

November 1997

SARGILL LEAD SMELTING MILL
NORTH YORKSHIRE

Report on Archaeological Survey

Sargill Lead Smelting Mill,
North Yorkshire

Report on Archaeological Survey

Report no 1997-98/(020)/7682

Checked by Project Manager. Date
Passed for submission to client. Date

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November 1997

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ACKNOWLEDGEMENTS

This report was commissioned by Yorkshire Dales National Park Authority (YDNPA). LUAU are grateful to Olwen Beazley for her assistance and advice. Thanks are also due to Richard Johnson for allowing access to the site.

The documentary research was undertaken by Jonathan Godfrey, and the fieldwork by Jonathan Godfrey, Chris Wild and Graham Mottershead. This report was written by Chris Wild and David Cranstone. The project was managed by David Cranstone and Jamie Quartermaine.

SUMMARY

An archaeological survey was undertaken at Sargill Smelt Mill, North Yorkshire, during May 1997 by Lancaster University Archaeological Unit. The survey comprised a topographic plan of the immediate vicinity of the smelt mill, a plan of the main smelt mill building, elevation drawings of all upstanding internal and external walls, a detailed gazetteer of the visible site components, and a photographic record.

The bellows for the smelting furnaces were driven by a water wheel within the smelt mill complex, which was fed by a mill race off the adjacent Sargill Beck. The original tail race was not identified, but an outlet was found immediately south of the wheel pit which led upstream into Sargill Beck.

Two hearths were identified which were of a shaft furnace type, which is distinct from the traditional low open type of hearth. This shaft type was introduced in the form of the Spanish Slag Hearth at around 1850 and the Sargill example is paralleled by one at Keld Heads smelt mill, which was built in the 1860s.

The flue extends north for about 24m from the mill buildings to a square chimney base. There is evidence of a proposed zig-zagged extension which leads up the slope from the chimney base, but this was never completed.

The documentary evidence indicates that the mill was constructed in the 1840s and was out of use by 1870. The survey evidence confirms that it had a very short life. There are very limited quantities of slag visible, by comparison with other Yorkshire smelt mill sites, and the mill does not appear to have been intensively used during its short operational life.

1. INTRODUCTION

1.1 CIRCUMSTANCES OF PROJECT

- 1.1.1 In May 1997, a non-destructive survey of the lead mining remains and adjacent land was undertaken by the Lancaster University Archaeological Unit (LUAU) at Sargill, Smelt Mill, Low Abbotside, North Yorkshire (NGR NY 8975 9259). The project was undertaken in accordance with a project design (*Appendix 2*) that was submitted in response to a project brief (*Appendix 1*) supplied by the Yorkshire Dales National Park Authority (YDNPA).
- 1.1.2 The aim of the survey was to provide a measured survey and building record in advance of archaeological conservation. The survey involved a basic documentary study, and a detailed instrument survey to produce an accurate 1:500 topographic plan of the study area, together with more detailed plans and elevations of surviving structures at 1:100 scale. A gazetteer of all structural components was prepared and is included within this report. A photographic record was also compiled.

2. METHODOLOGY

2.1 PROJECT DESIGN

- 2.1.1 A project design (*Appendix 2*) was submitted by LUAU in response to a request from YDNPA, at Sargill Smelt Mill, Low Abbotside, North Yorkshire (NGR NY 38975 49259). This was designed to meet the requirements of a project brief (*Appendix 1*) supplied by YDNPA.
- 2.1.2 The project design provided for both topographic and building survey, a photographic record and a desk-based survey, followed by the production of a gazetteer of surviving structures and earthworks; the results are presented within this written report. The work has been carried out entirely in accordance with the project design.

2.2 DESK-BASED STUDY

- 2.2.1 A basic documentary survey was undertaken (*Section 3*). This involved consultation of published works, and other cartographic and written information held in North Yorkshire Record Office.
- 2.2.2 Aerial photographs and OS map editions held by YDNPA were consulted, and used to inform the fieldwork and report.

2.3 TOPOGRAPHIC SURVEY

- 2.3.1 A new detailed earthwork survey was prepared of the survey area, as specified by the brief, which measured *c* 150 x 50m and included the ruins of the smelt mill, flue and chimney, and the earthwork continuation of the flue (Fig 4). The survey also included the mapping of coarse vegetation differences, with particular attention to lead-tolerant flora, and recording the nature and size of any process residues (dressing waste and/or slag) exposed within the survey area.
- 2.3.2 Survey control was established by a closed traverse, using a total station to an accuracy of +/- 25mm. The survey was tied in to the OS national grid by use of a Global Positioning System (GPS), accurate to +/- 1m.
- 2.3.3 The survey was undertaken by EDM (Electronic Distance Measurement) tacheometry using a total station linked to a data logger. Digital data was then transferred to a portable computer for manipulation and subsequent transfer to other digital media. Film plots were output via a plotter and archaeological detail added in the field as a dimensioned drawing on the plots with respect to survey markers. Significant topographic detail was also added during the field survey.
- 2.3.4 The final survey mapping was generated within a Computer Aided Draughting (CAD) environment and output at a 1:500 scale (Fig 4).

2.4 BUILDING SURVEY

- 2.4.1 A ground level plan of the buildings was prepared at 1:100 scale, and elevations of all walls retaining significant detail were prepared at 1:50 scale (Figs 5-13). These drawings were prepared to a context-outline level of detail, showing all significant architectural, structural, and technological features of the building. This included colour-coding of any differences in the nature of the building stone, and any evidence of alterations and phasing.
- 2.4.2 The ground-level plan and, where field conditions permitted, the elevations of the walls were prepared by use of EDM tacheometry using a reflectorless total station (See *Section 2.3.3*). As anticipated, some internal elevations were not readily accessible to reflectorless EDM tacheometry due to poor sight lines; in these cases, elevation drawings were prepared manually and digitised in order to provide a consistent CAD-based record.

2.5 GAZETTEER OF SITES

- 2.5.1 Descriptions of all the site features and structural components were prepared using survey proforma and these have been presented in the form of a gazetteer (*Section 5*) in conjunction with an annotated map at 1:500 scale showing the positions of the sites. Locations are given as ten-figure National Grid References. A description of each feature is provided in conjunction with an assessment of its condition.

2.6 ARCHIVE

- 2.6.1 The results of the fieldwork form the basis of a full archive to professional standards, in accordance with current English Heritage guidelines (*The management of archaeological projects*, 2nd edition 1991). The project archive, consisting of all the data and material gathered during the project, has been checked and indexed. It includes summary reports of the contexts records. The archive will be deposited in an appropriate repository agreed with the client.
- 2.6.2 The textual archive will be provided both as a printed document and on computer disks as ASCII files. Copies of Record Office documents will be provided as photocopies.

2.7 HEALTH AND SAFETY

- 2.7.1 LUAU provides a Health and Safety Statement for all projects and maintains a Unit safety policy. All site procedures are in accordance with the guidance set out in the Health and Safety Manual compiled by the Standing Conference of Archaeological Unit Managers (1991). A written risk assessment was undertaken in advance of project commencement and copies will be made available on request to all interested parties.

3. GEOLOGICAL AND HISTORICAL BACKGROUND

3.1 GEOLOGICAL BACKGROUND

- 3.1.1 Sargill smelt mill lies at 440m OD, on the north bank of Sargill Beck. The geological substrate consists of Brigantian (Lower Carboniferous) limestones, sandstones, and shales, variably overlain with glacial drift. The lead mineralisation is contained within the sub-vertical Sargill vein, cutting through the country rocks (Dunham and Wilson 1985, 163-6).

3.2 HISTORICAL BACKGROUND

- 3.2.1 The smelt mill has been previously described by Clough (1980, 101-2) and Raistrick (1975, 95-98). Although Sargill Mine operated from at least the early nineteenth century, the smelt mill is believed to have only been constructed in the 1840s and is shown as in use on the 1857 OS 1st edition map; by 1870 it was closed. By the standards of Yorkshire smelt mills, Sargill is relatively small, late, and short-lived.

- 3.2.2 So far as is known, the only previous measured record of the site is the plan and elevation published by Clough (1980, 101) (Fig 3), based on a field survey in 1948. The accompanying photograph (Clough 1980, 102) confirms that Clough was able to see and record features which no longer survive in visible form. Unfortunately, Clough's drawings contain considerable elements of reconstruction, and it is impossible to rely on them as evidence for features which are not now visible.

4. RESULTS

4.1 GENERAL DESCRIPTION

- 4.1.1 The principal element of the site is the smelt mill building complex which has two main hearths (ore and slag hearths) and a secondary calcining hearth. The main hearths were supplied with air from bellows driven by a water wheel within the main building complex. The water wheel was fed by a mill race leading out from Sargill Beck.
- 4.1.2 The exhaust from the hearths passed through a condenser and thence through a short (24m long) flue to a square-based chimney to the north of the building.
- 4.1.3 There are only limited amounts of slag associated with the mill complex.

