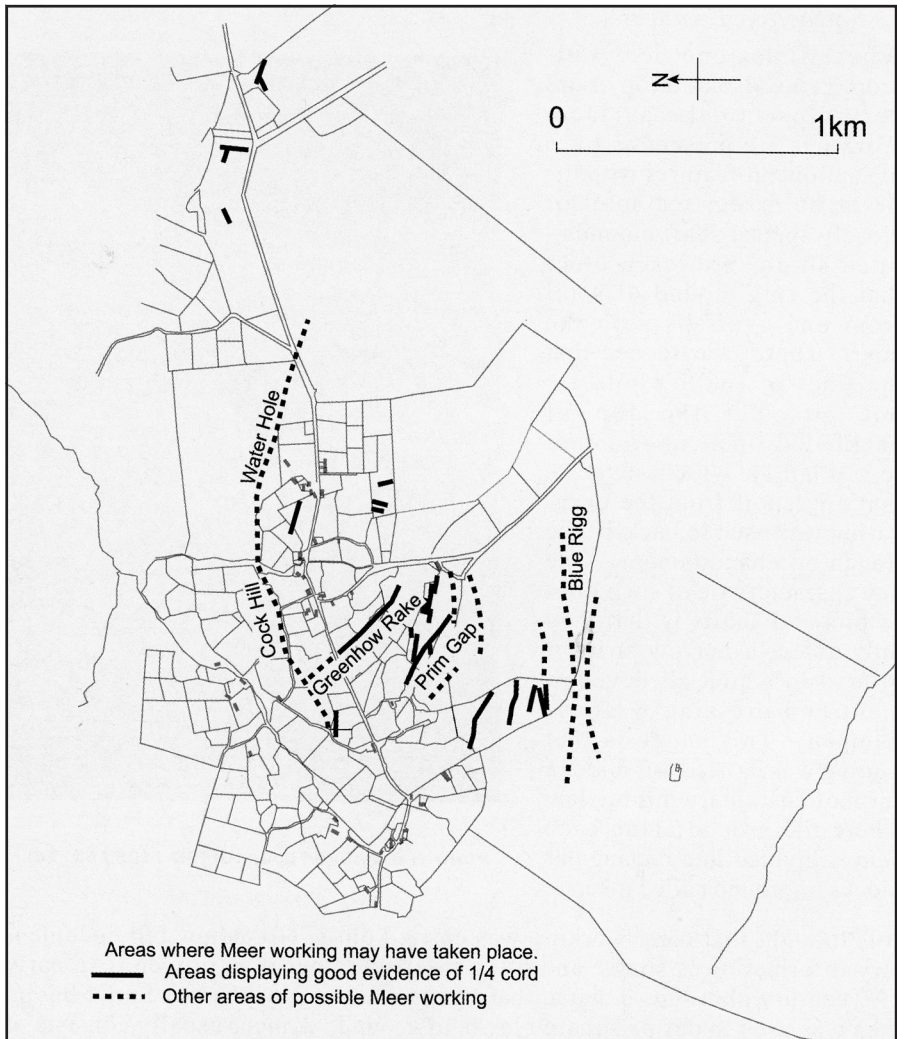


Figure3. Areas showing evidence of meer working.

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Meer working is known to have been practiced from the medieval period and at Greenhow a legal document from 1225 refers to “exploring” a pit “to the bounds of the mine”.<sup>1</sup> This suggests another custom of chasing or proving the vein along the length of one meer before moving on to another. This explains the close spacing of shafts and pits. Further evidence of a customary form of mining survives in the form of place name evidence. Prim-Gap was formerly the name for High View Farm, and is now the name of the property across the road, both of which are close to the Prim Gap Vein. A Prim Gap is “a length of vein less than half a meer between two mine titles or separate jurisdictions”.<sup>5</sup> The boundaries of meer grants were often marked by stones bearing the initials of the owners but no such stones have been found in the course of this survey.

