NAA

COMMUNITY ARCHAEOLOGY LANDSCAPE AND BUILDING SURVEY

TILBERTHWAITE COPPER MILL, CONISTON, CUMBRIA

on behalf of

LDNPA

NAA 18/21
May 2018

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Archaeological
Associates

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TILBERTHWAITE COPPER MINE, CONISTON, CUMBRIA
COMMUNITY ARCHAEOLOGICAL LANDSCAPE
AND BUILDING SURVEY

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TILBERTHWAITE COPPER MINE, CONISTON, CUMBRIA
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Summary

Northern Archaeological Associates (NAA) and John Pickin Archaeology (JPA) were commissioned by the Lake District National Park Authority (LDNPA) to work with local volunteers from within the National Park in undertaking an archaeological landscape and building survey of the Tilberthwaite mine, a multi-period copper mine near Coniston, Cumbria. The work was commissioned as part of the Heritage Lottery Fund-sponsored Coniston Copper project, a two-year scheme aiming to engage local people in the history and conservation of the area's nationally important mining heritage.

Tilberthwaite copper mine is a prime example of a medium sized multi-period metal mine. Mining began in the late 16th century when the Company of Mines Royal brought in skilled German miners to prospect for copper at Tilberthwaite and Coniston. Tilberthwaite was abandoned after a few years due to the poor quality of the ore and problems with flooding. The mine reopened in the 1690s and for the next 130 years was worked by a number of companies with varying degrees of success. By the early 19th century, the mine had reached a depth of over 100 feet (30m) using a water-powered pumping engine and had its own dressing floor and stamp mill.

In 1823, the mines at Coniston and Tilberthwaite were acquired by the entrepreneur and mining engineer John Taylor. At Tilberthwaite, Taylor, together with his manager John Barratt, began driving a drainage level, Waterfall Level, which reached the man workings in the early 1840s. Around the same time, work started on the much deeper Horse Crag Level that, when completed in the mid-1860s, would drain Tilberthwaite North Lode to depth of 525 feet (160m). All the ore from the mine was then transported out along Horse Crag Level to a new processing plant at Penny Rigg. It is likely that most of the surface operations at Tilberthwaite, especially stamping and dressing, stopped around this time. The mine was sold in 1875 and by the 1890s, if not before, the mill had stopped work. In the 1920s, Horse Crag Level and the ladder shaft at Tilberthwaite were reopened but no mining took place. The operation came to an end in 1930.

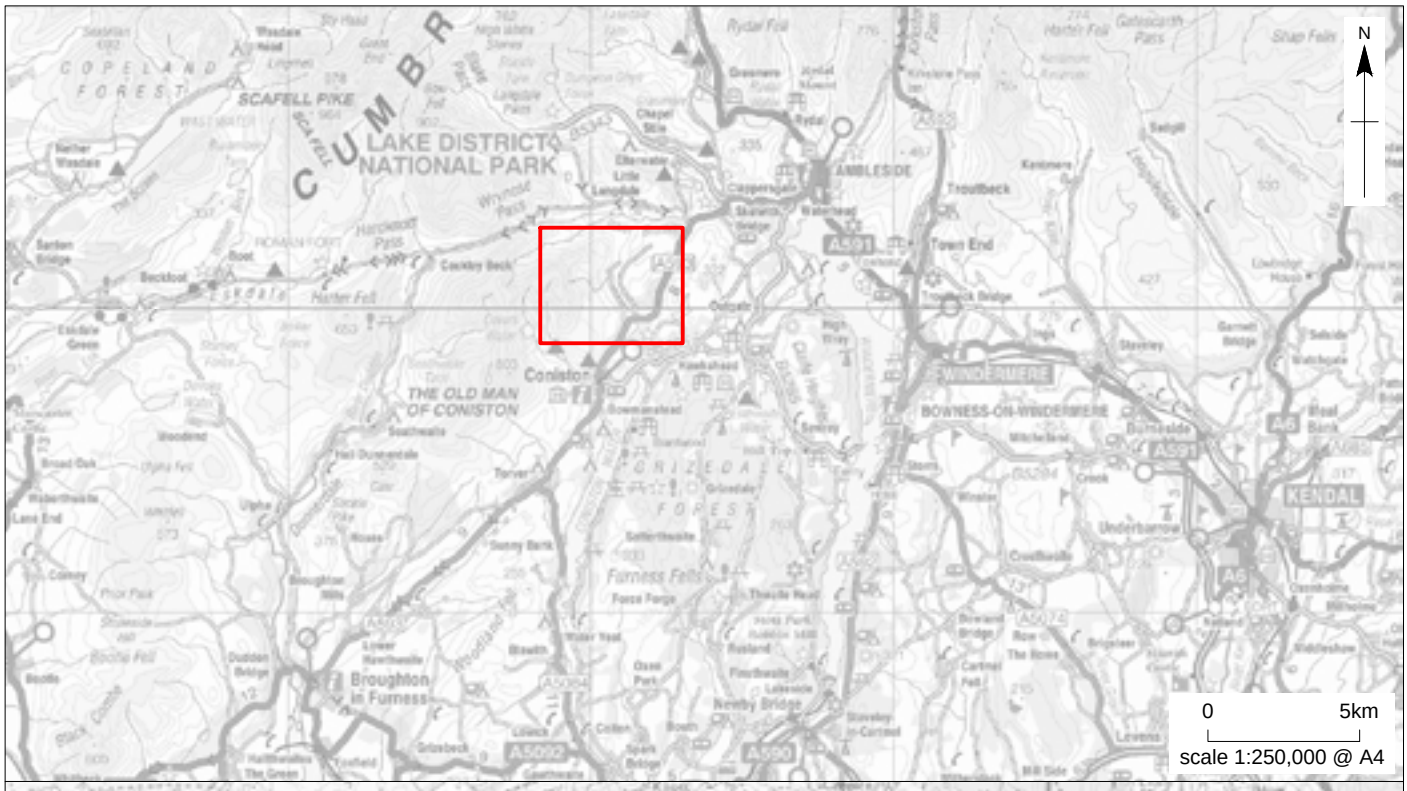
Today, Tilberthwaite mine comprises two long, discontinuous opencast workings that cross the fellside above Muckle Beck. Associated with the opencast are spoil tips, dressing floors, the

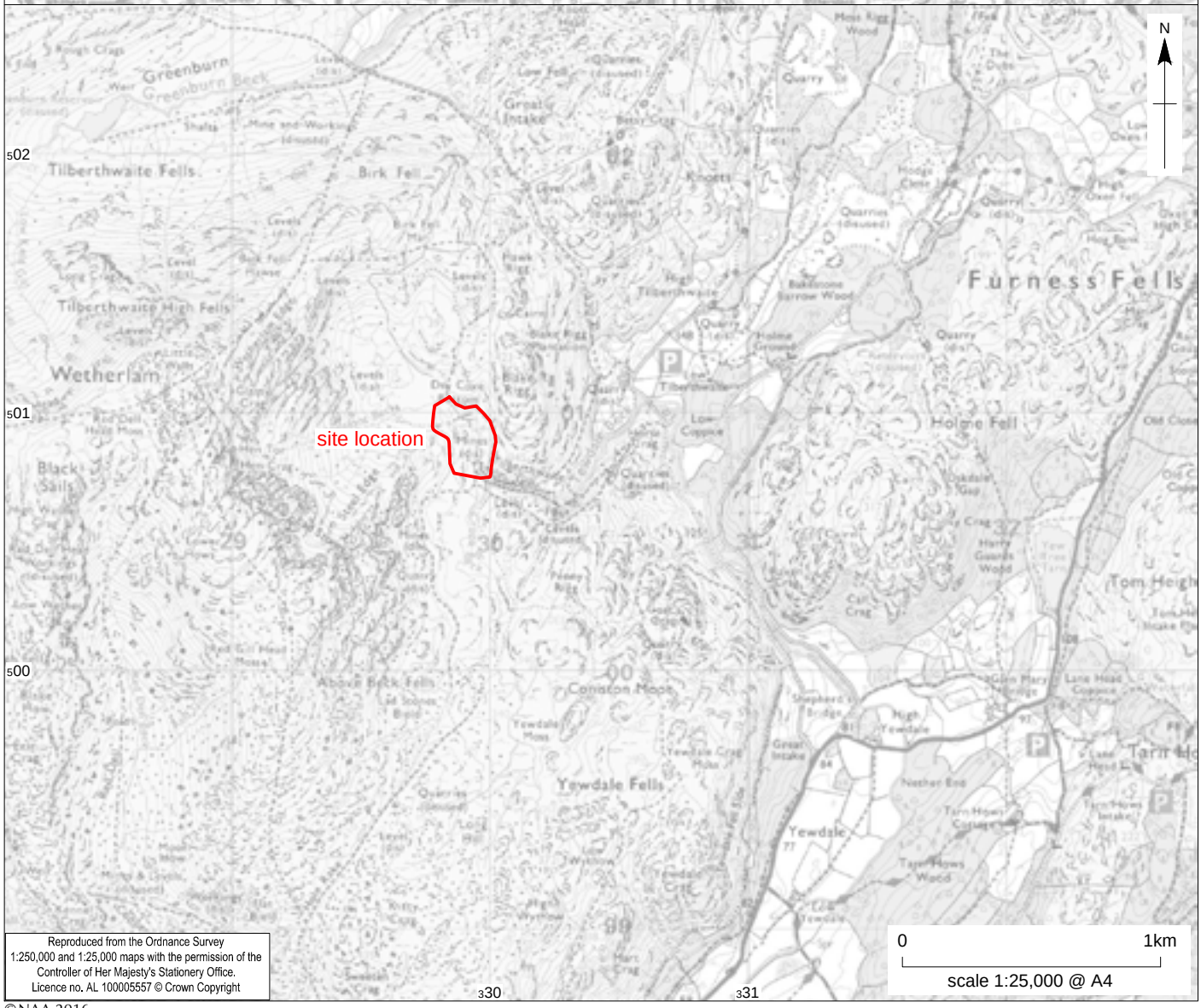
ruins of small sheds where the ore was dressed by hand and the more complex remains of a smithy and a water-powered stamp mill. There are also a series of deep shafts, prospection trenches, a dam, a leat, an embanked channel used to divert the beck away from the mine workings, and various trackways.

