

# BAR BROOK MILLS: THE TRANSITION FROM SMELT MILL TO SLAG MILL

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## SUMMARY

*This report summarises a central component of research undertaken for a recent master's thesis. The research examines the 17th-19th century Bar Brook lead mills near Baslow, Derbyshire. Using existing survey plans, measured survey, archival research and published sources a clearer insight into function and chronology of the mills materialised. The results demonstrate current scheduling complexity, significant earthworks and structures while highlighting significant survey work by the late L. H. Butcher. The chronology presents a smelt mill (Site 1), followed by a slag mill (Site 2) with a related cupola; a corn mill and pumping station later adopting the area of Site 1, following the slag mill transition downstream. The study recommends that scheduling is clarified and extended to include Site 1, and the work of L. H. Butcher is digitised fully to aid future research. Further research is also recommended to support the chronology and determine the environmental and landscape impacts.*

## INTRODUCTION

Lead processing mill remains (Bar Brook Mills) in the areas of Jack Flat and Eaglestone Flat in the Baslow area of the Peak District, Derbyshire, were highlighted as an area in need of research and recording. The area in focus has extensive archaeology in the form of foundations, dams, pits, leats and previously unidentified earthworks.

The area has undergone tree felling by the Eastern Moors Partnership which exposed some archaeological features. Increased visibility from the busy Sheffield Road and Gardom's Edge opposite, could raise visitor numbers as the area at present is frequented by walkers and cattle.

Many publications on lead mining, processing, smelting and the industrial landscape in general exist for the Peak District, but little is understood about these particular mills. Crossley and Kiernan (1992) outlined some of the history of the site, based on land lease documentation by the Mannors of Haddon. Previous research on these sites has accumulated an indefinite sequence of ownership and dates and descriptions of lead processing and associated process evidence has been varied. Statutory scheduling has resulted in a confused entry which May and Badcock (2011) also highlight.

### **Location and topography**

The survey area is in the Derbyshire Dales District within the Peak District National Park. The research covers the area between Baslow and Clodhall Lane on the north side of the Bar Brook water course (Fig. 1).

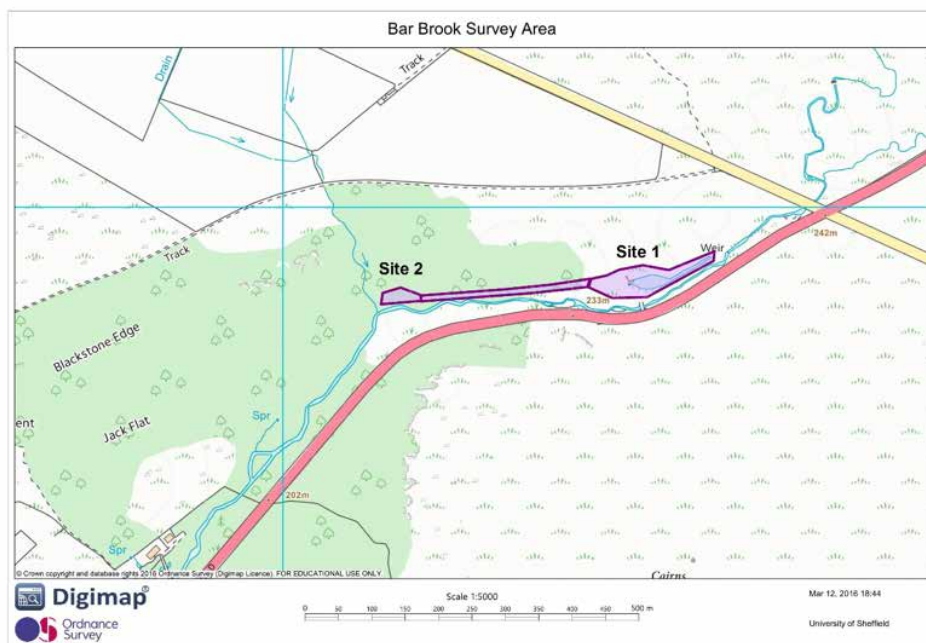


Fig. 1: Bar Brook Survey Area (2016) (Crown copyright and database rights 2016 Ordnance Survey (Digimap Licence)).

Local geology consists of superficial deposits of head boulders from the quaternary period, with a narrow bedrock line of Chatsworth Grit from the Namurian epoch to the far east of the site and within the area of the leat and pond close to the Clodhall Lane bridge. The parent soil is classified as clayey loam, a dominant material in the Peak District National Park.

The topography is typical of the Derbyshire Dales with variable heights and steepness. The area is located between Eaglestone Flat and Birchen Edge which are 300 and 310m above sea level respectively. A spot height is recorded as 233m on the Sheffield Road which cuts between the highest points.

### Statutory and non-statutory listings

Table 1 summarises available statutory listings from various sources. Listings were searched using “Bar Brook” and “Barbrook”, which can be confused with sites listed in Devon. This variation has also caused issues when archive searching. For the purposes of this report “Bar Brook” is used throughout, matching the name of the water course. Essentially, Site 2 is a scheduled ancient monument, Site 1 is not.