Along the Cockhill / Water Hole Vein system and on Blue Rigg Vein a slightly different arrangement of shafts is present. Here the alignment of the shafts still marks the line of the veins and activity is confined to a narrow strip of ground, however this strip is wider than a standard quarter cord. This may indicate that the shafts were initially sunk during a period when meer working was still in use. The wider spacing of the shafts suggests that the veins probably do not outcrop and that deeper shafts were required to reach the ore bodies and so evidence of chasing the vein along a meer length is not present at the surface.

These veins have been worked to a considerable depth from the shafts and, in the case of the Cockhill / Water Hole Veins, at a later date from levels. Before the driving of the Cockhill and Gillfield Levels the shafts may have been deepened, which would have resulted in an enlarging of the shaft mounds. It is probable that both the Sam Oon Level and the Jackass Level were driven to drain the ground worked by the shafts and both levels acted as adits only. Both levels have in the past been considered as ancient, possibly medieval or even Roman. This has since been challenged and although Sam Oon Level is still undated, Jackass Level has been shown to date from the 1740s.

At the end of the 18th century Sand Beck was the boundary between Cockhill Mine and Sunside Mine. Jackass drains the workings of Sunside and Sam Oon, Cockhill. This relationship suggests that this boundary may be earlier and the levels may be broadly contemporary with it and their driving could have been the catalyst, which led to the deepening of the shafts. The Cockhill and Gillfield Levels were driven in the 1780s, initially to the Cockhill and Water Hole Veins, but both were continued so that they eventually drained most of the veins under the village. These levels were driven as horse levels and equipped with rails to enable ore mainly from stopes above the levels to be taken directly to mechanised dressing floors adjacent to smelt mills.

Both Cockhill and Gillfield levels were used during twentieth century fluorspar mining operations, but as this activity took place underground it has

had little discernible affect on the surface archaeology. The situation is different on Greenhow Hill and Galloway Pasture. Greenhow Rake Vein, which runs over the summit of Greenhow Hill, has been worked by both shafts and open cuts. The form of the open cuts strongly suggests 20th century working, both on the north side of the hill and where the vein crosses Duck Street Quarry. On Galloway Pasture, Galloway Gulf represents a shakehole excavated in the early 1960s.<sup>1</sup>

### **Shaft Haulage**

Although most of the smaller shafts would have used a simple roller for haulage, many of the larger shaft mounds include the element “engine” or “gin” in their name. This indicates that they had horse powered winding engines, however the diagnostic flat topped shaft mound with an off centre shaft usually associated with gins is rarely present and only one example was found with the classic stone or turf wall defining the horse walk. This leads to several possibilities; firstly as most of the shafts are present as a large slumped feature, all traces of a gin may have disappeared. Secondly, and perhaps more realistically, as many of the shafts appear to be almost in the centre of the shaft mound, it is possible that rather than a “whim gin”, many of the shafts may have used the older style cog and ring gin.

### **Ore Dressing**

Ore dressing activity has been more difficult to identify and categorise due to sites being grassed over. In areas where meer working can be identified, the remains of ore dressing would have been confined to the quarter cord and is currently archaeologically invisible, however a detailed earthwork survey may help to separate heaps of development waste / shaft mound material from ore dressing waste. In other areas distinct zones of ore dressing have been identified, usually closely related to large shaft mounds. These all show evidence of disturbance, which has removed all traces of the original equipment and organisation of the dressing process.

At a few isolated sites evidence of small ore dressing areas known as “knocking floors” have been found. These are usually in the form of square, flat areas, approximately 2m across, with evidence of a small stone kerb around three sides. One feature that has been described as a medieval “crushing mortar” is the Panty Oon Stone. Making assumptions that this was used for ore dressing are without grounds and further investigation may reveal another, more plausible explanation. It is unlikely that medieval miners would want to crush ore so finely, as without the aid of sophisticated buddles and smelting techniques, fine crushing is a very wasteful method of ore dressing. Around the stone is evidence that a coarse-grained gritstone has been quarried. It may be possible that the site has therefore been used to crush this stone to make sand.