The aim of the community survey was twofold: firstly, to engage local volunteers in the history and conservation of the site through providing practical, hands-on training; and secondly, to prepare a detailed analytical survey (Historic England Level 2/3) of the surface earthworks and structures. The result is a comprehensive record of the mine complex as it currently stands that will provide a baseline for the future management and monitoring. The site is not currently designated but based on the results of the survey it is recommended that serious consideration should be given to scheduling the surface remains of the mine (as well as the associated Penny Rigg mill) in order to protect the complex from potential future risks, including changes to land and stock management regimes, fencing, tree planting and fossicking. Recommendations are also made to improve interpretation and intellectual access to the site.

Acknowledgements

NAA would like to thank all the volunteers for their enthusiasm, knowledge and dedication throughout the three-week survey project. Particular thanks go to Jeremy Rowan Robinson for sharing his research into the history of the mine and allowing some of it to be reproduced in this report. NAA is also indebted to Warren Allison, Ian Matheson, Mark Simpson and Mike Mitchell and their colleagues at CATMHS for sharing information and knowledge, and to the staff of the Cumbria Record Offices and Armitt Museum and Library for their patience and help. Thanks are due to the Barrow Mountaineering and Ski Club for use of their facilities. Finally, we owe a debt of gratitude to Eleanor Kingston and her colleagues at the LDPNA for commissioning the work and for their continued assistance and support throughout the project.





Tilberthwaite copper mill, Cumbria: site location *Figure 1*

1.0 INTRODUCTION

1.1 Northern Archaeological Associates (NAA) and John Pickin Archaeology (JPA), working together with local volunteers from the Lake District National Park, were commissioned to undertake an archaeological landscape and building survey of the remains of Tilberthwaite mine (NGR NY 30656, 00695), a multi-period copper mine near Coniston (Fig. 1). The work was completed as part of the Heritage Lottery Fund-sponsored *Coniston Copper* project, a two-year project administered by the Lake District National Park Authority (LDNPA), which aims to engage the local community in the history and conservation of the area's nationally important mining heritage.

Plate 1: view of the northern section of the site, showing the workings and buildings on North Lode. Left of centre is building 200.

Brief Description

1.2 Tilberthwaite copper mine is a prime example of a medium sized, multi-period metal mine. Mining began in the late 16th century when the Company of Mines Royal brought in skilled German miners from their works at Keswick to prospect for copper at Tilberthwaite and Coniston. Tilberthwaite was abandoned after a few years due to the poor quality of the ore and problems with flooding. The mine reopened in the 1690s and for the next 130 years was worked by a number of companies with varying degrees of success. Some of these companies were small-scale local concerns but the

mine also attracted the attention of larger organisations, such as the Macclesfield Copper Company, and investment capitalists like the Derbyshire miner Anthony Tissington. By the early 19th century, the mine was working a series of parallel mineral veins, the North Lode and Benson's Lode, to a depth of over 100 feet (30m) and had a water-powered pumping engine, as well as its own dressing floor and stamp mill.

1.3 In 1823, the mines at Coniston and Tilberthwaite were acquired by the entrepreneur and mining engineer John Taylor. Taylor, together with his manager John Barratt, changed the way that both operations were organised. At Tilberthwaite, a new drainage level—Deep or Waterfall Level—was driven from the head of Tilberthwaite Gill to unwater the main workings on the North Lode. This was successful but only drained the mine to a depth of around 145 feet (44m). In the early 1840s, work started on the much deeper Horse Crag Level that, when completed in the mid-1860s, would drain the mine to a depth of 525 feet (160m). All the ore from the mine was now transported out along Horse Crag Level to a new processing mill at Penny Rigg in the valley bottom; it is likely that most of the surface operations at Tilberthwaite, especially stamping and dressing, stopped around this time. The mine was sold in 1875 and by the 1890s, if not before, the mill had also stopped work. In the 1920s, Horse Crag Level and the ladder shaft at Tilberthwaite were reopened but no mining took place and the operation came to an end in 1930.

1.4 Today, the 5.1ha site comprises two long, discontinuous opencast workings that cross the fellside above Muckle Beck. Associated with the opencast are spoil tips, dressing floors, the ruins of small sheds where the ore was dressed by hand and the more complex remains of a smithy and a water-powered stamp mill. There are also a series of deep shafts, prospection trenches, a dam, a leat, an embanked channel used to divert the beck away from the mine workings and various trackways.

1.5 This document details the results of both the landscape and buildings survey and is intended to facilitate a better understanding of the nature, form, extent, and significance of the surface remains, and to inform future conservation and management programmes. It focuses on the surviving archaeological evidence of the mine and includes: a brief assessment of the history of the mine; a description of the mining and ore dressing processes; an account of the surviving evidence; an assessment of significance; and recommendations for any future work. Finally, it presents an illustrated site inventory of all recorded archaeological features and the

contribution of each to the overall significance of the site (Appendix 1).

Project Aims

1.6 The aim of the project was twofold: a) to provide practical, hands-on skills training in topographic and building survey techniques to local volunteers, and b) to prepare a detailed analytical survey of the surface earthworks and structures associated with the mine.

1.7 In achieving this aim, the following objectives, as specified in the original project brief (LDNPA 2017), were identified and met:

- a desk-based review of readily available archive and documentary material;
- a high-level survey using a quadcopter or pole cam;
- GPS topographical survey of the wider area (Historic England 2017 Level 2);
- a detailed survey of the extant building remains associated with the mine (Historic England 2016 Level 2 to 3);
- a plane table survey of the mine and associated features (Historic England 2017 Level 3);
- a site inventory of all associated features for inclusion on the LDNPA Historic Environment Record (HER);
- a digital photographic record of the site; and
- a narrative report detailing the sequence and development of the processing site.

1.8 Local volunteers were involved in all elements of the survey. Training was focused on ensuring a good grounding in traditional survey skills—the use of a plane table, planning frame, tape and offset—which were easily transferable to the recording of other mining and industrial sites in the area. A range of more modern recording techniques were also demonstrated, including the use of aerial drones, reflectorless total station theodolites (RTST), and rectified photography. This ensured a broad understanding of the various types of survey methodology that are available to record a complex industrial site like Tilberthwaite mine. The limitations of each method were discussed and illustrated on site.

Project Scope and Limitations

1.9 The project comprised an approximate 5.1ha survey area focused on the remains of the Tilberthwaite mine; a multi-period copper mine that was worked on a number of occasions between the late 16th century and the mid-19th century (NGR NY 29222

00967) (Fig. 2). A 1:200 topographic survey (Level 3; Historic England 2017) was produced of the surface remains associated with the North, Shaft and Benson's lodes using a plane table. A broader survey (Level 2; Historic England 2017) of the area outside the mine core was conducted using GPS. Detailed survey of the areas around some the mine workings—especially the fenced area on the North Lode—was limited by health and safety concerns. Remote survey techniques were used in these areas to ensure comprehensive coverage.

1.10 The building survey was conducted using a combination of offset planning and rectified photography (Level 3; Historic England 2016). The survey included the smithy and the stamp mill.

1.11 Survey was carried out over a three-week period in May and June 2017 by a team of local volunteers, supervised at all times by NAA staff and the mining specialist John Pickin (JPA). Conditions were generally good. The primary limiting factor was bracken cover, which caused some visibility issues in the north-east and central parts of the site.

Plate 2: the survey was subject to the caprice of the Lakeland weather, although generally conditions were good.