The statutory listings mainly detail Site 2, and it should be noted that dates for the mill are unclear, a factor additionally highlighted by May and Badcock (2011). Furthermore, in some areas details are merged with Site 1. Site 1 listings also include a later flour mill and a 20th century pumping station.

<i>Listing</i>	<i>Identifier</i>	<i>Listing source</i>	<i>Feature name</i>	<i>Notes</i>
Site 2 (and Site 1)	312084 SK 27 SE 34 24978 (legacy)	Historic England Monument Report (via Pastcape, 2016)	Lead smelt mill remains. (Scheduled)	“Barbrook Smelt Mill consists of a slag mill ruins and complex waterworks partially overlain by a later watermill dating from the 16th-18th century.” (Pastcape, 2016, p13) SK 27309 73867 – grid reference points to Site 2 and description pertains to Site 1 and 2.
Site 2 (and Site 1)	1009705	Historic England Listing	Lead mill on the north bank of Bar Brook. (Scheduled)	1st scheduled 1996. Remains of smelt mill built in 1618 and closed c.1770. Gritstone mould for lead pigs recorded. Entry describes the remains of the mill. (Pastcape, 2016 and Heritage Gateway, 2016) SK 27260 73869 grid reference points to Site 2 and description pertains to Site 1 and 2
Site 2 (and Site 1)	15816	Derbyshire HER	Scheduled Monument 1009705: Lead mill on north bank of Bar Brook, 80m E of confluence with Sandyford Brook	Scheduled site of a lead slag mill of probable 18th century date.  SK 272 738 Details contain description of Site 1
Site 1	1462225	Historic England Monument Report (Pastcape, 2016)	Site of ore hearth smelt mill (Not scheduled)	From 17th century to 1722 at Eaglestone flat. Bridge and dam noted and mill remains as an earthwork only. (Pastcape, 2016, p150) SK 27549 73889

Site 1	1302	Derbyshire HER	Barbrook lead smelting mill (site of), Curbar	Site of an ore hearth constructed in 1618 and in use until c. 1770. The site was used for milling flour in the 19th century and reused as a water supply pumping station in the early 20th century  SK 275 738
Site 2	1349	Derbyshire HER	Barbrook Cupola and slag mill, Baslow and Bubnell	Approximate site of a cupola and lead slag mill, in use between c. 1770 and 1840 - SK 267 733

*Table 1: Statutory and non-statutory listing, Goodinson (2016, 6).*

## METHODOLOGIES

### **Archival and published research**

During the research stage primary archive and secondary literary sources were consulted. These included: aerial data, regional archives, recent and historical maps, journals, published works and online databases.

### **Measured Survey**

Following initial planning, 7 station points were produced using a Leica 1200 series total-station. A Leica 470 series total-station was used for the feature points. Given that the overall survey covers an area of approximately 3 acres and was elongated in shape an open traverse was used. Backsite measurements were used for station point verification.

An overall survey scale of 1:2000cm was chosen to cover the entire area and a scale of 1:500cm for the detailed survey of Site 1. A detailed survey of Site 2 with the joining path and leat was not carried out due to the existence of plans by L. H. Butcher, which were discovered during an archives search at the Derbyshire Records Office (DRO). The plans were digitised and imported into ArcGIS.

Following the transfer and processing of data the points were plotted within ArcGIS using the Spatial Adjustment tool on an Ordnance Survey (OS) Master 12000 map, sourced from Digimap and set to the British National Grid Projected Coordinate. Layers were created for each feature in preparation for detailed measured drawing and further GIS analysis.

Once the feature lines were created (from measured points) Site 1 was printed on A3 via ArcGIS (at a scale of 1:500cm). With the aid of the feature lines and a 30m tape measure the plan (Fig. 4) was created during visits to the site.

## RESULTS AND DISCUSSION

**Site 1 – the smelt mill, flour mill and pumping station**

Site 1 is listed as the earliest site (1618) despite amalgamation with Site 2 dates under the Historic England listings 1009705 (Historic England (2016)) and 312084 (Pastscape (2016)). Crossley and Kiernan (1992) consulted Nottinghamshire Record Office (NRO), Belvoir Castle: Settlement and Charters, Public Record Office (PRO), and Lichfield Joint Record Office (LJRO) with reference to the appearance of the smelt mill on this site in 1618, built by Robert Mower of Millthorp and owned by the Manners of Haddon. The mill was shown according to Willies (1972) on the 1762 map produced by Peter Perez Burdett. The mill was closed by the owners, the Barker family between 1769 and 1773 (Barnett, Heathcote and Shaw 2008, 7) or 1770 according to Willies (1971). On later maps, e.g. the 1810 Fairbank Turnpike roads plan (Fig. 2) two rectangular blocks are shown; a 1848 tithe map displays a T-shape building to the west of the dam (Fig. 3).