4.2 TOPOGRAPHICAL SURVEY

- 4.2.1 A total of 29 topographical/archaeological features were recorded during the survey. The majority of these features can be identified as culverts, ditches, retaining walls, tracks or platforms (Fig 4). Descriptions of each feature are given in the gazetteer (*Section 5*).
- 4.2.2 The largest and most substantial feature observed was the 'V'-shaped zig-zag ditch (SAR 01) aligned approximately north/south from the flue chimney (SAR 4). There are shallow spoil banks on either side, and the feature widens slightly at the northern terminus, probably for a chimney base. The feature appears to be an uncompleted extension to the flue. Two features at the southern end (SAR 05 and SAR 06) appear to be associated ditches, most probably to drain surface water, flowing down the construction trench, away from the existing chimney base (SAR 04).
- 4.2.3 There were three other large topographic features located within the survey area (SAR 02, 03 and 15). These are all natural drainage gullies, running down the steep valley slope, but have been canalised and/or culverted (SAR 15, 26 and 30) at the base of the slope and were clearly associated with the smelt mill complex. Whilst it is unclear if the running water was utilised for washing materials, the water courses were certainly diverted to manage the drainage of the smelt mill platform. Three other culverts were also observed, one entering the site from the east (SAR 27) and joining culvert SAR 26, the other (SAR 11) joining the mill-race (SAR 12) from the north-east. The third culvert was observed only at its outlet into Sargill Beck. Without recourse to sub-surface investigation it is not possible to identify the sources of these three culverts, so postulations on their exact function are limited.
- 4.2.4 Two significant water courses recorded during the survey are the mill-race (SAR 12) and the tail-race outlet into Sargill Beck. The mill-race starts *c* 220m to the west of the mill, outside the survey area, and follows the contours along the lower slopes of the valley. Immediately to the west of the survey area, it crosses the canalised stream (SAR 15) which was culverted underneath. It continues along the contour of the hill to the north-west corner of the smelt mill where it turns sharply south to enter the building. It was not possible to locate the position of the tail-race to the south of the

wheel pit (SAR 32). However, an outlet into Sargill Beck was identified (SAR 19), aligned at approximately 45° to the front wall of the smelt mill and pointing upstream. It appears unlikely that this was the original terminus of the tail-race, because the beck has shifted its course since the 1890 OS map; it is probable that the original terminus has been destroyed.

- 4.2.5 Three, or possibly four, tracks were identified during the survey. The most substantial of these (SAR 52) is between 3m and 4m across and cut on a terrace, with shallow upslope banks and steeper downslope banking. It enters the survey area from the north-west and runs round the hill on a gentle gradient, appearing to terminate at the western side of the southern end of the flue (SAR 09). The desk-based survey identified this feature as the track from Sargill Mine to the north-west, it being clearly shown on the 1st edition OS map of 1857. Other tracks were observed to the south of the smelt mill along the edge of Sargill Beck. Two of these (SAR 14 and 21) appear to have been one track of *c* 2m in width, now separated by erosion at the south-west corner of the smelt mill. Associated retaining walls (SAR 16 and 18) were also observed along the north bank of Sargill Beck, probably built to stabilise the bank below the track (SAR 14). The western of these retaining walls (SAR 16) was poorly preserved in the survey area, but survived in much better condition further to the west. The track is also shown on the 1st edition OS map of 1857. Further to the south-east, lower down the slope than SAR 21, is another linear feature which merges with trackway SAR 21 at the eastern end of the survey area. Although this was possibly a lower 'branch' of the previous track, it is more probable that it is a natural feature formed by the meandering nature of the beck.
- 4.2.6 To the west of the northern end of the flue (SAR 09), two sub-rectangular sunken flattened platforms (SAR 07 and 08) of roughly equal dimensions (*c*2.5 x 2.0 x 0.3m) were observed. These appear to represent storage areas, possibly for peat or other fuel.
- 4.2.7 At the eastern end of the smelt mill are two further platforms (SAR 23 and 29). The largest (SAR 23), measuring 11.5 x 7.5m, has a retaining wall (SAR 22) along its southern edge, and appears to represent a large storage/processing, or possibly loading, area. It is possible that there were temporary structures located on this platform, but excavation would be required to examine this possibility further. The second platform (SAR 29), to the north-east, was a long, narrow platform *c*13 x 3m, which appears to have been terraced out of the hillside. Its function is unclear but it does have a culvert (SAR 30) diverting a stream around it. To the south of this are two shallow hollows of *c* 5m diameter and 0.3m depth (SAR 24 and 25). These were possibly the remains of circular buddles.

4.3 VEGETATION SURVEY

- 4.3.1 One of the aims specified by the brief was to identify and record differences in vegetation. However, the site as a whole displayed very little in terms of faunal differences, particularly with regard to lead-tolerant species such as Spring Sandwort. Only two areas of differing vegetation were observed (SAR 23 and 28), the large platform (SAR 23) having very lush green grass, whilst the area to the north-east (SAR 28) was the only barren patch within the survey area (Fig 4). This measured *c*6.5 x 4.5m and the surface was covered with small sandstone fragments and

occasional pieces of slag and coke, suggesting the presence of a slag hearth on the site.

4.4 BUILDING SURVEY

- 4.4.1 The smelt mill building complex was badly preserved, with large quantities of rubble obscuring much of the detail (Fig 5). However, the survey revealed that the smelting mill complex appears to have had four main structures, principally the smelt mill building itself, comprising ore and slag hearths, wheel pit, air blower and probable air-pipe passage. To the west was a smaller, adjoining building with a small chimney stack. This was structurally secondary, and probably contained a reverberatory roasting furnace. To the north of the main building was a flue with the chimney, and finally there was a walled area which appears to have been a loading platform.
- 4.4.2 ***The Smelt Mill Building (SAR 31: Figs 5, 8, 9 and 10):*** a poorly preserved rectangular structure measuring 17.25 x 8.70m with walls surviving to a maximum height of 3.95m. The external walls (SAR 31.1-4) were approximately 0.6m thick and of roughly coursed local stone, with long-and-short quoined corners. The southern, front and western walls also had several through stones, which appear to be the only bonding between the inner and outer faces.
- 4.4.3 The southern wall (SAR 31.1: Fig 8) was the best preserved and contained two doorways and one window. The western doorway, now partially blocked, was large enough for a loading door, and sockets for a pair of barn doors were observed in the lintel. The window and smaller doorway were fully blocked. The eastern end of this wall displays a subtle difference in the masonry; the quoins were smaller, suggesting a possible rebuild of this south-east corner of the building.
- 4.4.4 The eastern wall (SAR 31.2: Fig 12) was badly preserved, and the northern end was obscured under rubble collapse. It contained one small doorway, presently blocked by large salt-glazed pipes. No through stones were observed in this elevation, and the build appeared to be slightly different to the southern and western elevations; it may be part of the same possible rebuild identified in the southern elevation.
- 4.4.5 The western wall (SAR 31.3: Fig 9) survived in poor condition. One aperture, edged by quoin stones and measuring 0.75m in width, was identified in the wall. It appears to have been aligned with the centre of the wheel pit (SAR 32), and therefore probably held the axle mounting. The north wall (SAR 31.4) was in very poor condition, and was almost entirely destroyed or covered.
- 4.4.6 Internally, the mill comprised four cells. The western cell contained the wheel pit (SAR 32) and presumably the blowing mechanism; it contained the larger doorway of 31.1 in its south elevation. An aperture (SAR 42) in the north end of the eastern wall of this cell was observed to a depth of at least 2.0m. This opening probably carried the air pipes from the blowing mechanism, leading into the space behind the two hearths. The south-eastern cell contained an ore hearth (SAR 37) and a slag hearth (SAR 39). The space to the north of these was planned by Clough (1980, 101) as two enclosed cells, though the present survey evidence would suggest an alternative interpretation as a single unenclosed passageway (SAR 40). In either case, it probably carried the air-pipes from the blowing mechanism to the two hearths. To

the north of this, the wider trapezoid structure (SAR 50), at the south end of flue SAR 09, is interpreted as a condenser. It contained an iron tie and a service opening in the eastern wall. Unfortunately, this area of the mill is particularly poorly preserved, and further speculation can only be aided by excavation.

- 4.4.7 **The Wheel Pit (SAR 32):** this was aligned north/south, and measured 6.8m x 1.8m; it was located in the western end of the smelt mill (SAR 31). No remains of the wheel were observed and the pit itself has been backfilled.
- 4.4.8 **The Ore Hearth (SAR 37: Figs 5 and 13):** this was located to the east of the blowing mechanism, in the south-eastern cell of the smelt mill. The front, southern face contained worked stone supports (SAR 37.1 and SAR 37.2) and the internal wall faces were covered either in reddish discolouration, or fine brown dust.
- 4.4.9 **The Slag Hearth (SAR 39: Figs 5 and 13):** this is located to the east of the ore hearth (SAR 37). The front walls (SAR 39.1 and SAR 39.2) were both curved, suggesting a semi-circular hearth construction. The eastern front wall (SAR 39.2) had two iron straps protruding for hearth fittings.
- 4.4.10 **The Roasting Furnace Building (SAR 43):** a poorly preserved rectangular structure measuring 6.70 x 5.24m with walls surviving to a maximum height of only 1.50m; there was a small chimney stack (SAR 44), c 1.4m square, abutting the north-west corner. Entrances were observed at the south-west and south-east corners. In the north-east corner four iron beams were observed protruding from the ground (SAR 45) and were probably part of the strapping beams of the roasting furnace itself.
- 4.4.11 **Possible Loading Bay and Ore Bin (SAR 46-49):** a flattened area, terraced into the hillside immediately to the north of the smelt mill. The area was poorly preserved with large quantities of rubble overlying the surface. However, the remaining wall stubs suggest a long rectangular loading bay (SAR 46), and a smaller northern cell (SAR 47-49), which was probably used as an ore bin.
- 4.4.12 **Flue and Possible Condensing Chamber (SAR 09 and 50):** this (SAR 09) was a straight flue, aligned north/south from the possible condensing chamber (SAR 50) to the chimney (SAR 04). It comprised a vertical-sided trench (18.80 x 1.7m) lined with mortared stone walls to a depth of 0.45m (flue width 0.80m). It survived to ground height level, at a depth of 0.8m at the south end, rising to 0.5m at the north end. There was no evidence for a vaulted roof, and no flagstones were observed either.
- 4.4.13 The southern end of the flue (SAR 09) widened to form a trapezoidally-shaped cell (SAR 50) with two openings, now blocked, into the area behind the hearths (SAR 37 and 39), and an access aperture in the eastern wall. The southern wall (SAR 50.1) was pinkish from burning, and heavily covered with rust-coloured lichens. A pillar in the centre of the structure (SAR 50.2) appears to be the remains of a central dividing wall which may have supported the condensing mechanism. An iron tie, located in the south-east corner of the structure, may have served a similar function. Immediately to the east of this structure, to the south of the access, were the badly collapsed remains of a small rectangular structure, possibly a store for fume from the condenser (SAR 51).