N

fig. 11a

fig. 11b

key

structure

wall face

estate boundary wall

industry waste

SSSI

track

river

rock face

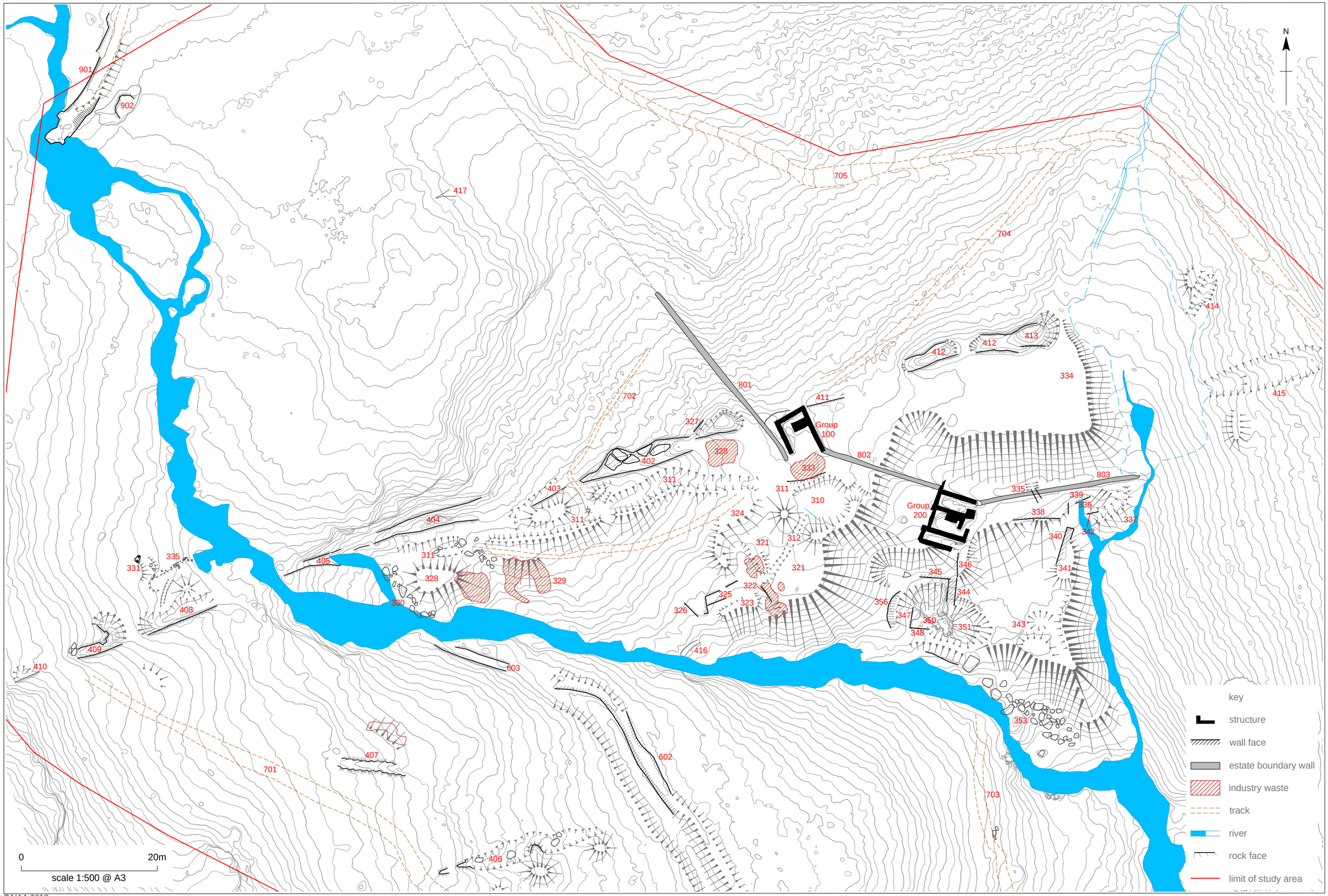
limit of study area

0 50m

scale 1:1000 @ A3

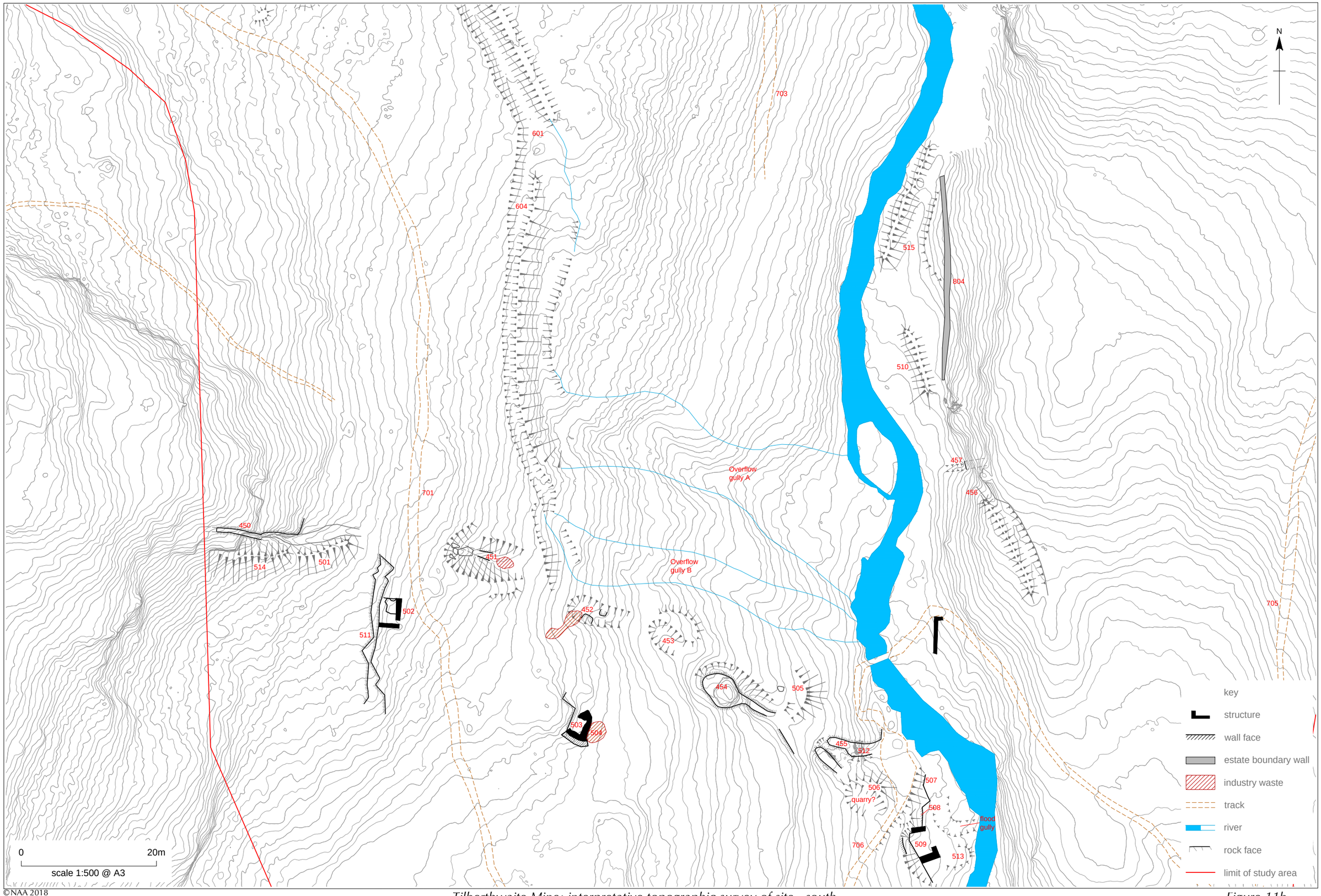
Tilberthwaite Mine: overview plan

Figure 2



Tilberthwaite Mine: interpretative topographic survey of site - north

Figure 11a



Tilberthwaite Mine: interpretative topographic survey of site - south

Figure 11b

2.0 METHODOLOGY

2.1 All methodologies were in accordance with the following published standards and guidelines:

- Understanding the Archaeology of Landscapes: A Guide to Good Recording Practice (Historic England 2017);
- Metric Survey Specifications for Cultural Heritage (Andrews *et al.* 2015);
- Understanding Historic Buildings: A Guide to Good Practice (Historic England 2016); and
- Standard and Guidance for the Archaeological Investigation and Recording of Standing Buildings or Structures (Chartered Institute for Archaeologists 2014).

Documentary Survey

2.2 A considerable amount of research has been undertaken into the history of the mines in the local area, and much of this has been undertaken by members of the Cumbria Amenity Trust Mining History Society (CATMHS). The existing research has been drawn on throughout this report and is referenced as appropriate; in particular, the work Eric Holland, whose publications include a great deal of information on Tilberthwaite mine (Holland 1981; 1986). Various individuals were consulted directly, including Warren Allison, Mark Simpson, Michael Mitchell and Ian Matheson, as well as both primary and secondary source material from the CATMHS archive held at the Armitt Library, Ambleside.

2.3 Documentary research into the history of Tilberthwaite mine is complicated by a number of factors. Not least, for much of the 19th century both Coniston and Tilberthwaite were operated under the auspices of a single company—the Coniston and Tilberthwaite Mining Company—and the records of the two mines are frequently interlinked, making it difficult to isolate specific references. Tilberthwaite mine also fell under two separate mining royalties[1]; the records for Muncaster (Tilberthwaite) being held at Whitehaven record office, and records for Fleming (Coniston) at Kendal. Pertinent records may also be held at the Barrow and Carlisle archives, but it was not possible to visit all four repositories within the constraints of the current project.

[1] Royalties are the rights to extract mineral deposits from below ground. They are distinct from land leases, which only deal with surface tenancies, although often the two equate.

Figure 3: annotated First Edition six-inch Ordnance Survey map (1850), showing the division between the Muncaster royalty (Tilberthwaite royalty) north of the Tilberthwaite Gill and the Fleming royalty (Coniston) to the south (WRO DPEN 60/5).

2.4 The following archives were reviewed as part of the project:

- Lake District Historic Environment Record (LDHER)
- National Trust Sites and Monuments Record (NTSMR)
- Whitehaven Record Office (WRO)
- Cumbrian Record Office, Kendal (CROK)
- Cumbrian Record Office, Barrow (CROB) – online only
- Cumbrian Record Office, Carlisle (CROC) – online only
- Armitt Museum and Library (AML) – CATMHS archive
- British Newspaper Archive (BRN)

2.5 As part of the wider work of the Coniston Copper Project, a number of volunteers undertook documentary research on the history of the mines. One of the volunteers, Jeremy Rowan Robinson, made a detailed study of Tilberthwaite mine and an abridged version of the results of some of his research is included here as part of Section 4 (History and Development of the Mine).

Archaeological Survey

2.6 The archaeological survey comprised topographic earthwork survey and building

recording. Each feature, building, complex or discrete area of space was allocated a unique identification number (context number). Some of these were incremented in set blocks—e.g. building (**100**): the smithy; and building **200**: the probable stamp mill—and any features associated with such elements ascribed a context number in that sequence—e.g. the smithy's east wall (**130**). A full list of context numbers is included in the site inventory at the end of this document (Appendix 1).

Plate 3: plane table survey underway at Tilberthwaite mine.

2.7 A series of control stations was established around the site to ensure that a tight level of dimensional accuracy was maintained throughout, in accordance with Historic England (2015) guidelines. A local reference system was used initially, later tied into the Ordnance Survey (OS) National Grid using an RTK GPS. All heights accord with the OS Newlyn datum.

Interpretative topographic earthwork survey

2.8 A detailed topographic survey (Level 3; Historic England 2017) was produced at 1:200 scale, providing a record of all features associated with the mine complex, including: built structures, water management features, dressing floors, tracks and pathways. The survey was conducted using a plane table, an alidade and tapes (Plate 2). The top and bottom (or other pertinent break of slope) of each feature was recorded and hachured by hand on site.