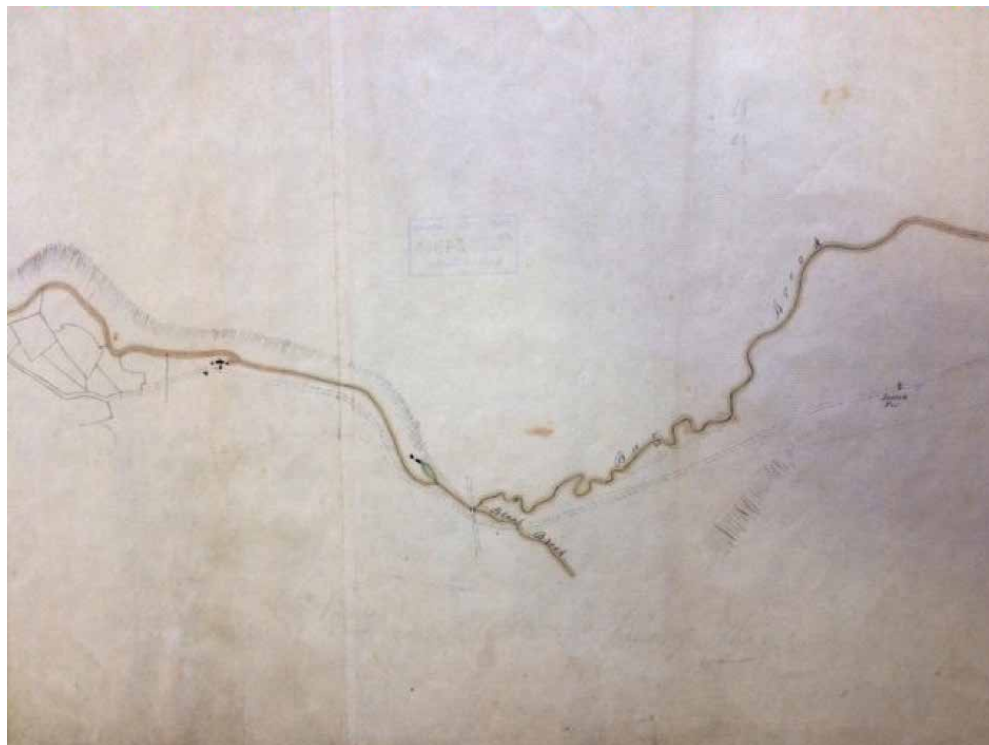


Fig. 2: 1810 turnpike road plan - brook highlighted (Sheffield City Council, Libraries Archives and Information: Sheffield Archives: FC/P/ERo/77R).

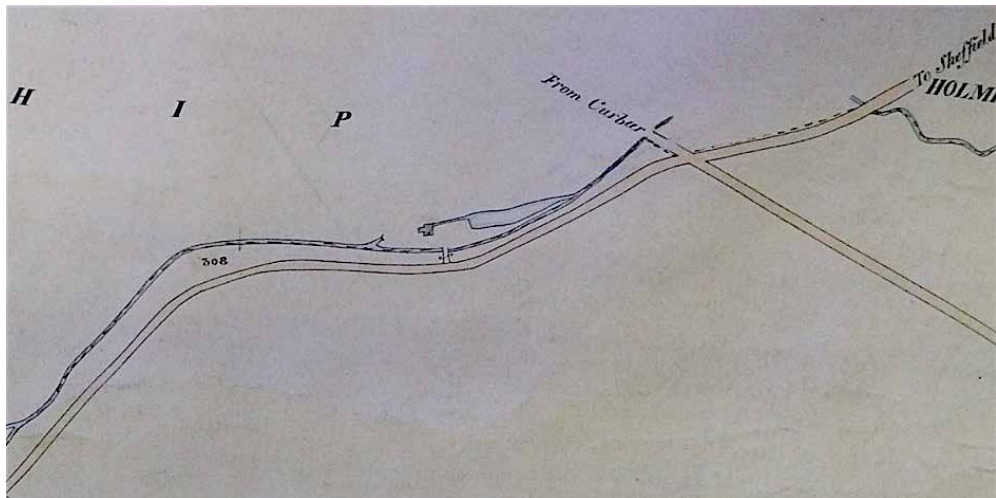


Fig. 3: 1848 Tithe map (Derbyshire Record Office: D2360/3/93a).