- 4.4.13 ***The Chimney (SAR 04)***: a rectangular stack (2.16 x 2.0m) at the north end of the flue (SAR 09), was observed to be in a poor state of preservation. The west wall has collapsed and the maximum surviving height was 2.40m. Just below this height was a ledge constructed from through-stones on the east side. No other walls survived to this height.

5. GAZETTEER OF SITES

Site Number SAR 01
NGR NY 89767 92683 - 89764 92625
Site type Trench
Period Nineteenth Century
Condition Good
Dimensions 73.50m long, 5m wide at top, 0.85m wide at base, 0.80m deep
Description 'V'-section trench, zigzag in plan, running north up the hillside from chimney SAR 04. It has shallow banks of spoil to either side of the trench. It widens slightly at the northern end probably for a chimney base. It was the construction trench for an extension to the flue, which was never completed.

Site Number SAR 02
NGR NY 89783 92680 - 89785 92612
Site type Gully
Period N/A
Condition Good
Dimensions 79.50m long, 5-7m wide, 0.70m deep
Description A meandering gully, which is damp in the bottom. It starts to the north of the survey area and runs down the hillside parallel to flue trench SAR 01. It is infilled where it passes the northern end of SAR 01, and it fans out onto the terraced platform SAR 29 at its southern end, where any water was culverted away to the Sargill Beck. The water was possibly used to wash materials near the beck.

Site Number SAR 03
NGR NY 89796 92647 - 89796 92609
Site type Gully
Period N/A
Condition Good
Dimensions 37.60m long, c6m wide, 0.60m deep
Description A straight, shallow, wide gully, which runs down slope to the east of terraced area SAR 29 and smelt mill buildings SAR 31. There is presently running water in the bottom. It was culverted around a terraced area (see SAR 26). It was possibly used for washing materials.

Site Number SAR 04
NGR NY 89764 92623
Site type Chimney
Period Nineteenth Century
Condition Fair
Dimensions 2.16m long, 2.00m wide, 2.40m high on east side
Description The remains of an almost square-plan chimney stack situated at the north end of flue SAR 09. It is constructed of mortared stone; there is a course of through-stones at the top of the east wall, although these may be a ledge or baffle. The west wall does not survive.

Site Number SAR 05
NGR NY 89767 92625
Site type Ditch
Period Nineteenth Century
Condition Fair
Dimensions 6.50m long, 1.10m wide, 0.20m deep
Description A shallow ditch running parallel to SAR 06. It runs south from the end of flue trench SAR 01 and to the east of chimney SAR 04. It was possibly an outlet ditch for the zigzag flue SAR 01 to avoid washing away the foundations of chimney SAR 04.

Site Number SAR 06
NGR NY 89767 92622
Site type Ditch
Period Nineteenth Century
Condition Fair
Dimensions 4.90m long, 1.20m wide, 0.30m deep
Description A shallow ditch running parallel to SAR 05. It runs south from the end of the flue trench SAR 01 and to the east of chimney SAR 04. It was possibly an outlet ditch for the zigzag flue SAR 01 to avoid washing away the foundations of the chimney SAR 04.

Site Number SAR 07
NGR NY 89759 92621
Site type Structure
Period Eighteenth/Nineteenth Century?
Condition Poor
Dimensions 2.30m long, 1.90m wide, 0.20m deep
Description A sub-rectangular sunken area, which has a principal axis that is perpendicular to flue SAR 09. It has a flat floor area. It was possibly a storage area for peat or other fuel or materials.

Site Number SAR 08
NGR NY 89748 92623
Site type Structure?
Period Eighteenth/Nineteenth Century?
Condition Poor
Dimensions 3.30m long, 2.50m wide, 0.35m deep
Description A rectangular sunken area with a flat floor; its principal axis is aligned with SAR 07 which is immediately to the east. Some squared stones survive in the edges. It was possibly a storage area for peat or other fuel or materials.

Site Number SAR 09
NGR NY 89763 92603 - 89764 92622
Site type Flue
Period Nineteenth Century
Condition Good

Dimensions 18.80m long, 0.80m wide, 0.50m deep at north, 0.80m deep at south

Description A straight flue running north from possible condensing chamber SAR 50 to chimney SAR 04. The flue is a vertical straight-sided trench, lined on both sides with mortared stone walls 0.45m thick. The top is flush with the ground surface, suggesting that it survives to original height. There is no sign of vaulting; the top was probably stone flagged, although the apparent lack of slab-sized stone on the site suggests otherwise. Alternatively the top could have been wooden.

Site Number SAR 10

NGR NY 89765 92604

Site type Retaining Wall

Period Nineteenth Century

Condition Poor

Dimensions 1.40m long, 0.30m+ wide, 0.60m high

Description A retaining wall at the south end of flue SAR 09. Its purpose is unclear.

Site Number SAR 11

NGR NY 89754 92606

Site type Culvert

Period Nineteenth Century

Condition Fair

Dimensions 5.85m long, 0.70m wide

Description A stone-capped culvert (small, roughly shaped stones not slabs), which is mostly grassed over. It joins mill-race SAR 12 at its east end before entering the back of the mill. It is not clear where the culvert starts.

Site Number SAR 12

NGR NY 89726 92608 - 89751 92604

Site type Mill-race

Period Nineteenth Century

Condition Fair

Dimensions 19.10m+ long, 0.85m wide

Description A boggy, narrow channel running east/west, following the contours of the valley. It starts c220m to the west of the mill and is sourced from the Sargill Beck. Immediately to the west of the site, it crosses a small culverted stream (SAR 15) on a small aqueduct, which is now caved-in and overgrown. At its eastern end it turns sharply south after meeting culvert SAR 11 and there enters the back of the mill.

Site Number SAR 13

NGR NY 89741 92597

Site type Ditch?

Period Nineteenth Century

Condition Poor

Dimensions 2.60m long, 0.20m wide

Description A possible ditch. It was possibly used to channel water around the mill buildings to stop undermining and damp.

Site Number SAR 14

NGR NY 89731 92592 - 89744 92591

Site type Trackway

Period Nineteenth Century?

Condition Fair

Dimensions 15.70m+ long, average 2.20m wide

Description A probable trackway, which enters the survey area from the west. It is covered by lush grass. It has a retaining wall (SAR 16) along its southern edge, and ends at the south-west corner of the smelt mill where the stream has eroded the bank almost up to the corner of the building. It probably continued around the smelt mill to join SAR 21. It can be identified as the trackway on the OS 2nd edition map.

Site Number SAR 15

NGR NY 89737 92606 - 89731 92594

Site type Culverted Stream

Period Nineteenth Century?

Condition Very Poor

Dimensions 20.20m long, 0.90m wide internally

Description The southern culverted end of a stream that forms the western edge of the survey area. It is culverted from the mill-race aqueduct to its junction with Sargill Beck. Most of the roof slabs have collapsed allowing the stream to flow over the top of the remains of the culvert.

Site Number SAR 16

NGR NY 89734 92590

Site type Retaining Wall

Period Nineteenth Century

Condition Poor

Dimensions 1.00m long, 0.40m+ wide, 0.30m high

Description The remains of a retaining wall for trackway SAR 14. More of this wall survives in much better condition to the west of the survey area.

Site Number SAR 17

NGR NY 89740 92588

Site type Culvert Outlet

Period Nineteenth Century

Condition Poor

Dimensions 0.20m wide internally

Description A culvert outlet into Sargill Beck. It was not possible to trace the culvert any further back.

Site Number SAR 18
NGR NY 89742 92588
Site type Retaining Wall?
Period Nineteenth Century
Condition Poor
Dimensions 1.00m long, 0.35m+ wide, 0.40m high
Description A probable retaining wall immediately to the east of culvert SAR 17. There is one large block visible, set at a slight angle to the present line of the beck.