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**Plate 2. Buddies (SD 10839 63492).**

Adjacent to Cockhill Level are the remains of a dressing floor which includes the ruins of a range of bouse teems and a water wheel case, suggesting the location of a water powered ore crusher. A flat area nearby suggests the location of further ore dressing plant. The layout of this site is typical of a late 18<sup>th</sup>-19<sup>th</sup> century mechanised dressing floor. There should be evidence of a similar layout at Gillfield Level, but this has not survived. It is apparent that this site has been much disturbed, most recently when a large section of the spoil heap was removed for road repairs.

The disturbance of ore dressing areas throughout the village is indicative of operations to recover discarded lead ore, fluorspar and barite. The recovery of lead ore at Greenhow is documented from the later part of the 18<sup>th</sup> century when waste redressing was leased separately to the mining. These operations appear to have left considerable remains, particularly at North Coldstones, where waste dressers were active in the 1780s. There, such activities resulted in damage to various watercourses plus the construction of new leats and dams. Sludge from these operations was allowed to run into several shafts, causing them to collapse and disrupting the miners working in Gillfield Level.<sup>1</sup> These areas, which are not associated with shafts or levels, are represented by low-lying, complex earthworks, usually served by leats and close to dams. Very little identifiable structure is present in these areas but, at a number of locations, simple buddies have been found (Plate 2). These are commonly sets of small, interconnected, sub-rectangular tanks up to 2m across, usually closely associated with water leats.

The mining and recovery of gangue minerals such as fluorspar and barite began in the 1920s and continued at a small scale for around 50 years. Close to Galloway Gulf are numerous piles of waste from the processing of fluorspar and barite. This waste was not produced at Greenhow but at the Dales Chemical Company plant at Grassington which operated between 1957 and 1964, and was supplied with material from Greenhow from 1962.<sup>1</sup> The Duke of Devonshire was not happy about waste produced from the processing of the Greenhow mineral being dumped at Grassington and so returning wagons