2.9 Elements forming part of the wider context of the mine, including spoil tips, levels, tracks and the southern section of the stream overflow channel, were surveyed using a sub-centimetre accurate base and rover Topcon differential RTK GPS. This was also used to record the natural topography of the site, to set the mine within its landscape context.

2.10 The survey was further enhanced by the use of a high-level aerial drone (quadcopter). A camera attached to the drone took a series of high-resolution images, which were orthorectified using GPS referenced control points. A Digital Terrain Model (DTM) was subsequently produced and used to inform both the earthwork and buildings survey.

Building Survey

2.11 A detailed record was made of all the two standing buildings on the site, the copper house/smithy (**100**) and the stamping mill/smithy (**200**). These were recorded using a combination of plane table, offset, drawing frame, RTST survey, and rectified photography. With the exception of very ephemeral modern features, all structures were recorded as existing. Structural features of historic significance, such as blocked openings, and fixtures and fittings, were recorded and annotated as appropriate.

2.12 A photographic record of the site was made using a Canon EOS 5D MkII full frame sensor 21-megapixel camera with 28–200mm 3.5–5.6 zoom lens. All detailed photographs featured a graduated photographic scale of appropriate dimensions. A full catalogue of photographs is included in the site archive.

3.0 BACKGROUND INFORMATION

Location of the study area

3.1 Tilberthwaite mine is located c.2km north of Coniston village (Fig. 1). The principal workings are on the west side of Muckle Beck and lie between the head of Tilberthwaite Gill and the natural amphitheatre of Dry Cove Bottom. The site is accessed by a footpath—the original mine track—that runs along the north side of Tilberthwaite Gill from the Penny Rigg quarry car park. Another footpath leads south-west from the mine to Hole Rake and Coppermines Valley.

3.2 The roughly triangular 5.1ha site was bounded on the east and north side by the footpath between Tilberthwaite Gill and Dry Cove Bottom. To the west it was defined by the lower slopes of Steel Edge and the south side followed an arbitrary line from

the base of Steel Edge to the head of Tilberthwaite Gill (Fig. 2).

3.3 The mine comprises three mineral veins—North Lode, Shaft Lode and Benson's Vein—which outcrop on the fellside north and west of Muckle Beck. The most northerly vein is North Lode, which has a height of c.333.5mOD at the point where it crosses Muckle Beck. Benson's Vein lies to the south and runs steeply up slope; its highest point is c.337.5mOD, dropping to c.299mOD adjacent to Muckle Beck.

Ownership

3.4 The area north and east of Muckle Beck is owned by the National Trust. The area west and south of the Beck is owned by the le Fleming family and forms part of the Rydal Estate, which is administered by Carter Jonas LLP of Kendal.

Designations

3.5 The mine and its associated remains are not protected by any statutory heritage designations. The site was reviewed by English Heritage in 1995 as part of Stage Three Monument Protection Programme assessment of the copper industry (English Heritage 1995, 7a). Described as a *'small undisturbed, largely 19th-century, mining and ore dressing site with evidence of 17th-century working and dressing'* (NRHE: 1461641), the site was assessed as being of national importance, meriting statutory protection.

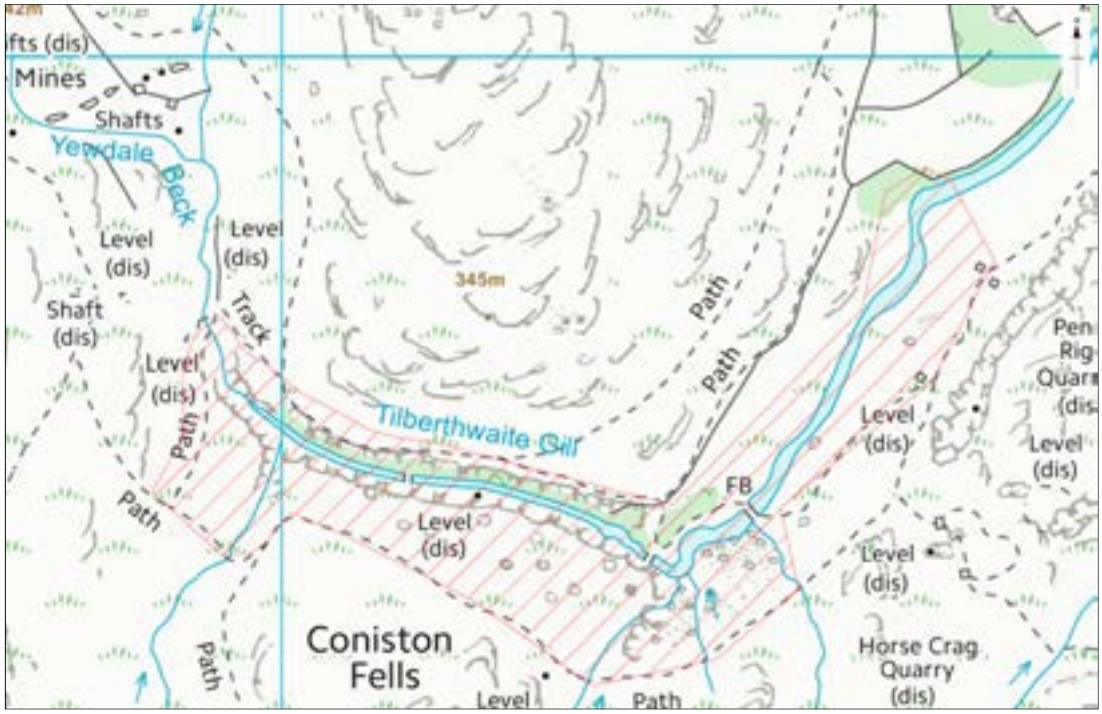


Figure 4: location of Tilberthwaite Gill SSSI

3.6 The complex is listed as a non-designated heritage asset on the National Trust Sites and Monument Record (NTSMR) (No. 20111) and is considered of significance in terms of the history and development of the region's copper mining industry. Non-designated heritage assets are afforded some protection in planning policy. Paragraph 135 of *National Planning Policy Framework* (DCLG 2012) states that: *the effect of an application on the significance of a non-designated heritage asset should be taken into account in determining the application. In weighing applications that affect directly or indirectly non-designated heritage assets, a balanced judgement will be required having regard to scale of any harm or loss and the significance of the heritage asset*.

3.7 Immediately south-east of the mine complex is the Tilberthwaite Gill Site of Special Scientific Interest (SSSI) (Fig. 4), which is protected under the Wildlife and Countryside Act 1987 as amended by the Countryside and Rights of Way Act 2000.

Geology

3.8 The geology of the region comprises rhyolitic and andesite lava flows, interbedded with hardened volcaniclastic dust and ashes of the Ordovician Borrowdale Volcanic Group, which formed roughly 450 million years ago (Holland 1981; Adams 1988; Fleming 2007). Subsequent tectonic activity resulted in folding and tilting of the sequence, forming cleaves and faults. Cleaving is most clearly manifest in the numerous slate deposits across the fells, while the faulting resulted in the formation of mineral-rich subterranean fissures, concentrated and transported by hydrothermal fluids. These fissures—or veins—contain a complex mixture of different minerals, including copper, lead, zinc and a variety of other metals.

3.9 Miners have divided the mineral-rich deposits into two groups: ore, and gangue. The latter comprised a range of minerals considered to be commercially worthless at the time, including quartz, baryte, fluorite, and calcite. The primary suite of minerals found at Tilberthwaite is chalcopyrite, arsenopyrite, iron pyrites and some galena or lead sulphide.

Copper

3.10 The principal copper ore is a brass-yellow chalcopyrite, a copper iron sulphide ($CuFeS_2$). This is found occasionally in a pure state, but is more generally mixed with gangue, necessitating crushing and dressing to extract the copper (Holland 1981; Adams 1998). Where the mineral content was high, or the enterprise small, this was sometimes undertaken by hand and the survey found evidence for this practice at

Tilberthwaite. Hand-crushed ore was often crushed again mechanically and at Tilberthwaite this was done in a water-powered stamping mill. The pulverised ore was then washed to further separate the copper ore, leaving a copper concentrate ready for smelting.

Landscape character and use

3.11 Tilberthwaite mine lies on the south edge of the Cumbrian High Fells District (NCA 8), a landscape characterised by '*mountain scenery of open fells and craggy peaks separated by U-shaped valleys with a radiating pattern of rivers and lakes'* (Natural England 2015). The expanse of the open fells is covered by rough grassland, dwarf shrub heaths, peatland, and bracken, with frequent outcropping rock, and screes. This landscape has traditionally provided upland grazing, the soil drained by narrow gills and streams. Off the fells, the more fertile land of the valley bottom features a patchwork of unimproved and semi-improved pasture, punctuated by blocks of woodland. Settlement is clustered in small hamlets and farmsteads, many medieval in origin, although the buildings largely date to the 17th and 18th centuries. Buildings are constructed of local stone, rubble-built with distinctive Coniston green slate roofs.

3.12 Mining and quarrying have traditionally been the key industries of the area and there are numerous disused sites scattered across the fells. Immediately north of the site, there are a number of copper mines around Dry Cove Bottom and on the slopes of Wetherlam and Birk Fell. Some of these, such as Hawkrigg mine, were first worked in the 17th century, while others were operating in the early 20th century. South of the site is Wetherlam mine, which was worked for copper in the early 1900s.

3.13 The slate industry has been an important part of the region's economy since at least the 18th century, the fine-grained blue-green stone being in much demand as roofing material. There are a number of quarries east of the mine but no workings of any significance within the survey area itself.