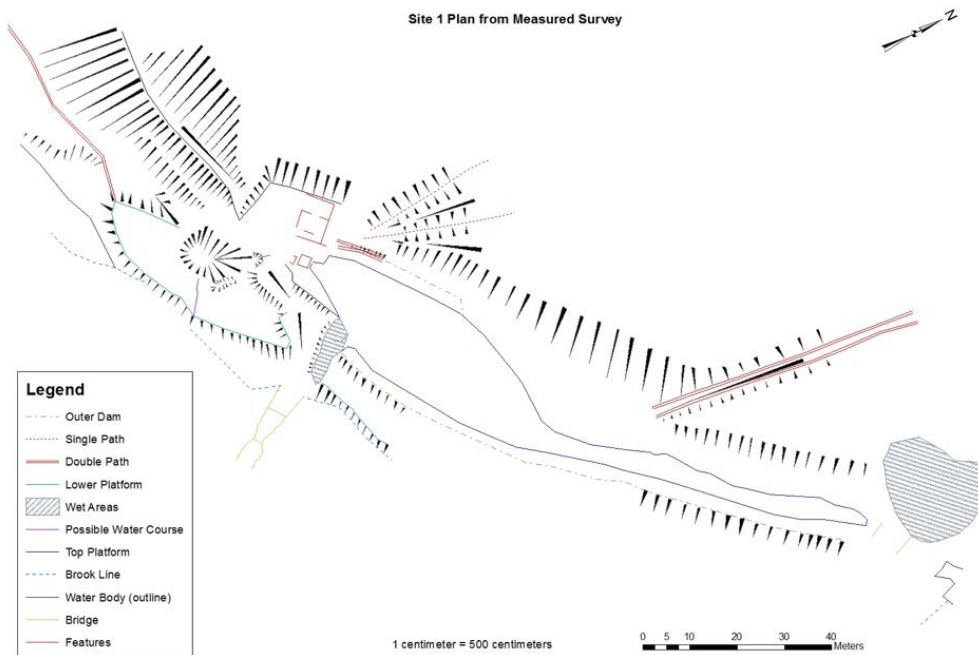


Fig. 4: Site 1 measured survey by author (created by ArcGIS from scan of trace original – printed on A3).



### Water structures

The plan of a standard smelting (or ore-hearth) mill site consists of a weir built upstream which diverts water into a head-race, either directly, or via a dam (Crossley and Kiernan, 1992). The latter is the case at Site 1, where a clear cutting at this section of the brook (approximately 200cm from the weir) runs in line with the leat head.

The area between the leat cutting and the leat head is approximately 9m and partly covered until it reaches a bridge like structure, formed by stone slabs directly abutting the beginning of the leat (see Plate 1, below). Dressed stone slabs lie exposed on the south side of the leat (see Plate 2, below). The slabs forming the apparent bridge are similar to the exposed slabs.



Plate 1: Main leat head covering (looking south).



Plate 2: Exposed slabs (looking west).

Butcher (n.d. c) indicates that the exposed dressed slabs could demonstrate the leat was covered or alternatively, that these slabs could have formed retaining walls for the leat sides. Based on the length of these slabs, their quantity and the same slabs retaining the dam, the author proposes that the slabs were used for retaining the leat sides.

As a water source, Bar Brook runs from east to west cutting through the valley where the mill sites are situated. Evidence of power source management is clearly visible in the brook cutting, weir, main leat and dam. The dam itself, and the platforms which the mills would have sat on are elevated above the brook, thus making the current dam system the only probable diverted water power source.

### Large ditch and associated features

To the south-west of the pumping station foundations is a substantial conical ditch, from 2 to 9m in depth (Fig. 5).

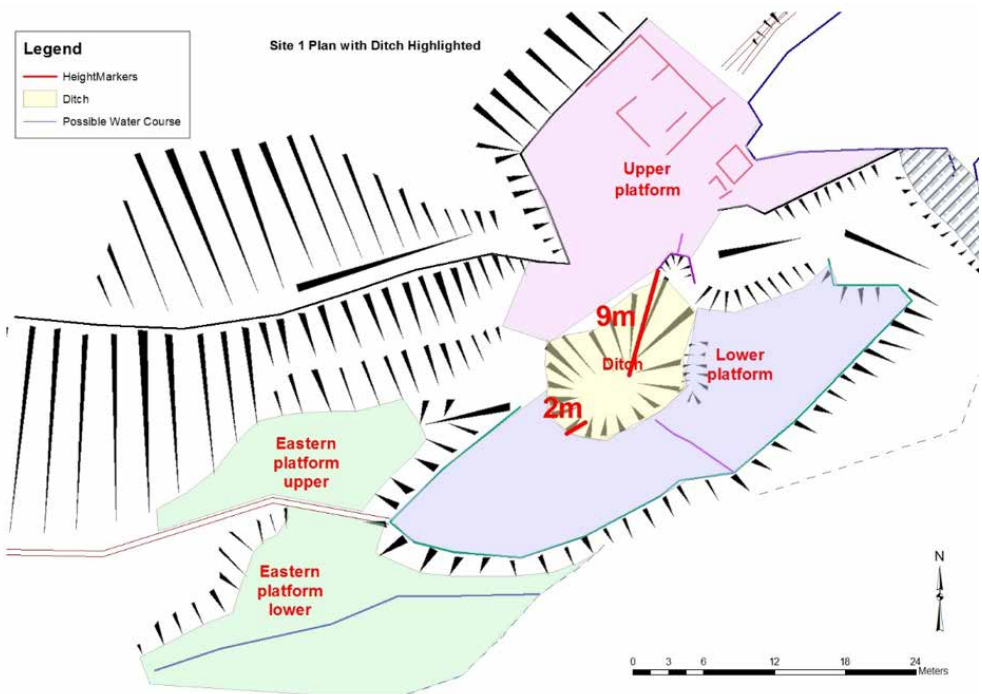


Fig. 5: Ditch highlighted (produced by ArcGIS).

Willies (1972), Crossley and Kiernan (1992), Barnatt, Heathcote and Shaw (2008, 7) describe this as a wheel pit. Given the nature of the ditch, the housing of a waterwheel would require some supporting structure to hold the wheel. Alternatively, the current ditch could be the result of the wheel having been dug out when removed.