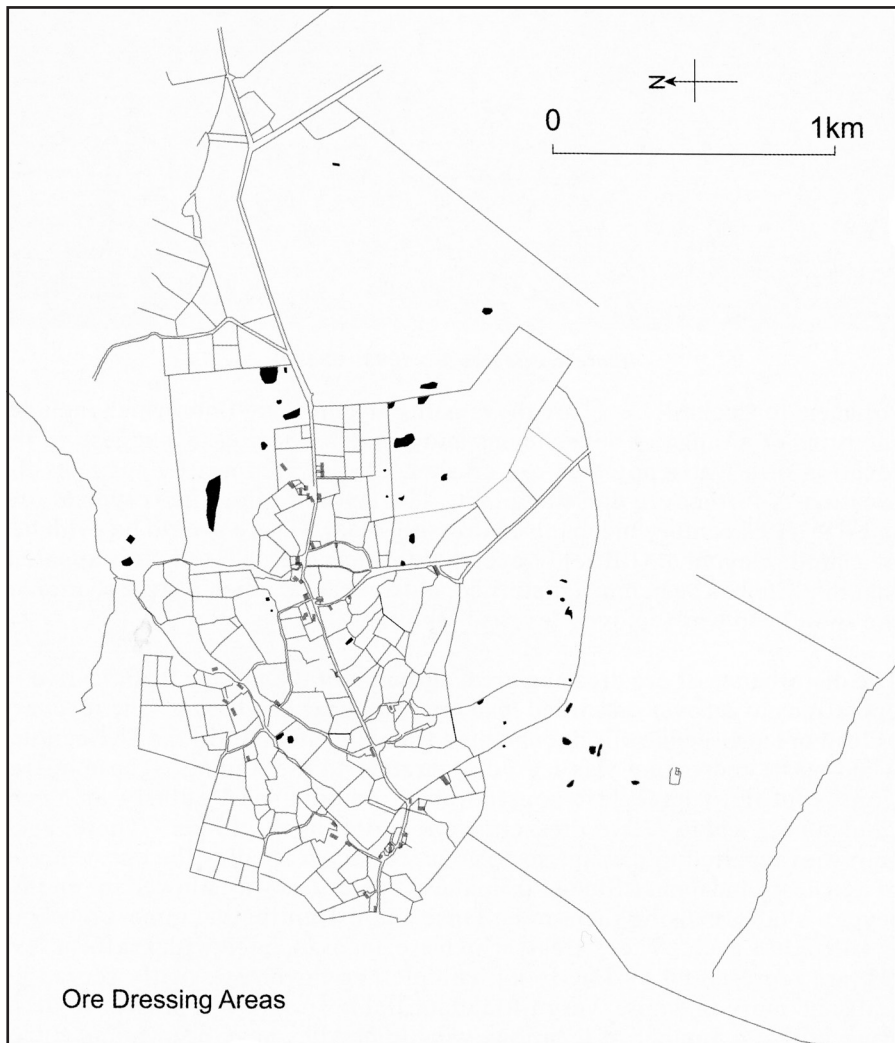


Figure 4. Ore dressing areas.

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brought it back to Galloway Pasture (pers com, Mr Colin Shepherd). Each pile of material therefore represents one lorry load. Further dumps of fine clay spoil are found on Galloway Moss and these mark the location of small scale reprocessing operations. Very little remains, other than a concrete engine mounting and a fragment of wall, of a gravity mill built close to the Cockhill Smelt Mill around 1933 by the Caldbeck Mining Company who worked underground in both Cockhill and Gillfield levels.

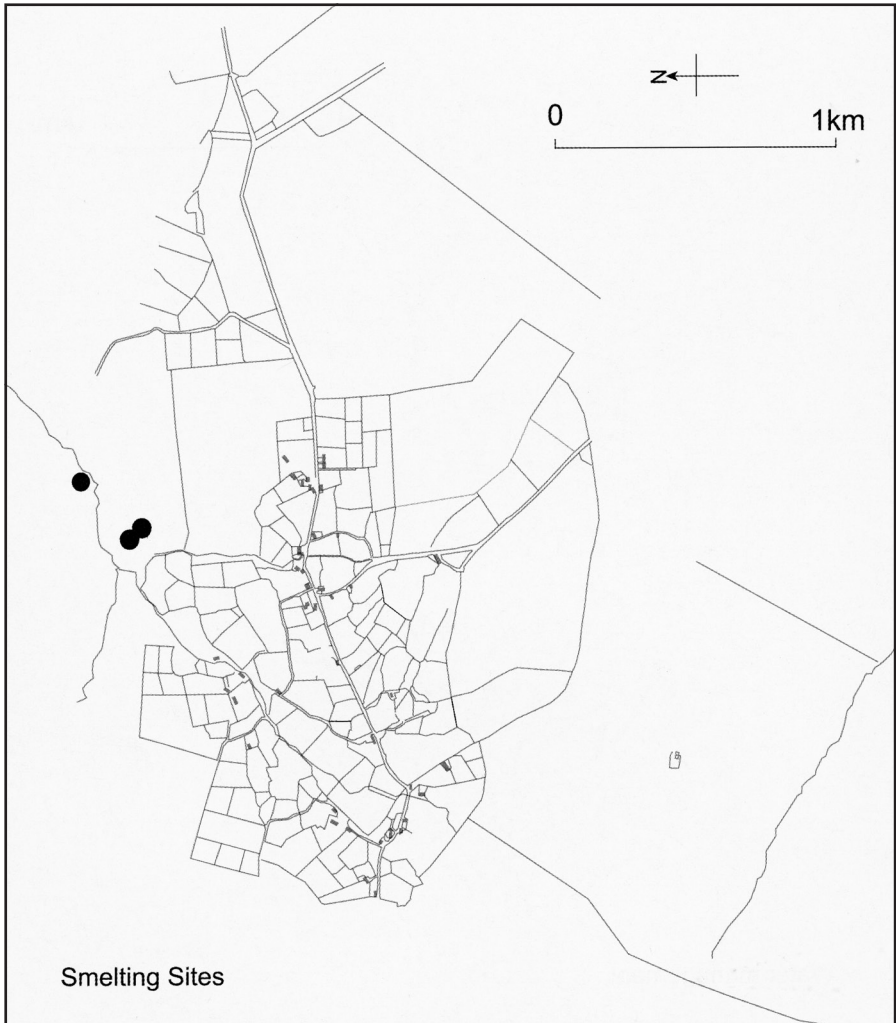


Figure 5. Smelting sites.