Site Number SAR 19
NGR NY 89752 92586
Site type Tail-race Outlet?
Period Nineteenth Century
Condition Poor
Dimensions 1.00m+ long, 0.65m wide, 0.15m+ high
Description This is an opening in the bank of Sargill Beck below smelt mill SAR 31. It has a slabbed top, and the interior is filled with collapse debris; a trickle of water flows from it. The outlet is aligned at 45° to the front wall of the building and points upstream. It was probably the tail-race from wheel pit SAR 32. Because the beck has shifted its course since the 1890 OS map, the end visible is almost certainly not the original terminal of the outlet.

Site Number SAR 20
NGR NY 89754 92585 - 89794 92580
Site type Trackway?
Period Nineteenth Century?
Condition Fair
Dimensions 40.50m long, 2.80m wide
Description A flat surface covered by lush grass running parallel to Sargill Beck at a lower level than trackway SAR 21. It was possibly a trackway, but more probably a natural feature. It fades away at its eastern end.

Site Number SAR 21
NGR NY 89749 92590 - 89786 92586
Site type Trackway
Period Nineteenth Century
Condition Good
Dimensions 26.30m long, 2.93m wide
Description A flat surface covered by lush grass running east from the south-west corner of smelt mill building SAR 31. It is wide enough for a cart, and was probably a continuation of trackway SAR 14. It can be identified as a trackway on both the 2nd and 3rd edition OS maps.

Site Number SAR 22
NGR NY 89772 92588
Site type Retaining Wall
Period Nineteenth Century
Condition Poor

Dimensions 8.20m long, 0.50m+ wide, 0.60m high

Description A retaining wall immediately to the north of trackway SAR 21 and also retaining the southern edge of platform SAR 23. The western part has a small return near its eastern end, and there is a single stone measuring 0.35m x 0.08m in plan. The eastern part has a return at the eastern end. The two parts were probably a single stretch of wall with a dog-leg in it, running from the south-east corner of smelt mill building SAR 31.

Site Number SAR 23

NGR NY 89775 92593

Site type Platform

Period Nineteenth Century

Condition Fair

Dimensions 11.50m long, 7.50m wide

Description A flat platform lying immediately to the east of a door in the mill. This area, like the trackways, but nowhere else in the survey area, is covered by lush green grass. There is a shallow ditch along the north edge, and the north-east corner is covered by rougher grass, probably concealing tumble. It was probably a storage and/or loading area for processed material.

Site Number SAR 24

NGR NY 89778 92590

Site type Hollow

Period Nineteenth Century?

Condition Fair

Dimensions 4.20m external diam., 2.40 internal diam., max. 0.30m deep

Description A horse-shoe-shaped scoop at the eastern end of retaining wall SAR 22. It was possibly a circular buddle. Two large pieces of glassy black slag were found immediately to the west. The slag was slightly vesicular with occasional prills of corroded lead.

Site Number SAR 25

NGR NY 89785 92590

Site type Hollow

Period Nineteenth Century?

Condition Poor

Dimensions 4.90m long, 5.20m wide, max. 0.30m deep

Description A horse-shoe-shaped scoop to the east of SAR 24. It is very similar to SAR 24 but larger and more indistinct. It was possibly a circular buddle.

Site Number SAR 26

NGR NY 89786 92593 - 89798 92609

Site type Culvert

Period Nineteenth Century

Condition Good

Dimensions 21.30m long, 0.55m wide

Description A stone-lined and capped (small roughly shaped stones not flags) culvert running from the south end of gully SAR 03 and disappearing below hollow SAR 25.

Culverts SAR 27 and 30 run into it. No outflow from it into the beck was visible, but the area immediately south of its southern-most visible part is very marshy. It was apparently used for water diversion, although it may have supplied buddles SAR 24 and 25.

Site Number SAR 27
NGR NY 89808 92602 - 89795 92601
Site type Culvert
Period Nineteenth Century
Condition Good
Dimensions 8.80m+ long, 0.36m wide
Description A stone-lined and capped culvert. It is very similar to SAR 26, which it runs into. The culvert starts to the east of the survey area and is made of rough stones. It is capped with the same material, rather than flags. It appears to be bringing water into the site rather than simply diverting it.

Site Number SAR 28
NGR NY 89779 92599
Site type Barren Area
Period Nineteenth/Twentieth Century?
Condition Poor
Dimensions 6.70m long, 4.30m wide
Description This is the only barren area within the survey area, and may have been cleared quite recently. The surface is covered with small pieces of sandstone and occasional small pieces of black slag and coke, suggesting the presence of a slag hearth in the mill. The only similarly barren areas lie to the west of the survey area near the mill-race.

Site Number SAR 29
NGR NY 89778 92603 - 89791 92605
Site type Platform
Period Nineteenth Century
Condition Fair
Dimensions 12.90m long, average 2.90m wide
Description A flat narrow platform, which was possibly terraced out of the hillside to the north or alternatively was spoil from the construction of flue SAR 09. Culvert SAR 30 directs water from gully SAR 02 around it.

Site Number SAR 30
NGR NY 89785 92612 - 89794 92604
Site type Culvert
Period Nineteenth Century
Condition Fair
Dimensions 13.10m long, 0.34m wide
Description A stone-lined and capped culvert which is very similar to SAR 26 and 27. It diverts water from gully SAR 02 around the north-east corner of platform SAR 29 and into culvert SAR 26.

Site Number SAR 31
NGR NY 89758 92593
Site type Smelt mill building
Period Nineteenth Century
Condition Poor to Moderate
Dimensions 17.25m long, 8.70m wide, 3.95m high
Description A rectangular building containing wheel pit, bellows or pump room, an ore hearth and a slag hearth. It was constructed from roughly coursed local stone. This is the main smelt mill building.

Site Number SAR 31.1
Site type Wall
Period Nineteenth Century
Condition Moderate
Dimensions 17.25m long, 0.60m wide, 3.95m high
Description The south wall of smelt mill SAR 31. It contains one cart-width doorway, one person-width doorway and one window. The window and smaller doorway are both fully blocked, while the cart doorway is half blocked. All the openings have rough wooden lintels. The lintel for the cart door has sockets for a pair of barn doors on its underside. Holes and orange lichen on the north (internal) face suggest some sort of beamed machinery; the bellows or pump were housed here over a low dividing wall SAR 33 and 34. The quoins at the western end of this wall are "long-and-shorts". The eastern end of the wall has much smaller quoins, and a subtle change in the masonry c1m from the eastern end suggests either a re-build or an extension here. Through stones are visible at lintel height on the external face only. They are also visible intermittently lower down the wall and run as far east as the line of the suspected rebuild. The jambs to the cart door are well finished but only the eastern one is rebated. Apart from the through stones, the outer and inner skins of the walls are apparently not tied together and may be of different builds. All mortar on the external face of the wall appears to have been eroded.

Site Number SAR 31.2
Site type Wall
Period Nineteenth Century
Condition Moderate
Dimensions 3.95m long, 0.62m wide, 1.90m high
Description The east wall of the smelt mill. There is a person-sized doorway by the south end, which is blocked by two large (0.46m) diameter ceramic salt-glazed pipes, and has iron door fittings *in situ* on the outer skin, as well as a rebate. The lower pipe rests on the threshold. The northern end of the wall has collapsed and is hidden behind rubble. The inner face of the wall bows out at its northern end, where it is butted by the slag hearth. There are no through stones visible in the wall, and the inner and outer skins are apparently not tied together, suggesting a different, later, build for this part of the smelt mill. All mortar has been eroded on the external face of the wall.

Site Number SAR 31.3

Site type Wall
Period Nineteenth Century
Condition Poor
Dimensions 8.67m long, 0.64m wide, c 2.1m high
Description The west wall of structure SAR 31. The wall survives in two parts, north and south, separated by a dressed stone, 0.76m wide opening at the point where the water wheel axle would be in plan. Long and short quoins survive well at the south end where it joins SAR 31.1, but not so well at the north end where the wall has collapsed. There are reddened areas at the bottom of the external face of the northern part of this wall, and also at the northern end of the southern part of the wall. There are two through stones visible in the northern part of the wall; the southern part does not survive to the height of the through stones. The opening in the middle of the wall is 0.75m wide and is filled with rubble. It was not possible to confirm the position of its base, but it is at least 0.20m below the present rubble-filled bottom. The purpose of the opening is not clear, although it could be a second power take-off from the wheel to power another fan/bellows in the roasting hearth building (Fig 5 (A)) or simply access to the waterwheel bearing. Rubble is stacked up against the internal face of the southern part, which thus could not be examined. The rubble appears to have been cleared into the wheelpit from the rest of the building, probably to avoid accidents by sheep. The internal face of the northern part of the wall has a ledge, 0.33m wide, running around it. All mortar has been eroded on the external face of the wall.

Site Number SAR 31.4
Site type Wall
Period Nineteenth Century
Condition Very Poor
Dimensions 1.95m long, 0.60m wide
Description The north wall of structure SAR 31. Only the quoins shared with SAR 31.3 and the south edge of the western end are visible. The ledge of SAR 31.3 is continued along the southern edge of this wall but is only 0.15m wide. More of the wall may survive further to the east, below the rubble.