Previous archaeological work

3.14 Eric Holland produced a sketch survey of the site, which is included in *Coniston Copper Mines: A Field Guide* (Holland 1981, fig. 37). Members of CATMHS have also undertaken research into the history and development of the mine, most notably Peter Fleming, Warren Allison, Ian Matheson, Mark Simpson and Mike Mitchell. Recent work by CATMHS's members has included some drone photography.

Glossary

3.15 A glossary of technical terms has been included at the end of this document (Appendix 2).

4.0 HISTORY AND DEVELOPMENT OF THE MINE AND MILL

4.1 The following section incorporates part of a more detailed report on the mine's history produced by Jeremy Rowan Robinson for the Coniston Copper Project. Copies of the full history report are to be deposited with the CATMHS Archive at the Armitt Museum and Library, Ambleside, and with the LDNPA HER.

Elizabethan beginnings

4.2 There is very little evidence for copper mining anywhere in Cumbria before the mid-16th century and it seems that mining at Tilberthwaite began no earlier than the late 1590s.

4.3 In 1564, the Company of Mines Royal, a joint stock company set up by royal charter, began mining and prospecting in north-west England. The company invited a group of mining experts from Bavaria and the Tyrol, led by Daniel Hechstetter, to oversee the search for, extraction and smelting of copper and other ores in the region. In the early years of the company, mining concentrated around Keswick and it seems that work at Coniston and Tilberthwaite began in or around 1599 (Holland 1986, 22). At first the Tilberthwaite operation appears to have been unsuccessful and an Exchequer Commission appointed in 1600 and again in 1600 reported:

'We also viewed the copper mine at Tilberthwaite where cost has been bestowed with great loss to the Company; being a kind of ore which proved well at first and continued the same show of goodness, but the metals in divers parts very base in proof of melting. Although the directors set on in sundry places about these hills where there was good appearance of ore, yet the hinget (hanging wall) and ligat (footwall), being unnatural, the veins did not continue. Therefore we think it not meet any further trial to be made there; only one place excepted, called St. Edward's adit, which has been wrought some 6 fathoms deep upon good ore. But they were enforced to give it over by reason of the influence of water, leaving a vein of ganz (good or complete?) ore a foot broad, which may be recovered with some £30 charges and then be continued and wrought as the vein shall continue plentiful or barren.

The rich lead ore there has not been wrought 6 days since the return of the last

commission. Neither can it be truly discerned without cost of some £4 or £5 to be bestowed in sinking to see whether the veins enlarge any better towards the bottom. There has been trial made by the leasers on the ore now gotten in the great furnace but they cannot melt but to great loss, although that ore, for so much as is ganz ore, holds as much silver in the small assay as that of Caldbeck.'

(Donald 1994, 180)

4.4 Following the Commission's report, the mine appears to have been abandoned. The exact location of these early workings is unknown, but they are likely to have been on the surface outcrop of North Lode and Benson's Vein.

Early private investment

4.5 In 1689, the Mines Royal Act ended the royal monopoly on certain minerals, including copper. The mineral rights were transferred to the owner of the land and this opened the door to private investment in mining. However, investment in the Tilberthwaite mine could have presented a challenge because the mineral rights in the area were divided between two estates, with Muckle Gill forming a natural boundary. On the west and south-west side of the Gill was the Manor of Coniston held by the le Fleming family of Rydal and on the east and north-east side was the Manor of Tilberthwaite and Little Langdale, held by the Pennington family of Muncaster. The principal copper vein at Tilberthwaite, the North Lode, crosses the beck in Muckle Gill and anyone wishing to exploit the mine's full potential would have had to negotiate with the two separate estates.

4.6 Investment in mining in the area followed quickly after the end of the royal monopoly. Early interest focused on the Manor of Coniston, then owned by Sir Daniel Fleming. In 1684, prior to the ending of the royal monopoly, Sir Daniel, in response to an enquiry, arranged for a report to be prepared about earlier copper mining activity on the Manor. The report drew on accounts given by three former miners and included a reference to the workings at Tilberthwaite:

'Three Kings Mine in Tilberthwaite, being 3 Works, and wrought above Forty Fathoms apiece, the Seam being above 14 inches of very good Ore, but a little troubled with water, having no sump to draw it away. There is Fall enough to make one, and is near the last Work, and may be recovered with about 40l (pounds sterling).'

(Lister 1693, 741)

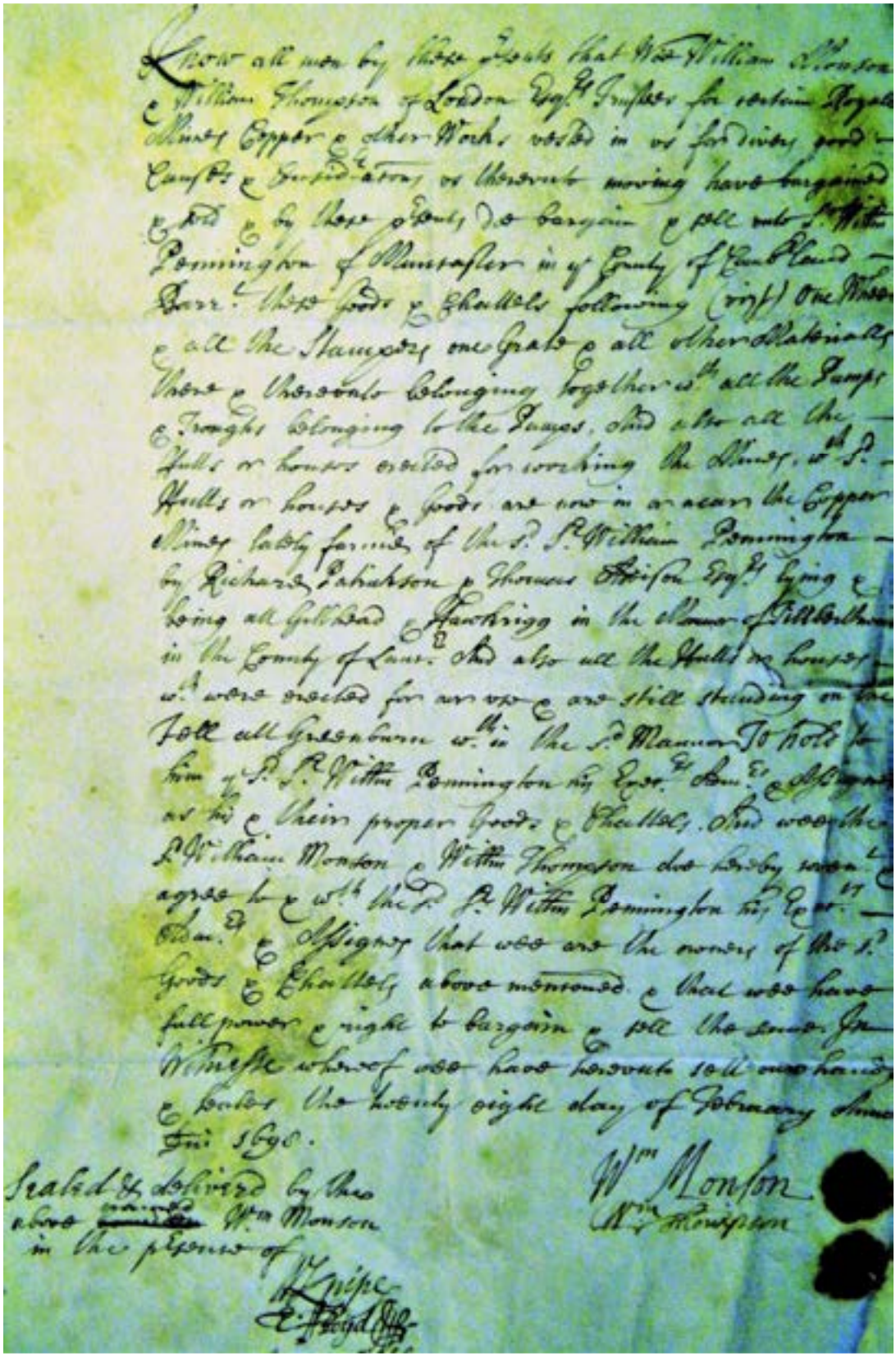


Figure 5: extract from 1690 survey of Three Kings Mine (CRO Whitehaven, DPEN/ BUNDLE 46/83-89).

4.7 Mining appears to have resumed at Tilberthwaite late in the 1680s. A document from 1690 refers to the sale of equipment and buildings (Fig. 5):

'...in or near the Copper Mines lately farmed of the said Sir William Pennington by Richard Patrickson and Thomas Anison Esqs lying and being at Gillhead and Hawkrigg in the Manor of Tilberthwaite...'

and also mentions the sale of:

'…One Wheel & all the Stampers ore Grate and all other Materials then & thereunto belonging together with all the Pumps and troughs belong to the Pumps And all the Huts and houses erected for working the Mines…'

(CA Whitehaven, DPEN/ BUNDLE 46/83-89)

4.8 Hawkrigg Mine is a comparatively small copper mine located north-east of Tilberthwaite mine, and Gillhead is the name used for Tilberthwaite mine until the second half of the 18th century. The mention of a water-powered stamp mill suggests a comparatively high level of capital investment in the mine and the reference to pumps—probably on Tilberthwaite North Lode—indicates that deep mining was taking place below the water table.

4.9 There is no doubt that work continued at Gillhead on the Muncaster royalty after the sale of the equipment because Sir William Pennington received payment for ore weighed up at Gillhead in September and October 1694 (66 cwt) and March, April, May and September 1696 (237 cwt) (CATMHS Archive, DSCN 0391-0398), with further entries for 1698, 1700 and 1701. There may also have been some activity within the Manor of Coniston, but in 1703 a mining lease granted by Sir Daniel Fleming was cancelled on *'being voide for not working'* (CRO Kendal, WDRY/6/4/1/1).