### Smelting

Three smelt mills are located in the Cockhill area and two, Cockhill and Providence, have previously been recorded and interpreted. The third, Gillfield mill, has not, but sufficient structure of this small mill survives to allow a basic interpretation of the building's layout, although some clearance of vegetation may be required. All three mills have surviving evidence of water supply to power a waterwheel.

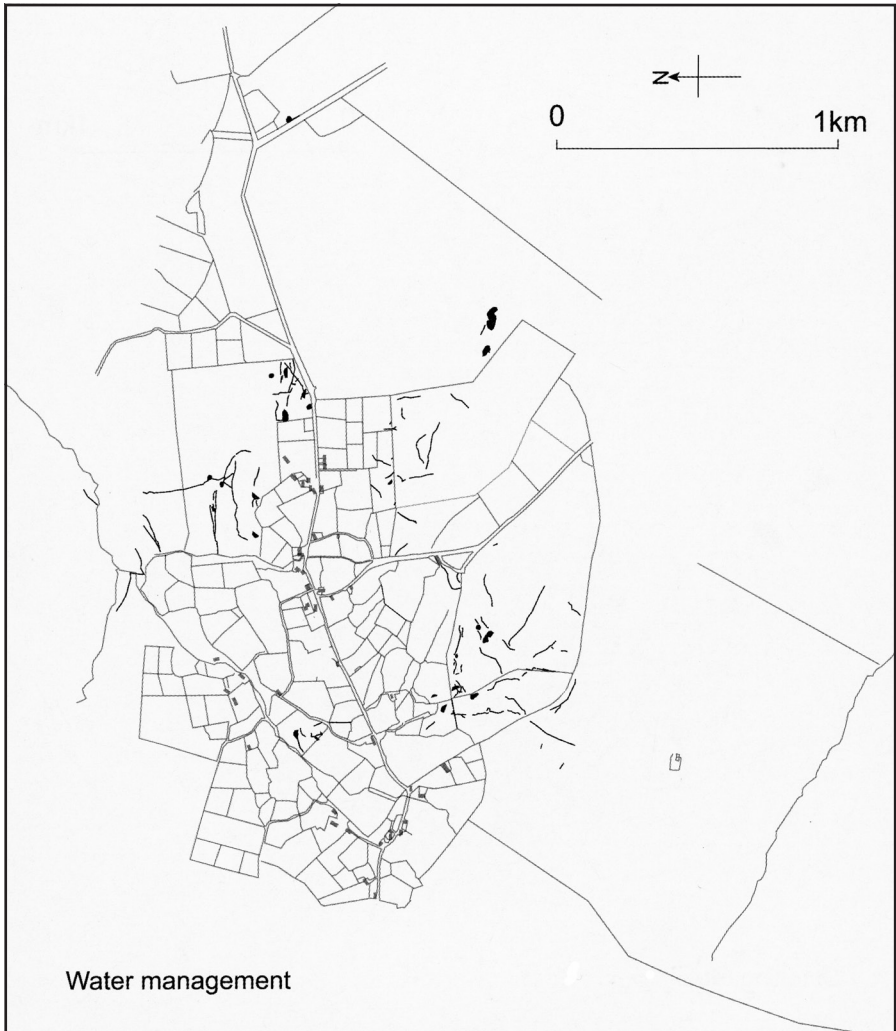


Figure 6. Water Management features.

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Evidence of earlier bale smelting has not been found during the course of this survey. As the survey has concentrated on the areas where extraction and ore dressing have taken place, the evidence of early smelting, which is often very ephemeral, may have been missed.