Examples of mills and their wheels have been recorded elsewhere. Raistrick (1975, 71) highlights a similar wheel-housing structure at the Beldi Hill smelt mill in Swaledale, Yorkshire. Furthermore, depth of the pit may not correctly represent the wheel size and the ditch may have been in-filled during use, or when removing the wheel, therefore the extent of



soil removal cannot be used to infer wheel size or type. Housing features associated with the wheel may reside either side of the ditch.

The wheel type is suggested to have been an overshot wheel (Barnatt, Heathcote and Shaw 2008, 7). Overshot wheels are generally large, as the diameter needs to match the head of water (British Hydropower Association, 2016). Alternatively, the wheel may have been a breastshot structure, however, breastshots are not as efficient (Power in the Landscape (2007) and were used if stream flow was insufficient to power an overshot wheel. Studies in waterpower efficiency in mill sites of this nature would assist in confirmation of the wheel type used at Bar Brook.

### **Platforms and mill site footprints**

The platforms highlighted in Fig. 5 form a distinctive terraced landscape, significantly different to the immediate surrounding area of Site 1.

The upper platform covers approximately 344m<sup>2</sup> and is sub-rectangular, with off-shoots to the south-east and south-west. The 20th century pumping station foundations sit on the upper area of Site 1 and intersect the site entrance. This pumping station partly uses the upper platform, and, as highlighted by Butcher (n.d. c), the foundations do not fit the expected alignment of the mill based on the dam and other features. This mismatched alignment is also obvious on the plans and maps. It is, therefore, suggested that the upper platform either accommodated a larger structure (than the pumping station), formed a flat working area, or was the main entrance to the original mill. On balance, it is most likely that the area was used as an entrance to the original smelt mill, given the established tracks coming in from the north-east.

The lower platform, overlooking the brook, runs east to west from south of the ditch to a southerly slope roughly 1-3m in height, approximately 382m<sup>2</sup> and elongated in shape. The platform contains the south side of the ditch and ditch outlet, which divides the platform in half. East of the lower platform is a slope climbing up towards the trackway forming the bridge. Based on the intersecting slopes, access to this lower platform from the bridge was not a priority.

Due to the onset of seasonal vegetation cover, the eastern upper and lower platforms were recorded on a site visit without the total station. A walkover helped identify partial features: a sloping platform surrounded by additional steeper slopes. L. H. Butcher also incorporated this area into his survey but this area requires more detailed investigation during the winter months. The obvious feature in the eastern lower platform is a cutting, the depth and uniform nature of which suggests anthropogenic origin, and it does reach the brook at either end. This cutting may have some relationship with the connecting leat and path between sites 1 and 2. Butcher (n.d. c) concludes that there is insufficient evidence of the mill, and Barnatt, Heathcote and Shaw (2008, p7) refer to the pumping station as the only remains on site today. Despite the lack of physical remains, however, we can use the platforms themselves as evidence of the form of the previous structure.

### **The flour mill**

This report is based principally on the lead smelting industry, however it should be noted that Bar Brook Site 1 has additionally been recorded as a flour mill and is listed as “Flour” on the Ordnance Survey 1880s map. Furthermore, Butcher (n.d. c), Barnatt, Heathcote and Shaw (2008), May and Badcock (2011) and the statutory and non-statutory designations list this site

as a corn mill. Additionally, in 1895 the miller is listed as Thomas Marples (Gifford 1999, 35). Crossley and Kiernan (1992) suggest the flour-mill is marked only as earthworks to the west of the dam. On investigation of the 1870s map (Fig. 6) a clear building is shown to the west of the dam but at a more southerly location. To confirm the positioning of the mill, the 1870s historical map was rectified onto the measured survey plan, using known points (Fig. 4).