Site Number SAR 32
NGR NY 89752 92595
Site type Wheel Pit
Period Nineteenth Century
Condition Poor
Dimensions 6.8m long, c 1.80m wide, unknown depth
Description The wheelpit is filled with rubble from the collapse of wall SAR 31.3 immediately to west. The rubble is graded and a cleared area lies immediately to the east of the pit; both of these are probably a result of clearance to reduce sheep injuries. The head race is not visible but was probably entered at the northern end at c0.70m above the ledge in wall SAR 31.4. The gap in the wall immediately to the west (SAR 31.3) is covered by rust-coloured lichen as far west as 0.08m from the external face of wall SAR 31.3. It is not possible to determine whether the wheel was overshot or undershot due to disturbance to the leat at this point.

Site Number SAR 33
NGR NY 89757 92592

Site type Wall
Period Nineteenth Century
Condition Poor
Dimensions 2.82m long, 0.50m wide at north, 0.46m wide at south, c1.1m high
Description A low wall running from external building wall SAR 31.1 north towards ore hearth SAR 37. This wall divides the wheel pit and bellows/pump area of the main mill building from the hearth area. The uppermost surviving course of this wall is bonded into wall SAR 31.1. Much rubble lies to the west and east of this wall, as well as over its top. Possible socket or beam holes lie directly above this wall in SAR 31.1.

Site Number SAR 34
NGR NY 89757 92591
Site type Wall
Period Nineteenth Century
Condition Poor
Dimensions 1.62m long, 0.44m wide, 1.1m high
Description A low wall running parallel to and apparently butting wall SAR 33. It disappears below rubble.

Site Number SAR 35
NGR NY 89758 92594
Site type Wall
Period Nineteenth Century
Condition Moderate
Dimensions 0.46m long, 0.35m wide, 1.05m high
Description A wall stub with a return on the southern end. It butts on to curved blocking SAR 36 of ore hearth SAR 37 at the north. There are no signs of reddening due to burning.

Site Number SAR 36
NGR NY 89759 92594
Site type Blocking
Period Nineteenth/Twentieth Century?
Condition Moderate, poor at top
Dimensions 2.25m long, 0.45m+ deep, 1.45m high
Description The dry-stone blocking of the ore hearth. Supports for the workstone protrude c0.30m from it and these pillars are flush with the blocking. The western end curves outwards to meet stub wall SAR 35. Much collapse and rubble covers the top of this blocking. The lower parts of the blocking contain large pieces of ceramic salt-glazed pipe. A further wall, possibly the original front of the ore hearth, is visible 0.50m behind the front of the blocking by the western support for the workstone.

Site Number SAR 37
NGR NY 89761 92596
Site type Ore Hearth
Period Nineteenth Century
Condition Poor
Dimensions 2.54m long, 2.3m wide

Description The ore hearth, which is much obscured by rubble.

Site Number SAR 37.1

Site type Support for Workstone

Period Nineteenth Century

Condition Very Good

Dimensions 0.90+m long, 0.50m wide, 0.25m deep

Description A corbel-like stone support for the workstone of the ore hearth. It is mortared onto a stone pillar. The pillar is as wide as the support but is not reddened by burning. On the top face of the support is a slot running north/south (0.02m by 0.08m by 0.03m deep) and a chamfer on the inside edge (0.23m by 0.06m by 0.04m deep) towards the centre of the workstone.

Site Number SAR 37.2

Site type Support for Workstone

Period Nineteenth Century

Condition Good

Dimensions 0.90+m long, 0.50m wide, 0.25m deep

Description Part of a pair of supports with SAR 37.1. It is a corbel-like stone support for the workstone of the ore hearth. It is mortared onto a stone pillar. The pillar is reddened by burning and is wider than the corbel support (0.68m wide). On the top face of the support is a slot running north/south and a chamfer on the inside edge towards the centre of the workstone.

Site Number SAR 37.3

Site type Wall

Period Nineteenth Century

Condition Moderate

Dimensions 1.48m long, 0.46m wide, 0.80m high at north

Description A wall forming the western side of ore hearth SAR 37. It has a mortared construction, and is tied into wall SAR 40 to the north at lower courses but not at the upper courses. The area to the east is covered by rubble and there is a coating of fine, chocolate coloured dust between the stones.

Site Number SAR 37.4

Site type Wall

Period Nineteenth Century

Condition Moderate

Dimensions 0.75+m long, 0.46m wide, c1.5m high

Description A wall running across the back of the hearth. This wall is not apparently bonded to walls SAR 37.3 or SAR 40. It is of dry-stone construction, with an abundance of fine, chocolate-coloured powder between the stones. It is not reddened by burning and is covered by rubble on its eastern end.

Site Number SAR 38
NGR NY 89762 92594
Site type Wall
Period Nineteenth Century
Condition Good at bottom, Poor and unstable at top
Dimensions 0.5m long, 1.22m wide at south, c 1.70m high
Description A substantial earth and mortar-bonded wall. Butts against reddened pillar SAR 37.2. The western face of this wall is very reddened from burning and rises directly from the western edge of support SAR 37.2. After c1.30m this western face turns a corner to head east, leaving an opening at the back of the hearth for gases to go to the condenser and flue. The east side of the wall is covered with rusty-coloured lichen but is not burnt. It butts to the wall to the north, SAR 40. The southern end of this eastern face starts to curve eastwards at its southern end, probably to form a circular corbelled feature (SAR 39.1).

Site Number SAR 39
NGR NY 89764 92595
Site type Slag Hearth
Period Nineteenth Century
Condition Poor
Dimensions 3.76m long, 2.62m wide
Description A presumed slag hearth, which is much collapsed and rubble covered.

Site Number SAR 39.1
Site type Wall
Period Nineteenth Century
Condition Poor
Dimensions 1.68m long, 0.45+m wide, 1.07m high
Description A curved dry-stone wall forming the southern half of a semi-circular chamber with SAR 40. Rubble behind wall obscures the back edge of a wall, which shows no signs of reddening caused by heat.

Site Number SAR 39.2
Site type Wall
Period Nineteenth Century
Condition Poor
Dimensions 1.70m long, 0.50m wide, c 1.4m high
Description A wall forming the south-eastern side of slag hearth SAR 39. The wall is of dry-stone construction and contains chocolate-coloured dust between the stones. Two iron straps protrude from the front of the wall and extend back into wall SAR 39.3. The straps are initially rectangular in section (40mm x 15mm), then square (25mm x 25mm x 180mm long) and finally round and threaded (25mm diameter x 70mm long) where they protrude.

Site Number SAR 39.3
Site type Wall
Period Nineteenth Century
Condition Poor

Dimensions 0.71m long, 0.26m wide

Description An indistinct dry-stone wall with much chocolate-coloured dust between the stones. The iron straps associated with SAR 39.2 continue into this wall.

Site Number SAR 39.4

Site type Wall

Period Nineteenth Century

Condition Poor

Dimensions 1.05m long, 0.70m wide

Description This earth and mortar bonded wall appears to curve inwards (southwards) to form an enclosed area possibly mirroring that formed by SAR 40 and SAR 39.1. It is butted by SAR 39.5 and is covered by rubble to the north, west and east.

Site Number SAR 39.5

Site type Wall

Period Nineteenth Century

Condition Good

Dimensions 1.52m long, 0.81m wide

Description A wall forming the eastern side of slag hearth SAR 39. The wall is mortared and the dog-leg in the centre of the slag hearth is bonded-in to the rest of the wall. The top of the dog-leg section is *c*1.10m below the surviving top of the main wall. It is surrounded by rubble on all sides, and shows reddening due to burning on the south side only. The main wall is burnt on the west side only, with rusty-coloured lichen on the east side. It butts wall SAR 39.4 to the north.

Site Number SAR 40

NGR NY 89760 92597

Site type Wall

Period Nineteenth Century

Condition Poor

Dimensions 6.30m long, 0.70m wide at east, 0.60m wide at west, *c* 1.43m high

Description This substantial dry-stone wall is shared by both hearths as their back wall. At the western end is an opening, although now rubble filled, which is 0.59m wide by at least 0.40m deep. Above and to the east of this, the eastern end of another opening is visible (at least 0.30m wide and at least 0.46m high). There is no sign of burning on the western half of the wall but there is abundant rusty-coloured lichen. Near the centre of the wall is a blocked opening, the sill of which survives and whose eastern edge is unclear. It is 0.68m high and *c*1.20m wide, with a triangular-section iron tie protruding from the blocking. At the eastern end, the northern face of the wall continues in a straight line, below rubble, for at least 0.90m beyond the junction with SAR 38, while the southern face curves south to form the northern half of a semi-circular chamber. The wall does not continue to the dogleg of SAR 39.5 but stops *c*0.50m short. The southern face of this eastern end of the wall is reddened by heat.

Site Number SAR 41

NGR NY 89757 92596

Site type Wall

Period Nineteenth Century

Condition Moderate

Dimensions 1.99m long, 0.35m wide, 0.47m high

Description This mortared wall is the return of SAR 40. Rubble covers the back and the area in front (west). It is slightly curved and butts to wall SAR 42.

Site Number SAR 42

NGR NY 89757 92597

Site type Tuyere Hole

Period Nineteenth Century

Condition Good

Dimensions 2.00m+ deep, 0.42m wide, 0.25m high

Description A hole with a dry-stone constructed surround leading into a chamber (at least 2.00m deep) to the east. A lip stone (1.02m long, 0.40m wide) extends 0.60m out of the hole into the area that would have housed the bellows and waterwheel. A low wall to the north butts against the hole surround.