Tilberthwaite mine in the 18th century

4.10 Adams (1988, 151) summarises the position at the Tilberthwaite mine during the 18th century by saying that there was intermittent small-scale production throughout the period, but by the end of the century the mine was in poor condition with much of the underground working in a state of semi-collapse and prone to flooding. Both estates granted mining leases to a number of individuals during the first half of the 18th century but there is little evidence that much activity took place.

4.11 In 1756, Sir William Fleming entered into a 21-year lease of mines of copper in the Manor of Coniston with Charles Roe and Rowland Atkinson (CRO Kendal, WDRY 6/4/1/1). Charles Roe was an industrialist who played an important role in the silk

industry in Macclesfield. He also had copper mining interests in Cheshire and later in Wales, and in 1764 acquired a 21-year lease on Parys Mountain in Anglesey that, following the 1768 discovery of a very large deposit of copper ore, became the largest copper mine in Europe. Roe's company, the Macclesfield Copper Company, was active on the Coniston royalty and, while his interest focused for the most part on the Bonsor Vein in Coppermines Valley, he was also active at Tilberthwaite, having acquired the mineral rights to the Pennington royalty in 1760.

4.12 In September 1759, after a period of intermittent activity on the Muncaster royalty, Anthony Tissington acquired mining rights at Tilberthwaite for a term of 15 years. Tissington was a mining entrepreneur who had mining interests in Derbyshire, Yorkshire, Durham and Scotland, as well as the Lake District. There is reference in January 1760 to three miners working at Gillhead on behalf of Tissington for a fortnight but to little effect. However, by June of that year, the Bailiff of Langdale reported that there had been no miners at work in any part of the Manor of Tilberthwaite for some time. Tissington was nonetheless interested in continuing and it seems he switched his interest to Hawkrigg and Greenburn mines. The extent of Tissington's work is unknown but either he or Roe may have been responsible for starting Gillhead or Waterfall Level—the level driven from the head of Tilberthwaite Gill to explore and drain the Tilberthwaite veins.

4.13 Dickson (1814), in his report on the General View of the Agriculture of Lancashire, makes reference to three copper mines in operation in the county: *'The oldest mine is at Coniston; there is another at Muckle Gill, a little more to the north-east, which has been established about five years…'*. The third was at Hartriggs.

4.14 The reference to the mine at Muckle Gill is to the Tilberthwaite mine, but just who had been working it for the five years is unclear, although interest may have been triggered by an upturn in the demand for copper from the Royal Navy. The report goes on to say that ore from Muckle Gill was sorted by hand and processed on site using a water-powered stamp mill before being sent to Messrs Watkin, Borrow and Atkinson at Cheadle in Staffordshire for smelting. It also describes the work force at the mine:

'In getting and preparing the ore, twelve or fifteen men are employed under the ground, and eight or ten above. The former work in companies, being down about six hours in the day. The tools made use of are chiefly picks and jumpers, which are

tempered very hard. In sinking the shafts and driving the levels, they are paid according to the nature of the strata that are to be wrought through'.

(Dickson 1814, 69)

The Taylor/ Barratt partnership

4.15 In 1823, John Barratt, an experienced mine manager who was to make a major impact in the Coniston area, appeared on the scene for the first time. He was employed at the time by John Taylor, mine agent to the Duke of Devonshire, as the manager of the lead mines at Grassington in Yorkshire. John Taylor was a mining entrepreneur and engineer. More than anyone else, Taylor '*was responsible for transforming the traditional practice of British mining into a planned and systematic discipline, managing labour efficiently and using all the latest technology of the day'* (Matheson 1986). After visiting the mines in Coppermines Valley, Barratt was impressed with their potential and wrote to Lady le Fleming in August 1823 expressing an interest, subject to discussing the matter with Taylor, and in 1824 a 21-year lease was agreed (CRO Kendal, WDRY 6/4/1/1). This resulted in a period of restored production and prosperity in Coppermines Valley.

4.16 Interestingly, there was excepted from the 1824 lease *'those parts of the lordship of Coniston now occupied and held by Michael Knott as tenant'*. Michael Knott's involvement in mining in the Coniston area is a little obscure but he seems to have taken a lease of the Tilberthwaite mine from the Muncaster estate at some point. There is a reference in the lease of September 1824 to *'parts of the lordship of Coniston'* that would suggest he also leased part of the le Fleming royalty.

4.17 Kendal Record Office has a scaled plan dated 3rd January 1824 purporting to show *'A sketch of the Tilberthwaite Mines belonging to M Knott Esq.'* (Fig. 6). The sketch shows two levels, both on the north-east side of the beck in the Muncaster royalty. The longer level is described as 10 fathoms, while the shorter level is described as 21 fathoms. A shaft is shown to the north-east of the levels. This suggests that Knott's workings were concentrated on Shaft Lode and had reached a depth of 38.4m (126 feet). Interestingly, the map does not mark Deep or Waterfall Level. By September 1824, Knott had offered his mines to Taylor in return for a share of the whole (Holland 1986, 106) and for the next 40 years the future of the Tilberthwaite mine was very much bound up with what happened in Coppermines Valley.

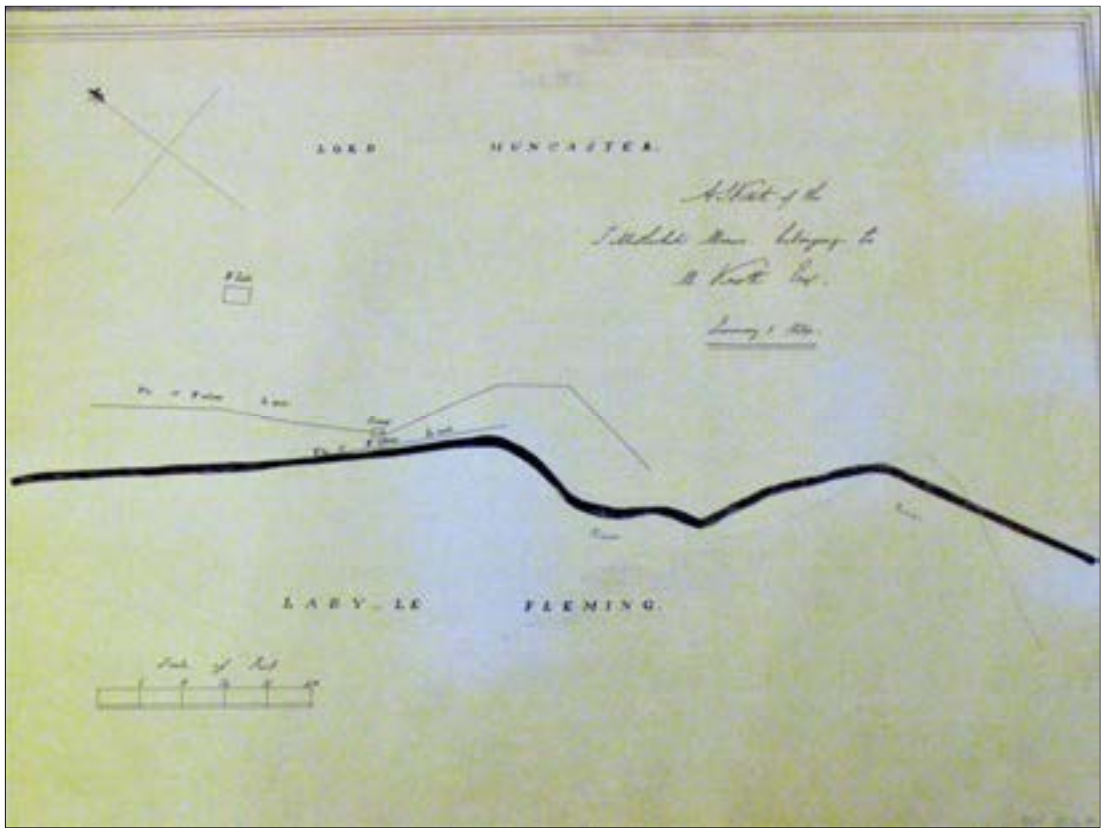


Figure 6: a sketch of the Tilberthwaite mines belonging to M Knott Esq., 1824 (CRO Kendal WDB 35/2/848 (1824)).

4.18 While production was forging ahead in Coppermines Valley, work was now also taking place at Tilberthwaite. On 17th December 1824, Barratt reported to Taylor that:

'... the ground in the adit at Tilberthwaite is favourable, the end is going at £2 per fathom, have about 5 fathoms to go to cut Spedding's Lode. The shallow adit south upon Spedding's Lode is poor and the lode has a most unpromising appearance. I have therefore stopped it'.

4.19 However, by 17th February 1825 the news was not so good:

'Tilberthwaite have met with a kind of floucan [a vein of clay] *and the ground is considerably softer than we expected it would be. We have driven it about 40 fathoms and have about 45 fathoms more to cut the lode, which Mr Knott was raising the ore upon when we accepted the mines. W Nicholls as well as self thinks as the level will now be driven up in a few months that it will be the best way to suspend the putting in of the pumps until such time as we cut the lode. We shall see then what kind of prospect we have before we go to too much expense in putting up the engine etc.'*

4.20 The level being driven to cut the vein is a reference to the extension of the Deep or Waterfall Level that was undertaken at some point to drain the deepening workings at Tilberthwaite mine, and which eventually intersected the North Lode at a depth of 145 feet (44.2m) below the surface. An undated plan (Fig. 7) in the CRO at Kendal shows the Deep Level connecting with Spedding's Lode and then continuing in a north-westerly direction to connect with the South and North Lodes (CRO Kendal, WDRY/6/4/5). As the mine workings were pushed lower and lower, Deep Level would have provided essential drainage. However, the awkward access down to the waterfall would suggest that it was not used for transporting ore from the mine. Until the Horse Crag Level was opened in the 1860s, this would have been raised to the surface via one of the shafts.

4.21 The entrance to Shallow Adit (**515**) is also marked on the plan and three shafts are noted on the North Lode; the Old Drawing Shaft (**404**), the New Shaft (**411**) and the Footway Shaft (**413**).