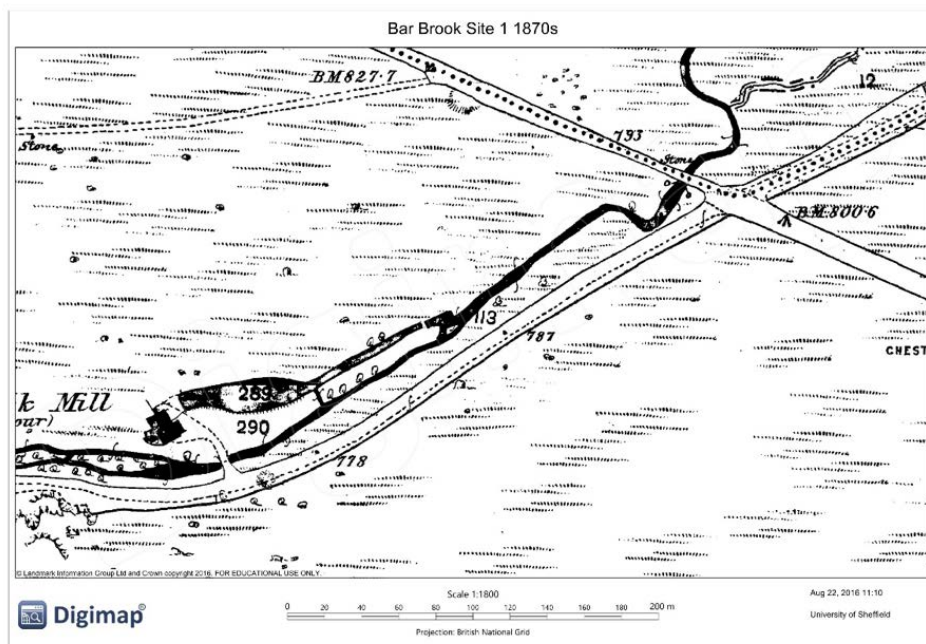


Fig. 6: 1870s historical map (Landmark Information Group Ltd and Crown Copyright 2016, Digimap).

Given the quality of the historical map there is a possibility that the rectification is inaccurate; however, the map and survey plan offer a suggested guide as to where the mill may have resided. Figure 7 illustrates the mill over the ditch and with access from the bridge. Barnatt, Heathcote and Shaw (2008) describe the mill as T-shaped on the 1870s map. The author considers the mill to be irregular in shape. The wheel could be external at either side of the mill. Alternatively, given the rectified position on the plan, it could also be an internal wheel.

An image found in a Clarion Ramblers booklet refers to a sketch of the Bar Brook mill. This image was disputed by Barnatt, Heathcote and Shaw (2008) as it shows an undershot wheel. Willies (1972, 41) conversely, believed this to be Bar Brook mill. As an attempt to confirm that the image is a sketch of the mill, comparison is made with a photograph taken by the author at the same setting (Fig. 8, and Plate 3).

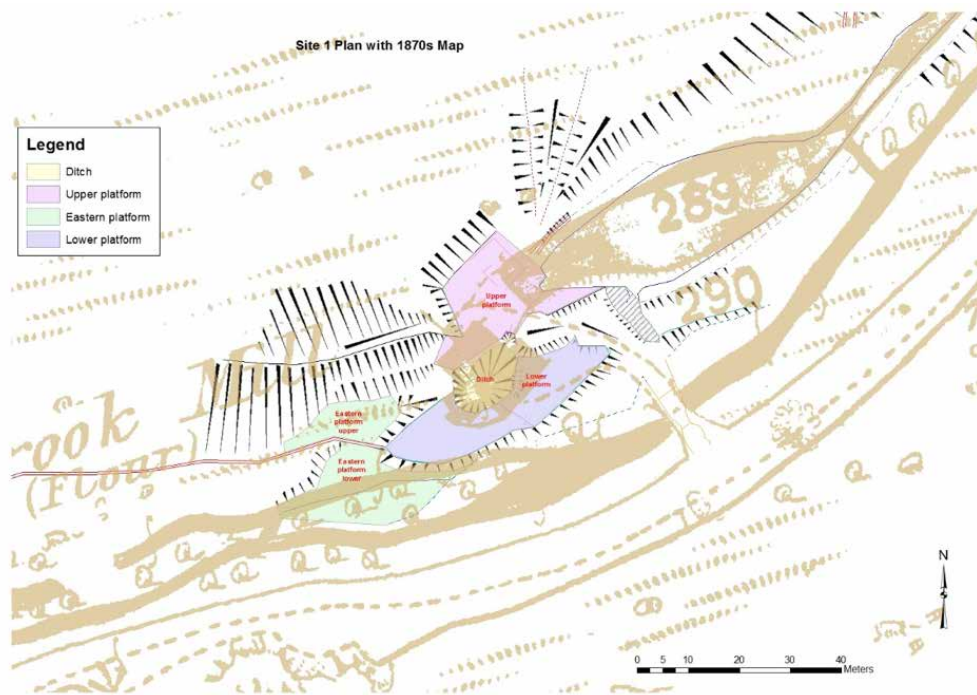


Fig. 7: Survey plan over 1870s historical map (Landmark Information Group Ltd and Crown Copyright 2016, Digimap).



Fig. 8: "Barbrook Mill" sketch sourced, Ward (1921: 34-35) (Sheffield Local Studies Library: 914.274 SST).



Plate 3: Photograph of the same setting as the Barbrook Mill sketch.

The brook, crags, bridge and suggested mill placement are in similar positions; moreover, the sketch was initially loaned to the Clarion Ramblers by the residents of Cupola Cottage nearby. Allowing for artistic representation and with the possibility that the wheel was internal (with the artist wanting to show the waterwheel), it is quite credible that this sketch represents Bar Brook mill.

As the power needed for flour mills was generally provided by leats, weirs and waterwheels (Harris, 1971), the earlier smelt-mill offered the necessary requirements for powering the flour mill. Similarly, Wood (1993, 49) describes how a pre-existing workforce accustomed to long hours and low wages was used during the establishment of Richard Arkwright's 1771 cotton mill in Cromford. It was, therefore, possible that the local workforce and transport infrastructure developed as a result of the lead mining industry, would have provided the resources to operate the later flour mill.

### **Site 2 – the slag mill**

Site 2 is scheduled (Table 1) and lies to the west of Site 1 approximately 260m downstream. Site 2 has more physical remains than Site 1 (Plate 4).