Site Number SAR 43

NGR NY 89747 92596

Site type Roasting Hearth

Period Nineteenth Century

Condition Poor

Dimensions 6.61m long, 5.24m wide, 1.50m high

Description This is a rectangular structure apparently tied-in to the main mill building (SAR 31). There are two person-sized doorways, one in the south wall and one in the west wall.

Site Number SAR 43.1

Site type Wall

Period Nineteenth Century

Condition Poor

Dimensions 0.59m wide at west, 0.80m high at west

Description A wall forming structure SAR 43. The south edge is covered by rubble but visible at both ends. There is an opening in the centre (1.28m wide). The western end of the wall has toppled outwards but is on the same alignment.

Site Number SAR 43.2

Site type Wall

Period Nineteenth Century

Condition Moderate at south, Poor at north

Dimensions 1.60m long, 0.61m wide, 1.46m high

Description Part of a wall with a return at the north end. It has a single through stone at the same height as the lower line of through stones on the main building south facade (SAR 31.1). A threshold or sill is visible to the north of the return, though rubble mostly covers this opening. The wall can be seen again further to the north, where the chimney butts against it. There is one part-vitrified brick and some ironwork near the chimney, and a hole in the building wall allowing access to the base of the chimney stack.

Site Number SAR 44
NGR NY 89744 92598
Site type Chimney Stack
Period Nineteenth Century
Condition Moderate
Dimensions 1.40m north-south, 1.40m west-east, 0.42m high
Description A chimney stack for roasting hearth SAR 43, immediately to the west of the hearth. There is an 80mm gap between the stack and roasting hearth. The chimney stack is square, of mortared construction, and the inside is reddened from heat.

Site Number SAR 45
NGR NY 89749 92599
Site type Iron Beams
Period Nineteenth Century
Condition Moderate
Dimensions 0.10m x 0.025m section, 0.30m+ high
Description Four iron beams protruding vertically from the ground, all apparently cut down from their original height. They are unevenly spaced and are possibly associated with the transfer of ore into the roasting hearth.

Site Number SAR 46
NGR NY 89750 92600
Site type Structure
Period Nineteenth Century
Condition Poor
Dimensions 3.86m long, 2.55m wide, 0.60m high
Description An 'L'-shaped structure cut into the hill. It consists of a dry-stone retaining wall at least 0.28m wide.

Site Number SAR 47
NGR NY 89755 92602
Site type Wall
Period Nineteenth Century
Condition Poor
Dimensions 4.47m long, 0.66m wide, 0.90m+ high
Description A substantial wall cut into the hillside to the north and running almost to the north wall of the main structure (SAR 31). It is of earth and mortar bonded construction, and contains a large flat stone at its north-west corner. Rubble lies to the west, east and south of the wall, and there is an opening below the large, flat stone mentioned above. This opening is quite large, and possibly allowed water to pass through or under the wall to the condensing chamber to the east.

Site Number SAR 48
NGR NY 89754 92603
Site type Structure
Period Nineteenth Century

Condition Poor
Dimensions 1.00m long, 0.55m wide
Description A dry-stone structure abutting SAR 47. It is collapsed at the north-west end, and there is much rubble to the west and south. To the north it appears to butt a mortared retaining wall (belonging to the south edge of head-race culvert SAR 49).

Site Number SAR 49
NGR NY 89754 92603
Site type Retaining Wall, possibly of head race culvert
Period Nineteenth Century
Condition Poor
Dimensions 1.75m long, 0.20m wide
Description The south side of the head-race culvert. The bottom of the wall has slipped down the slope here. The culvert itself is c 0.55m wide at this point and was stone-flag capped, but is now collapsed. The opening to feed the wheel may be 1.40m west of this wall, but is filled with rubble and collapsed. The culvert may have extended further to the east, possibly to wash the condensing chamber.

Site Number SAR 50
NGR NY 89763 92601
Site type Condensing Chamber
Period Nineteenth Century
Condition Moderate
Dimensions 5.53m long, 3.90m wide
Description A trapezoidally-shaped structure at the base of flue SAR 09. There are openings into it from the backs of the hearths, and also an access door. It has a pillar in its centre. It would appear to have been a condensing chamber.

Site Number SAR 50.1
Site type Wall
Period Nineteenth Century
Condition Moderate
Dimensions 6.02m long, 0.62m wide, 1.80m high
Description Substantial wall forming the south side of condensing chamber SAR 50, but it is not quite on the line of wall SAR 31.4. There are no protruding through stones. The east corner is missing and the north side is heavily covered with rust-coloured lichen, and slightly pink from burning. There is one definite and one possible opening to the condensing chamber in this wall; both have thin sandstone sills. The west end of the wall returns to join the condensing chamber wall and is bonded-in. One triangular-section iron tie is located just to the east of the westernmost opening.

Site Number SAR 50.2
Site type Wall
Period Nineteenth Century
Condition Moderate
Dimensions 0.55m long, 0.44m wide, 0.90m high

Description A stub wall in the centre of the flue chamber; it is surrounded by and slightly covered by rubble. It was previously higher. It has a mortar-bonded construction, and is not tied in to the wall above the surviving height; it is not possible to see if it is tied in below. It was a possible support for the condensing mechanism. It is shown by Clough (1962) as part of the central wall in the structure.

Site Number SAR 51

NGR NY 89767 92599

Site type Wall

Period Nineteenth Century

Condition Poor

Dimensions 0.60m long, 0.38m wide, 0.28m high

Description The surviving corner of a small room or shelter built into the corner of the condensing chamber SAR 50. There is some low rubble inside the presumed structure. There is a beam socket in the centre-top of the wall to the west.

Site Number SAR 52

NGR NY 89734 92636 - 89756 92607

Site type Trackway

Period Eighteenth/Nineteenth Century?

Condition Good

Dimensions 39.35m+ long, 3.20m wide

Description The main trackway into the smelt mill complex from Sargill Mine to the north-west. This track can be positively identified with a track shown on the 2nd edition OS map.

6. DISCUSSION

- 6.1 The site is a moderately-preserved example of a small ore hearth smelt mill. While it is one of the smaller and less dramatic of the surviving smelt mill ruins within the Yorkshire Dales National Park, it nevertheless contains several features of interest. The most obvious of these is the 'zigzag' trench running north from the flue and chimney. This would appear to be the construction trench for an extension to the flue system, which was abandoned during construction. Flue systems were typically introduced in the late eighteenth century, and their progressive enlargement until the collapse of the traditional lead-smelting industry in the 1870s is very much the national pattern (Willies 1991, 113-115).
- 6.2 The smelt mill building, as would be expected given its late date of foundation, differs from the traditional Yorkshire smelt mill in that its layout does not permit the hearths to be blown directly by bellows coupled to a waterwheel. Instead, the blowing mechanism was presumably housed in the western cell of the building, adjacent to the wheelpit, and the air conducted by blast pipes through aperture SAR 42 and along the passageway north of wall SAR 40, to be fed into the rear of the two hearths. It is likely that either a piston or a fan blower was used, but the field evidence does not permit precise identification of the blowing apparatus.
- 6.3 The size of the wheelpit (6.8m long) indicates a waterwheel of around 6.6m diameter. The headrace at the point of entry to the wheel does not adequately survive to be able to determine, with any reliability, if the wheel was an overshot or breastshot form. However, visual inspection indicates that the differential between the wheel and the race does not appear to be particularly great, and this would imply that it was the breastshot type.
- 6.4 The most important feature of the site, however, is the remains of the two hearths. Although these are severely obscured by rubble, and therefore impossible to interpret in great detail, it is clear from the height of the surviving walls that both were broadly of shaft-furnace form, rather than the traditional low, open type of ore- and slag hearths. Such furnaces were introduced in the form of the Spanish slag hearth in about 1850 (Willies 1991, 111-112). The development of the ore hearth into an enclosed shaft-furnace is less clearly documented, but the Sargill example appears very similar to that used at the Keld Heads smelt mill in the 1860s (Percy 1870, 278-282). The survival of *in situ* remains of shaft furnaces is very rare nationally, and the Sargill examples are of better quality than any identified in the national coverage of the Lead Industry for the English Heritage Monuments Protection Programme (D Cranstone, pers. comm.).
- 6.5 Ore hearths were normally fuelled with a mixture of peat and small coal, whereas the slag hearth was fuelled with coke, and was operated at much higher temperatures; consequently, the slag hearth was normally bound with iron strapping to resist the expansionary pressures of the heat. At Sargill, the remains of strapping in the ruins of the eastern hearth would suggest that this was a slag hearth. However, the chocolate-coloured dust surviving in the joints of the walls around both furnaces is thought to be the remains of peat fuel, which may indicate that the eastern furnace was dual-purpose, being used as slag hearth or ore hearth according to need.

- 6.6 By comparison with other Yorkshire smelt mill sites, Sargill is unusual in the very limited quantities of slag visible, and the virtual absence of visual and botanical indicators of lead contamination. The presence of heat-reddening on some of the walls of the hearths and roasting furnace confirms that the mill was brought into use, but there is an implication that it was operational for a very short period.

7. RECOMMENDATIONS

7.1 ARCHAEOLOGICAL SIGNIFICANCE

- 7.1.1 The Sargill smelt mill complex is not among the largest or most impressive surviving in the Yorkshire Dales. However, the survey has identified surviving remains of shaft-type ore and slag hearths which are on present knowledge the best-preserved in England, and form an important survival of nineteenth century developments in lead smelting technology.
- 7.1.2 The site is therefore considered to be of high importance for conservation, and to be of Schedulable quality.