### Water management

Perhaps the most significant discoveries made during this survey were the complex water management features. Although now fragmentary, enough

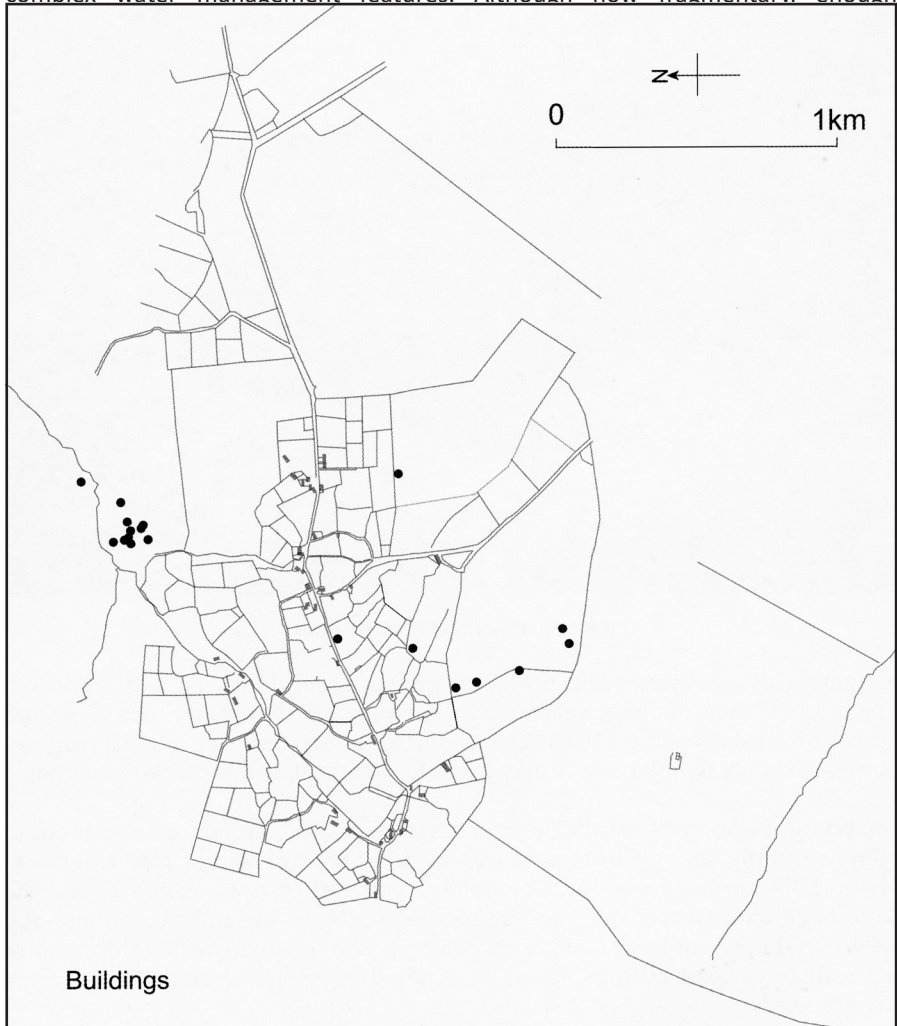


Figure 7. Buildings.

evidence survives to suggest that water was collected, stored and brought to a number of ore processing sites.

**Buildings and Miscellaneous features**

The remains of nineteen mining related buildings have been found, of which eleven are located in the Cockhill area. Two buildings are in the style of a traditional miner's coe, which is usually associated with meer working. Such buildings are unusual in the Yorkshire Dales and therefore highly significant.



**Plate 3. Coe (SE 11051 63836).**

A number of trackways and holloways have been identified and recorded. The significance of these features will require further study, but there are interesting relationships between the tracks and mining and quarrying activities. A study of other tracks may give clues to the development of the village.

Quarrying is an activity that exerts a strong visual impact on the modern village and the active Coldstones quarry has become a major landscape feature. This survey has found evidence that both gritstone and limestone have been extensively quarried at a small scale all around the village and although it may not have had the same impact on the historic development of the village as lead mining, it has been significant and would benefit from further study.

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## Conclusion

Greenhow Hill is a historically important area of lead mining. This survey has provided a large amount of data, which should form the basis for a great deal of further study.

## Acknowledgements

Thanks to the Nidderdale AONB for commissioning this survey and to the residents of Greenhow Hill for allowing access onto their land.

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