Figure 7: Plan of Tilberthwaite Mine, undated (CRO Kendal WDRY/6/4/5).

4.22 Work progressed at Tilberthwaite and on 1st January of 1830 Barratt wrote again to Taylor to say that the prospects at Coniston were:

'... much the same as when you were there, except Tilberthwaite where there was a little improvement in the bottoms of the North Lode. The bunch of ore for about 4 fathoms in length would produce about 2 tons of ore per fathom.'

(John Barratt's letter book; CATMHS Archive, AML 2016.887).

The Horse Crag Level and Penny Rigg Copper Mill

4.23 In 1841, John Taylor withdrew from the venture and sold some of his shares to Barratt. Sometime around the middle of the decade, Barratt conceived an ambitious plan for resolving drainage problems at the Tilberthwaite mine inherent in the continued deepening of the North Lode, while at the same time facilitating access for the miners and the transport of material out of the mine. This would involve a new level being driven some 3200ft (975m) from Horse Crag Quarry, just to the west of the road along the Tilberthwaite valley, to intersect with a group of veins, in particular, the principal vein, the North Lode, some 550ft (168m) below the surface.

4.24 The new level would drain the mine and the ore would be brought out through the level in tubs pulled by horses to a new dressing mill to be constructed near the entrance to the level at Penny Rigg rather than being taken by packhorse to the Bonsor dressing mill in Coppermines Valley. Work on the new level was underway by 1847 and in November of that year Barratt wrote to Thomas Jackson, the agent for the le Fleming estate:

'… we have lately resumed operation (at Tilberthwaite mine) by commencing a level, which is a great undertaking, and will cost at least £3,000 to carry out the Trial. This level will unwater the whole of this district about 100 fathoms deep, and will require upwards of 7 years to reach the principal mine.'

Figure 8: First Edition six-inch OS map, published in 1850, showing the project area in red. The newly begun Horse Crag Level is shown to the south of Penny Rigg Quarry but there is no indication of the later copper mill.

4.25 In the event, it took 10 years rather than seven to complete the level and at a cost considerably in excess of £3,000, but it is probable that it was operational sometime around 1860 (NAA 2017). Barratt appears to have delayed construction of the new mill at Penny Rigg pending completion of the level; he may have wished to trial the new level before committing himself to the expenditure involved in the new dressing plant. The completion of the new level, and the opening of the mill, would have rendered the surface operations of the Tilberthwaite mine at Muckle Gill redundant.

4.26 Tilberthwaite mine saw several years of continuous, if modest, production. In 1867, at least 18 men were recorded as working at the mine, an improvement on the position in 1862 when the Kinnaird Commission, set up to enquire into the condition of all mines not subject to the Mines Regulation and Inspection Act 1860, recorded just six men.

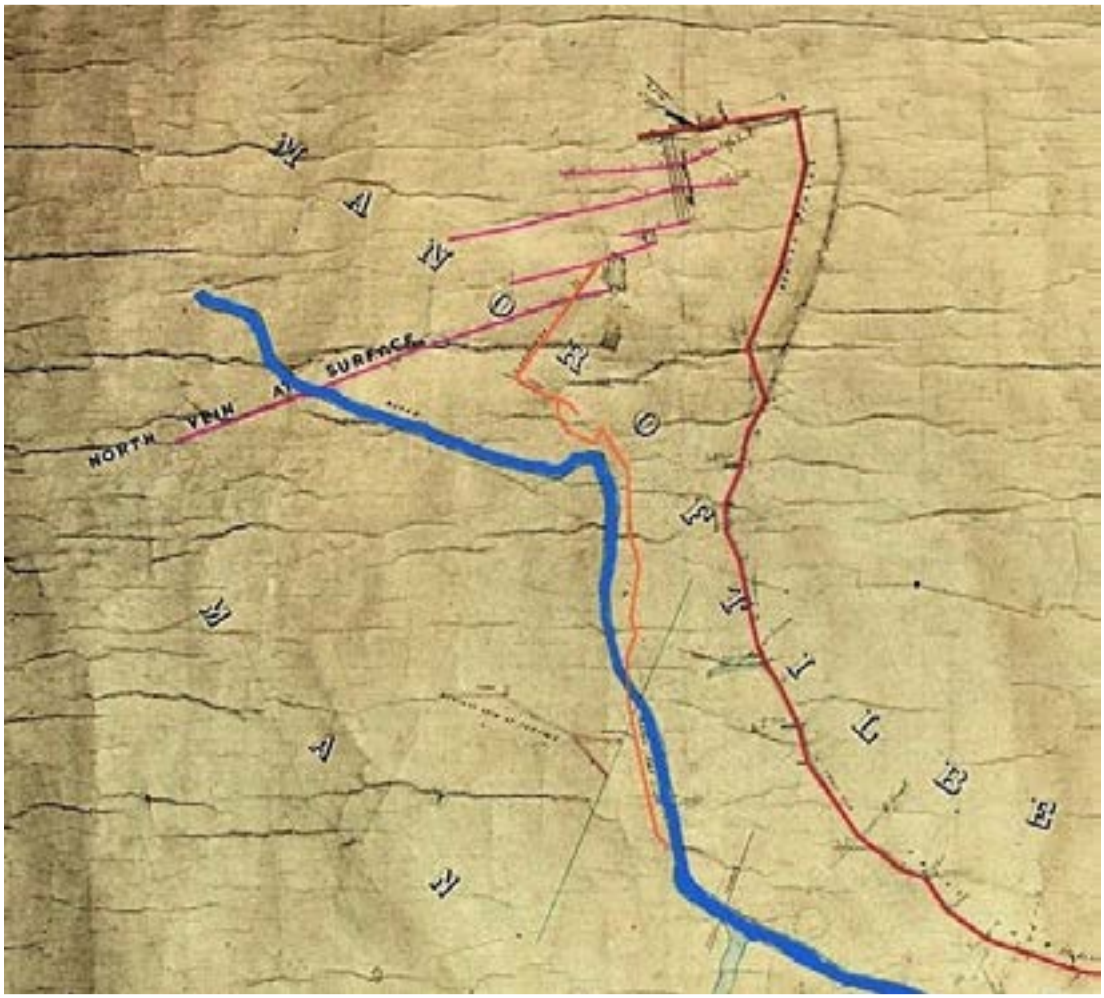


Figure 9: extract from the Lampton plan, showing North Lode (here called North Vein), Waterfall Level (orange) and Horse Crag Level (red) (CATHMS, unref).

The price of copper falls

4.27 John Barratt died in 1868 and did not live to see the completed mill in operation. John's nephew, William, who had been the underground manager at Coniston, took over as Chairman of the Board. In 1874, a new company, the Coniston & Tilberthwaite Mining Co., was formed to carry on the work and production at Tilberthwaite mine continued under the captaincy of William Bawden until 1875. However, competition from cheap Chilean imports of copper rendered the operation at both Coniston and Tilberthwaite uneconomic, and in 1875 the Company eventually took the decision to sell. The Tilberthwaite mine never returned the huge investment in driving the Horse Crag Level and in constructing the Penny Rigg mill. It seems that about £10,000 was invested in the development of the mine, but it is likely that the returns did not exceed half that sum (Postlethwaite 1913, 119).

4.28 The sale was by auction at the Clarence Hotel, Manchester, on 3rd August 1875. The sales flyer gave an optimistic picture of the position at the Tilberthwaite mine:

'The Tilberthwaite Royalty comprises a large area adjoining Coniston, the deep level has been driven 1000 yards, and underwaters a large district, one lode only has been partially opened on, and there are three other lodes in short distance, and there is no doubt large returns will be made from this Mine.'

(Warren Allison collection)

4.29 Thomas Wynne, an inspector of mines and a former shareholder in the Company acquired the residue of the terms of the mining leases for both the Coniston and Tilberthwaite mines along with all the plant and machinery, payment eventually being made in September 1877. The name—Coniston Mining Company—was retained. In the same year, Wynne entered into a new 21-year lease of the le Fleming royalty and the following year a similar lease was executed for the Muncaster royalty.

4.30 By 1889, copper prices had reached an all-time low, and in 1891 Wynne relinquished his interest in the Coniston and Tilberthwaite mines to Thomas Warsop who had worked for him at Coniston as a specialist in air-compressed drilling. A year later, in an attempt to raise capital, Warsop sold his interests in the mines to the newly formed Coniston Mining Syndicate Ltd. Tilberthwaite mine remained closed but Penny Rigg slate quarry was reopened later that year, thereby bringing an end to the copper mill and the mill's 32ft water wheel was dismantled in 1897 and sold off for scrap. The Syndicate soldiered on at Coniston until 1908, when it was eventually wound up.

Tilberthwaite mine in the 20th century

4.31 There were a number of abortive attempts to rework the mine during the first half of the 20th century. In 1912 and 1913, the Central Chile Copper Company undertook investigations in the Tilberthwaite area, and in 1917 a small enterprise, the Langdale Silver, Lead and Copper Company, briefly took over the site but little was achieved.

Figure 10: Third Edition 25-inch OS map, published in 1914, showing the project area in red (part only). Shown is the completed, and abandoned, Penny Rigg mill and the mine.

4.32 In 1924, the Greenburn & Tilberthwaite Mining Company was set up, headed by William Mathias, H. Foster-Williams, B. G. Blunt and James Brown. The Horse Crag Level was cleared, retimbered and extended a little; a ladder-way was constructed to the surface more than 500ft above and work resumed on the North Lode (Holland 1986, 268). The Penny Rigg copper mill was not restored; the ore was hand-dressed and then carted to Coniston. The returns on the investment were poor, and in 1930 a roof collapse in the Horse Crag Level terminated production and the mine was abandoned. The Company pursued other interests elsewhere but eventually went into liquidation in 1942.