7.2 RECOMMENDATIONS FOR FURTHER RECORDING

- 7.3 Appropriate conservation of the hearth area is of particular importance, and any disturbance to, or additional exposure of, the historic fabric should be accompanied by archaeological recording.

8. BIBLIOGRAPHY

8.1 CARTOGRAPHIC SOURCES

Ordnance Survey, 1857, 1st edition 6" to 1 mile map, 51

Ordnance Survey, 1914, 3rd edition 6" to 1 mile map, NY 51 SW

8.2 SECONDARY SOURCES

Clough, R T, 1962 *The Lead Smelting Mills of the Yorkshire Dales and Northern Pennines*, 1st edn, Keighley

Clough, R T, 1980 *The Lead Smelting Mills of the Yorkshire Dales and Northern Pennines*, 2nd edn, Keighley

Dunham, K C and Wilson, A A, 1985 *Geology of the Northern Pennine Orefield, 2, Stainmore to Craven*, London

Percy, J, 1870 *Metallurgy: 3, Lead*, London

Raistrick, A, 1975 *The Lead Industry of Wensleydale and Swaledale, 2, The Smelting Mills*, Hartington

Willies, L, 1991 Lead: Ore Preparation and Smelting, in j Day and RF Tylecote (eds), *The Industrial Revolution in Metals*, London, 84-130

APPENDIX 1
PROJECT BRIEF

APPENDIX 2

PROJECT DESIGN

1. INTRODUCTION

- 1.1 Sargill smelt mill (SD 8976 9260) lies at around 440 mOD, on the north side of Sargill Beck, a northern tributary of the River Ure in upper Wensleydale. It is believed to have been built in the earlier nineteenth century, and worked until around 1870.
- 1.2 A site visit has not been possible due to severe weather conditions. However, air photographs and ground-level colour slides in the Yorkshire Dales National Park office have been consulted, and inform this tender.
- 1.3 These photographs confirm that the smelt mill survives as a ruined building, of plain rubble masonry; some evidence of internal divisions and features is exposed, but these are severely obscured by rubble. A short length of ruined masonry leads from the mill to the stub of a chimney, beyond which lies a zigzag earthwork, possibly the construction trench for an intended extension of the flue. A short length of headrace leat also lies within the survey area.
- 1.4 This Project Design is a response to a Brief for a measured survey and building record in advance of archaeological conservation, issued by Yorkshire Dales National Park, and is designed to accord with all provisions of the Brief.
- 1.5 The Lancaster University Archaeological Unit (LUAU) has considerable experience of the assessment, evaluation, and excavation of sites of all periods, having undertaken a great number of small and large projects during the past 15 years. Projects have taken place within the planning process, to fulfil the requirements of clients and planning authorities, to very rigorous timetables. The team has considerable expertise in both topographic survey and building recording on industrial sites, including detailed recording of Langcliffe limeworks (North Yorkshire) and Nenthead lead mines (Cumbria).
- 1.6 LUAU has the professional expertise and resource to undertake the project detailed below to a high level of quality and efficiency. LUAU and all its members of staff operate subject to the Institute of Field Archaeology (IFA) Code of Conduct.

2. METHODS STATEMENT

- 2.1 The following programme has been designed, in accordance with the brief supplied, to provide a measured topographic and building survey, written account, and other documentation, of the designated area. The required stages to achieve this end are as follows:-

2.2 TOPOGRAPHIC SURVEY

- 2.2.1 A new detailed earthwork survey will be prepared, accurate at 1:500 scale. The survey area, as specified in the Brief, measures *c* 150 x 50m, and includes the ruins of the smelt mill, flue and chimney, and the earthwork continuation of the flue.
- 2.2.2 Survey control will be established by a closed traverse, established by use of Total Station Electronic Distance Measurer (EDM) to an accuracy of +/- 25mm. The survey will be tied in to the OS national grid by use of a Global Positioning System (GPS), accurate to +/- 1m. Permanent survey control markers will be left on site, and station descriptions will be generated to facilitate further survey work in future. The survey of each area will be undertaken by EDM tacheometry using a total station EDM linked to a data logger. Digital data will be transferred to a portable computer for manipulation and transfer to other digital or hard media. Film plots will be output via a plotter and archaeological detail added in the field as a dimensioned drawing on the plots with respect to survey markers. Topographic detail will be included in the survey if it is archaeologically significant or is in the vicinity of archaeological features. The final survey mapping will be generated entirely within a CAD environment and will be output at 1:500 scale. A gazetteer of all site components will be prepared by using the LUAU Field Survey Form, with any modifications agreed with the client to provide information in the most useful format for management purposes.

- 2.2.3 The survey will include mapping of coarse vegetation differences, with particular attention to lead-tolerant flora, and recording of the nature and size range of any process residues (dressing waste and/or slag) exposed within the survey area.

2.3 BUILDING SURVEY

- 2.3.1 A ground level plan of the buildings will be prepared at 1:100 scale, and elevations of all walls retaining any meaningful detail will be prepared at 1:50 scale. These drawings will be prepared to a context-outline level of detail, showing all significant architectural, structural, and technological features of the building. This will include colour-coding of any differences in the nature of the building stone, and any evidence of alterations and phasing.
- 2.3.2 The ground-level plan will be prepared by the methodology described in paragraph 2.1.2 above. Where field conditions permit, elevations of the walls will be prepared by use of EDM tacheometry using a reflectorless EDM linked to a data logger. Digital data will be transferred to a portable computer for manipulation and transfer to other digital or hard media. Film plots will be output via a plotter and archaeological detail added in the field as a dimensioned drawing on the plots. The final elevations will be generated entirely within a CAD environment and will be output at 1:50 scale. We anticipate that some internal elevations will not be readily accessible to reflectorless EDM tacheometry due to poor sight lines; in these cases, elevation drawings will be prepared manually and digitised in order to provide a consistent CAD-based record.
- 2.3.3 The intended team leader has expertise in rectified photography, and may use this technique instead of reflectorless EDM tacheometry for any walls where in his judgement it forms a more cost-effective method of recording. Our judgement at this stage, however, is that rectified photography will not be cost-effective in this instance.
- 2.3.4 A gazetteer of all structural components will be prepared by using the standard LUAU Building Context Record and Room Description Forms appended to this document, modified if requested by YDNP to include additional information on the condition and threats.

2.4 DOCUMENTARY RESEARCH

- 2.4.1 Aerial photographs and OS map editions held by Yorkshire Dales National Park will be consulted, and used to inform the fieldwork and report.
- 2.3.2 A basic documentary survey will be undertaken. This will involve consultation of published works, and of any other cartographic and/or written information held in North Yorkshire Record Office.

3 HEALTH AND SAFETY AND INSURANCE

- 3.1 LUAU provides a Health and Safety Statement for all projects and maintains a Unit safety policy. All site procedures are in accordance with the guidance set out in the Health and Safety Manual compiled by the Standing Conference of Archaeological Unit Managers (1991). A written risk assessment will be undertaken in advance of project commencement and copies will be made available on request to all interested parties.
- 3.2 LUAU holds Public Liability Cover for £15 million, and Professional Indemnity insurance to a limit of £2 million in any one claim (£1 million for pollution claims).
- 3.3 All other terms and conditions will be in accordance with North Yorkshire County Council Standard Conditions of Contract, unless otherwise agreed by both parties. We request that in this instance payment be made in three equal instalments: one on commissioning, one on completion of fieldwork, and one on submission of the completed report.

4. ARCHIVE AND REPORT

4.1 ARCHIVE

- 4.1.1 The results of the survey will form the basis of a full archive to professional standards, in accordance with current English Heritage guidelines (*Management of Archaeological Projects*, 2nd edition,

1991). The project archive represents the collation and indexing of all the data and material gathered during the course of the project. The deposition of a properly quantified, ordered, and indexed project archive in an appropriate repository is considered an essential and integral element of all archaeological projects by the Institute of Field Archaeologists in that organisation's Code of Conduct. The archive will be deposited in a suitable repository agreed with the client.

- 4.1.2 The textual archive will be provided both as a printed document and on computer disks as ASCII files. Copies of Record Office documents will be provided as photocopies.

4.2 Report

- 4.2.1 Three bound and one unbound copies of the written synthetic report will be submitted to the client. The report will be produced in a format similar to this Project Design, subject to any comments from the client. It will include:

- details of any agreed variations on the project design
- a method statement
- an analysis of the data generated by 2.1.1-2.3.2 above, to provide an account of the form and development of the site as a whole, and of its individual components.
- copies of all useful map evidence (subject to any copyright restrictions)
- bibliography of all sources used
- list of other sources identified during the study but not studied in detail

4.3 CONFIDENTIALITY

- 4.3.1 The report is designed as a document for the specific use of the client, for the particular purpose as defined in this project design, and should be treated as such; it is not suitable for publication as an academic report, or otherwise without amendment or revision. Any requirement to revise or reorder the material for submission or presentation to third parties or for any other explicit purpose can be fulfilled, but will require separate discussion and funding.