Despite the substantial remains of this mill, little investigation has taken place to determine its history and construction. Kiernan (1989, 134) also notes that there have been no surveys of lead smelting sites within Derbyshire except for the cupolas (or reverberatory furnaces). These factors make Site 2 difficult to categorise.

The slag mill replaces the smelt mill (Site 1) around 1769 (Crossley and Kiernan 1992) and is closely linked with the cupola further west which Willies (1990) records as being in use from 1790. Farey (1811) lists the slag mill (along with the cupola) as being owned by the Barker family, who closed Site 1 from 1769 to 1773 (Barnett, Heathcote and Shaw, 2008, p7).





Plate 4: Site 2 remains (looking east).

With regards to the research carried out by Willies (1973, 58), the Barker family had a connection to the cupola by the way of John Barker, Steward to the Duke of Rutland, who opened his own cupola on land owned by Duke of Rutland at Barbrook, Baslow. Willies (1971) indicates the mill was in use until 1850, conversely (Barnatt, Heathcote and Shaw 2008) suggest the site was abandoned in 1835. The site is not shown on any maps until the 1870 OS map, when it is shown as a small enclosure (Fig. 9). Site 2 was surveyed by the late L. H. Butcher; his plans reside in the Derbyshire Record Office (Fig. 10).

### **Water structures**

Like Site 1, the dam is to the east of the remains, however the dam is now silted up and revegetated but has recently undergone tree-clearance (Plate 5).

### **The mill**

Characteristically, slag hearths are very close to ore hearths (Kiernan, 1989) but use coke for fuel (Raistrick 1975, 16) however, both are grouped as smelting mills.

Kiernan (1989, 133) describes the complexity of slag mills and their differences. Not all possess chimneys for example. They did however have space for bellows and furnaces, as well as adjacent rooms and buildings for storage. Storage sheds for fuel such as peat or wood were prevalent. Other evidence included black slag heaps separate from grey heaps (Raistrick 1975). A grey heap may be present at the back of the building remains (Plate 6) but no black heap is obvious; this may be due to the vitreous nature of the black slag. Willies (1972) describes the remains as having a wheel pit and, at the back of the building, possibly two slag hearths where grey fume is evident (Plates 4, 6 and 7).

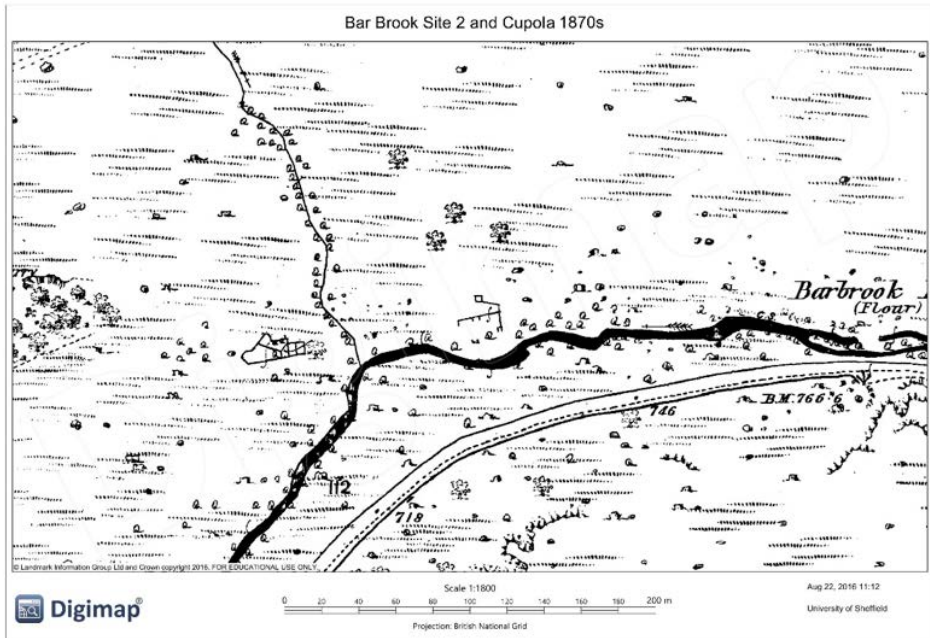


Fig. 9: 1870s OS map with Site 2 remains and cupola (Landmark Information Group Ltd and Crown Copyright 2016, Digimap).



Fig. 10: L. H. Butcher (n.d. d) detailed plan of Site 2 (Derbyshire Record Office D1699/ZLP/30-31) (no scale).





Plate 5: Site 2 silted dam (looking east).





Plate 6: Back of the building showing grey fume (looking north).



Plate 7: Back of the building showing grey fume (looking west).



Dimensions of the main building are approximately 16m x 9m. Inner walls running from north to south are faced at the end, and are low, forming an obvious wall end (Fig. 10 and Plate 6). These internal walls also include either a section covering a void for a water channel, or a weight loading partition using lintels (Fig. 11). Four lintel type blocks can be seen partly *in situ* (Plates 7, 8, and 9).