5. PROJECT MONITORING

- 5.1 Any proposed changes to this project design will be agreed with the client. LUAU will arrange a preliminary meeting if required, and will inform the National Park Archaeologist of the commencement of the project.

6 WORK TIMETABLE

- 6.1 Work will be commenced in March 1997, and the report will be completed by 30th June 1997. Fieldwork is estimated to take four to five days in total, divided between two visits (due to the need to plot surveys before checking and field enhancing).

7 STAFFING

- 7.1 The project will be under the direct line management of **David Cranstone MA MIFA Cert. Local History (Newcastle)** (LUAU Project Manager), to whom all correspondence should be addressed. David Cranstone has extensive experience of landscape survey and building recording, including detailed building recording projects at Old Gang and Grinton smelt mills, and survey and building recording of Gunnerside Gill mining landscape (Phase 1).
- 7.2 Subject to availability, the field team will be led by **Jonathan Godfrey BA** (LUAU Supervisor). Jonathan has extensive experience of survey and building recording, including the use of EDM plus CAD processing, reflectorless EDM, and rectified photography. He is currently conducting the LUAU survey and building record of the Nenthead Lead Mines. Should Mr Godfrey be unavailable at the requisite time, he will be substituted by another LUAU supervisor with suitable experience of manual and CAD-based survey and building recording.

APPENDIX 3 ARCHIVE INDEX

1. FINAL REPORT, AS SUBMITTED (UNBOUND)

2. ADMIN AND CORRESPONDENCE

- 2.1 Project Brief
Covering letter, 6 page Brief, Conditions of Quotation, 7 pages additional information
- 2.2 Project Design
Covering letter, 5 pages
- 2.3 Correspondence
36 pages

3. DOCUMENTARY DATA

Extracts of OS 1st and 3rd edition maps, 3 letters

4. FIELDWORK DATA

- 4.1 Survey data
Printout of Sargill Stations - Microsurveyor; MIDAS printout
- 4.2 Gazetteer field sheets
30 *pro-forma* sheets, 4 pieces of permatrace

5. DRAWINGS

- 5.1 Field drawings (oversize, stored separately)
5 pieces of permatrace
- 5.2 CAD layer lists
2 *pro-forma* sheets
- 5.3 CAD plots
27 pages

6. PHOTOGRAPHS

- 6.1 Photographic record forms
4 *pro-forma* sheets
- 6.2 Black and white negatives and contact prints
4 films
- 6.3 Colour negatives and prints
2 films, prints 9" x 6"
- 6.4 Colour slides
5 films

7. ELECTRONIC MEDIA (4 DISKS)

Disk 1: GPS data

Disk 2: Report: cover, inside cover, and text, (Word for Windows format)

Disk 3: FastCAD files: plans and elevations

Disk 4: FastCAD for Windows files: illustrations for the report.

1 SMALL BOX OF INDUSTRIAL RESIDUES

ILLUSTRATIONS

- Figure 1 Sargill Location Plan
- Figure 2 OS 6" Map 3rd Edition 1914 (enlarged)
- Figure 3 Smelt Mill Plan surveyed 1948 (after Clough 1962)
- Figure 4 Survey Plan
- Figure 5 Smelt Mill Building Plan
- Figure 6 Elevation Location Drawing
- Figure 7 Elevations 1, 2, 3 and 4
- Figure 8 Elevation 5
- Figure 9 Elevations 6, 7 and 8
- Figure 10 Elevations 9, 10 and 11
- Figure 11 Elevations 12, 13 and 14
- Figure 12 Elevations 15, 16, 17 and 18
- Figure 13 Elevations 19, 20, 21, 22 and 23

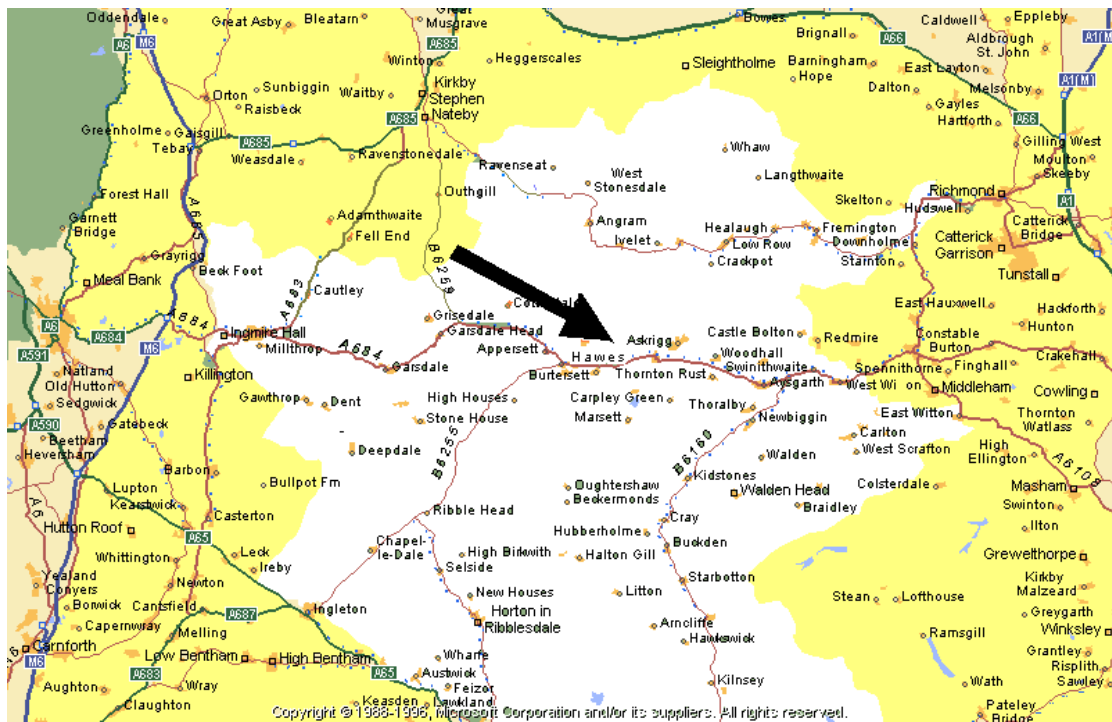


Fig 1 Sargill Location Plan

PLATES

- Plate 1 Sargill Smelt Mill and Flue from the South-East
- Plate 2 Sargill Smelt Mill from the North East
- Plate 3 Sargill Smelt Mill from the South (Elevation 5)
- Plate 2 Elevation 14 from the North

Fig 2 OS 6" Map 3rd Edition 1914 (enlarged)

Fig 3 Smelt Mill Plan surveyed 1948 (after Clough 1962)

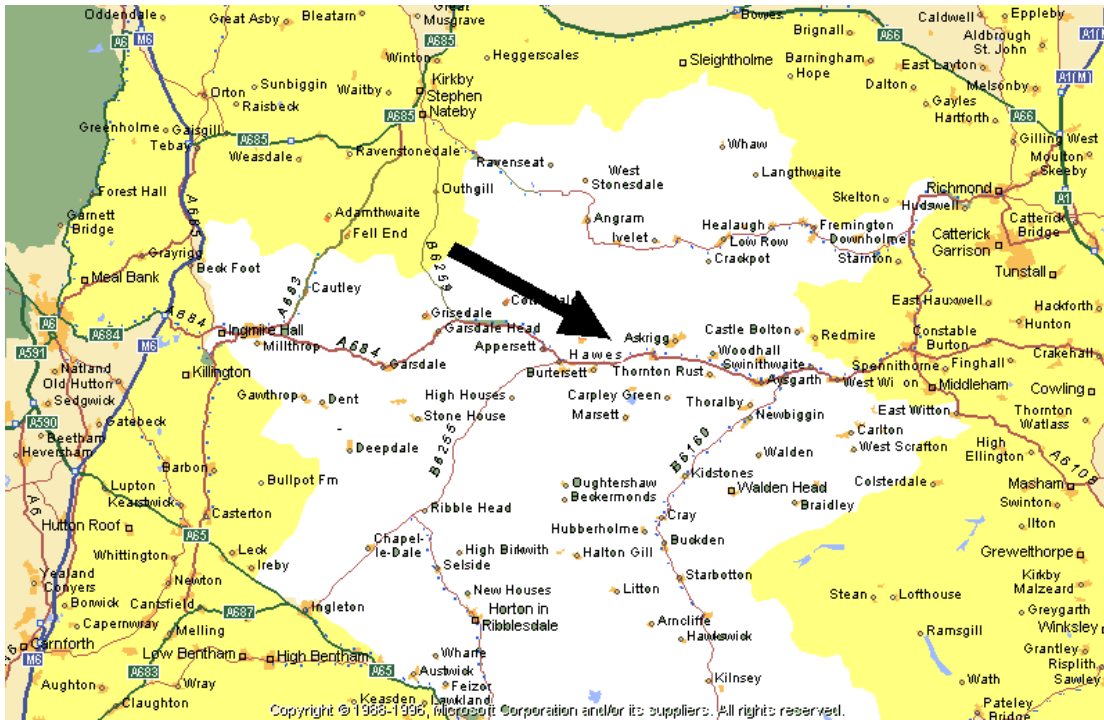


Fig 1 Sargill Site Location Plan

Fig 2 OS 6" Map 3rd Edition 1914 (enlarged)



Fig 3 Smelt Mill Plan surveyed 1948 (after Clough 1962)