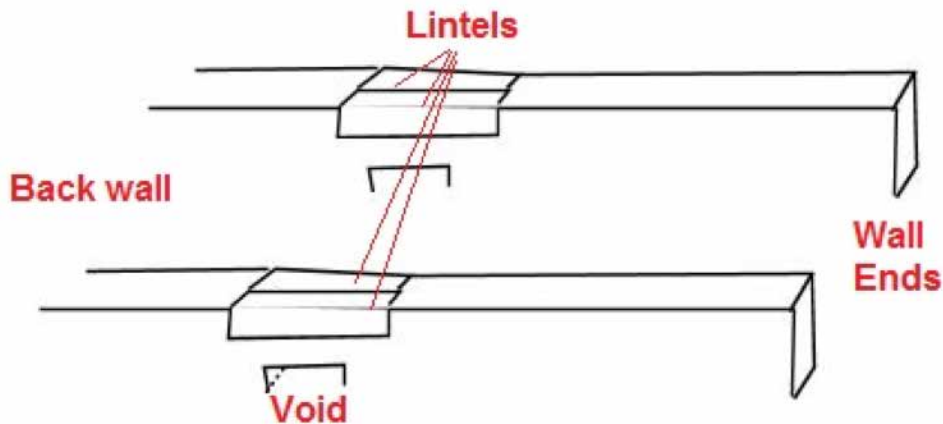


Fig. 11: Internal walls diagram with possible lintels.



Plate 8: Inner walls with possible lintels.



Additionally, the inner walls may have housed arches around the hearth, a feature archetypally in smelt mills. Alternatively, the lintels could have housed a base for bellows or a wheel; especially as this area is lower than the rest of the building foundation. The voids found under the inner wall may have been a water channel.

Comparison with existing mills is difficult given few are recorded in Derbyshire, however typical examples are abundant in Yorkshire where there are arches, space for bellows/waterwheel, hearths and various store rooms (Clough 1980). It should also be taken into consideration that building of this mill was governed by the area and shape of the land available, thus making this a small and narrow structure. Throughout the research on existing mills no matching evidence has been found for the domed semi-circular feature to the west of the building remains (Plate 11). The dome is probably a form of flue outlet or may have been used for fuel preparation.

Further walled features suggest peripheral structures possibly used for storing fuel as well as providing working areas. Rooms/stores within the main building area are hard to decipher from the remains and would require detailed investigation.

A wall of significant height (3m) when seen from the south looking north, runs parallel with the main mill building.

On initial investigation, this wall seemed to have functioned as a retaining wall, given the earth backed up against it. However, as there is no obvious water outlet from the mill remains, it is suggested this was a support for a possible wooden water outlet, carrying water away from the mill platform to the brook.





Plate 10: Lintel partly *in situ*.



Plate 11: Domed feature west of the site (looking north).

## CONCLUSION

The smelt mill (Site 1) was built in 1618 according to sources consulted by Crossley and Kiernan (1992). Evidence for the mill structure residing on the upper platform is based on the alignment with the dam, which Butcher (n.d. c) also proposes. The 1870s historical map shows an irregular shaped structure (labelled as a flour mill) to the west of the dam, which coincides with the orientation and size of the platforms. The author supports the idea that the sketch shown in the Sheffield Clarion Ramblers booklet is the Bar Brook mill, but possibly the flour mill.

The initial smelt mill was closed by the owners, the Barker family, between 1769 and 1770. A structure is still evident in 1810 (seen on the turnpike plan Fig. 2); in 1880 it was a flour mill owned by Thomas Marples and a flour mill in 1895 (Gifford 1999, 35); no building is shown on the 1890s OS map. Clearance of the mill, therefore, was between 1880 and 1895. Subsequently, the pumping station evident on the 1920s OS map was demolished around 1941 (Barnatt, Heathcote and Shaw 2008).

Unlike the earlier smelt mill, the later slag mill (Site 2) has been scheduled (Table 1). Built by the Barker family c.1769 the slag mill was linked to the cupola further downstream. The mill succession is typical of this period, noted by Kiernan (1989, 134) ‘...Nearly all of the Derbyshire mills had been abandoned by c.1782 or incorporated into the reverberatory smelting complex as slag mills...’. As the smelt mill was closed by c.1770, conceivably it was not considered for a slag mill and instead John Barker decided on a purpose-built mill close to the cupola during his stewardship to the Duke of Rutland.

The slag mill clearly shows more remains than at Site 1; nonetheless, given the lack of comparable sites recorded in Derbyshire it was difficult to interpret. Characteristic structures based on sites in the Yorkshire Dales helped to determine this later site and it was seen to contain features typical of a smelting site.

This evidence for the transition from smelt mill to slag mill gives some significance to the area, which has for many years been in the shadow of the archaeology of Gardom’s Edge close by. The transition demonstrates the lead processing industry from a point of increased production to its decline. Furthermore, Site 1 illustrates a move from one industry to another as it later provided the resources required for flour milling. Therefore, it is suggested that the scheduling of Site 2 be extended to Site 1 and that an information board be installed on site. A further suggestion is that the work by L. H. Butcher be digitised and published for future use.

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