5.0 MINING, ORE DRESSING AND THE SURVIVING EVIDENCE IN THE LANDSCAPE

5.1 The following section describes and discusses the archaeological evidence surviving at the Tilberthwaite mine. It looks at how the mine operated, including raising, sorting,

crushing and dressing the ore, as well as transportation, water management and power transmission across the site. It also considers how the mining operations changed over time and attempts to date the main archaeological features.

5.2 Each feature has been assigned a unique identification (ID) number shown in brackets in the text, e.g. opencast working (**350**). A full list of features can be found in the site inventory (Appendix 1) and are illustrated on Figure 11. Building plans and elevations are referred to within the text as appropriate and inserted within the report.

Mining and ore dressing

5.3 The mining and processing of copper ore involves a series of sequential operations. Mining includes prospecting for and discovering a mineral deposit or vein, trialling or testing the vein to determine its value and the viability of working it, and the actual exploitation and extraction of the vein by opencast or underground mining or a combination of the two.

5.4 Ore dressing is the processing of separating ore from veinstuff—the waste rock, quartz and other parts of the vein that are not ore—and involves a series of operations including sorting, crushing, jigging and buddling. Evidence of all these processes has been recognised at Tilberthwaite and is discussed below.

The mineral veins

5.5 There are three principal mineral veins within the survey area, North Lode, Shaft Lode and Benson's Vein. These veins contain the copper ore chalcopyrite along with some iron pyrite and the arsenic mineral, arsenopyrite in a filling of brecciated or smashed rock and quartz (Dewey and Eastwood 1925, 66). The veins are not consistent in size and range in width from 2m to less than 0.35m. In 1815, when the General View of the Agriculture of Lancashire was published, the North and Shaft Lodes were being worked:

> *'... in the Muckle Gill they have two veins of metal, one lying in an east and west direction, and the other crossing it from north to south. In both the mines, the veins of metal lie embedded with quartz and fine crystallized spar, being closely jammed in between the bands of bluestone rock. The veins of ore in the Muckle Gill mines, as the shafts get deeper, become less rich, the ore getting more coarse and more mineralised with sulphur.'*
>
> (Dickson 1815, 69)

5.6 The largest of the veins is North Lode, which has a WSW-ENE orientation and outcrops along the surface of the fell for a distance of at least 210m. At its eastern end, the vein has been displaced some 10m to the south by a fault. North Lode is not vertical but inclines or 'hades' at a slight angle to the north.

5.7 Shaft Lode—also called South Lode on some of the historic mine plans—is some 40m south of North Lode and its surface outcrop can be seen in a partially infilled opencast working (**350**) on the north bank of Muckle Beck. Nineteenth-century mine plans show the vein orientated NE-SE, which suggests that Shaft Lode is the same as the N-S vein described in the General View of the Agriculture of Lancashire (*ibid.*). Shaft Lode is inclined to the south.

5.8 Benson's Vein has a NW-SE orientation and its surface outcrop can be traced for some 120m on the hillside west of the Muckle Beck footbridge. It continues south-east outwith the survey area and has been explored by further workings in Tilberthwaite Gill. Unlike the other two veins, Benson's Vein is vertical.

5.9 The survey also recorded three small, unnamed mineral veins. One is on the eastern side of Muckle Beck, which has been worked by a short adit and opencast (**456**, **457**). On the west side of the beck is a small opencast vein working (**407**) and a prospection trench on a vein exposure (**406**). None of these small veins appear to relate to or be extensions of the principal mineral veins.

Mining

5.10 The North Lode and Benson's Vein, exposed in Muckle Beck and outcropping at a number of places on the fellside, must have been obvious landscape features that were easily identified by the early miners. Initially prospecting pits and trenches were dug on and across the veins to establish their position, size and mineral content. Later mining has removed any evidence for prospection on North Lode and Benson's Lode but prospection trenches (**406**, **417**, **456**) survive on some of the smaller unnamed veins, and two linear trenches (**414**, **415**) at the east end of North Lode represent an attempt by the miners to locate the eastern extension of the main vein.

5.11 Once prospection had proved the value of a vein, it was standard practice in the 17th and 18th centuries to excavate the vein in one or more vertical opencast pits. At some mines, opencast workings follow a vein's surface exposure in a single, continuous trench, but at Tilberthwaite, due to the irregular or 'bunchy' nature of the veins, the

opencasts form a series of discrete pits with areas of unworked ground left in between (for example opencasts **452**, **453** and **454** on Benson's Vein and opencasts **401**, **402**, **404**, **408** and **409** on North Lode).

5.12 Water was always a problem and as early as 1600–1602 one of the Tilberthwaite workings had had to be abandoned because of flooding. One solution to the water problem was to drive a drainage tunnel into the bottom of an opencast. An example of this at Tilberthwaite is level **455** which was driven onto the lowest section of Benson's Vein to unwater opencast **454**, and possibly opencasts **452** and **453**. This level also allowed the western extension of the vein to be explored at depth. Another solution was to use pumps, and some sort of pumping machinery was working at Tilberthwaite—probably on the North Lode—by 1691. By 1815, some type of water-powered bucket pump was in use:

'The shaft at present in work, is driven in from the side of the mountain, and is about thirty yards in depth. The water is taken off the shaft by a sort of lifting-pump, moved by a water power, in large buckets or barrels, thirty or forty, or more of which, are discharged every morning.'

(Dickson 1815, 69)

5.13 This pump may have been in Shaft Lode shaft (**350**) and was powered by the same water wheel operating the stamp mill (building **200**).

5.14 To work a vein at depth, it was necessary to employ underground mining techniques. At Tilberthwaite, North Lode shafts were sunk within existing opencasts (probably **404** and **411**) and joined underground by levels driven along the course of the vein, which were later extended to connect with Shaft Lode. Chambers or stopes were excavated on the vein to extract the ore and veinstuff, and this material was raised to the surface using windlasses or possibly horse gins. Opencast **404** is marked as a 'Drawing' or haulage shaft on a 19th-century mine plan (CRO Kendal, WDRY/16/4/5) and shaft **350** was the main haulage shaft on Shaft Lode.

5.15 By the 1850s, the mine's main shaft was shaft **413** at the east end of North Lode, which was over 500ft (152m) deep and followed the vein in a series of dog-legs or steps. Pumps were in use to drain the mine, including a water-powered bucket pump on either North or Shaft Lode (Dickson 1815, 69). Drainage levels, or adits, driven in from valley sides reduced the need for pumping and allowed veins to be worked to

even greater depths. In addition to a shallow adit on Benson's Vein, there were two major 19th-century drainage levels at Tilberthwaite; Deep Level (**458**) and Horse Crag Level, which drained the mine at depth.

Ore dressing

5.16 Ore dressing at Tilberthwaite was carried out at the mine. Initial hand sorting separated the ore from the veinstuff and unmineralised rock, and the waste was dumped in spoil tips close to the opencasts or at the side of the shafts (**321**, **328**, **329**, **334**, **343, 505**). The ore and veinstuff were then crushed.

5.17 During the 17th and early 18th centuries, crushing was done by hand and evidence of hand-dressing floors were found close to the opencasts or as level working areas on the tops of spoil tips (**321**, **329, 331**, **328**, **505**). Some hand-dressing took place within small stone shelters or cabins and two of these structures (**503**, **509**) still contain mortar stones where the ore was crushed. These mortar stones, with their distinctive circular depressions, are found at a number of other Cumbrian metal mines known to have been worked by the Company of Mines Royal, including Back Strings and East Bonsor at Coniston, and Long Work and Dale Head in the Newlands Valley. Hand-dressing (without mortar stones) probably continued into the early 19th century and one of the large flat-topped tips (**321**) could belong, at least in its final form, to this period.

5.18 A stamp mill was operating at Tilberthwaite in 1691, although its location is unknown. Stamp mills comprised a set of vertical wooden poles with cast iron ends, which were lifted by cams on a shaft operated by a water wheel. The stamp poles then dropped back onto a hard surface—often a cast iron plate—where hand-dressed ore was pulverised (Fig. 10). A stamp mill was still working at Tilberthwaite in 1815 (probably building **200**) and a contemporary account of the mine describes both the mill and the dressing process:

'The quantity of ore now raised is usually about two tons and a half per week, which affords from two to three hundred weight of metal in the ton, but none more than three. It is separated and prepared into two different sorts at the works, namely into chattered or hand ore, and what is termed slime ore. The former consists of the finer parts of the ore, cleared of most of the extraneous matters, and broken into small pieces, in general of a square form, weighing probably from about two drachms to nearly half an ounce; but the latter is formed from the more coarse refuse, by being

subjected to the power of the stamping-machine in water, and washed in troughs contrived for the purpose.'

(Dickson 1815, 69)

5.19 Dickson's (1815) account states that the stamped ore was *'washed in troughs contrived for the purpose'*. These will have been buddles, inclined wooden troughs where the crushed material from the stamps—Dickson's 'slime ore'—was raked in flowing water to separate the copper ore from the lighter waste. Two probable buddles (**325**, **355**) were recorded during the recent survey and more buddles may have been located in the area now covered by spoil tip **334** at the east end of North Lode. Buddling was the final part of the dressing process at Tilberthwaite. Crushed copper ore and concentrate—the product of stamping and buddling—were taken away for smelting elsewhere. In the first phase of mining, around 1600, dressed copper from Tilberthwaite was smelted at Keswick. During the early 19th century, it was transported to Cheadle in Staffordshire for smelting.

6.0 INTERPRETING THE ARCHAEOLOGICAL INDUSTRIAL LANDSCAPE

6.1 The principal archaeological features identified during the survey are described below and shown on Figure 11.

Benson's Vein

6.2 The archaeology of Benson's Vein includes a mine level (**455**), opencast mine workings (**450**, **451**, **452**, **453**, **454**), spoil tips and hand-dressing floors (**501**, **506**, **514**) and associated structures (**503**, **504**, **505**, **507–509** and **513**). There is also evidence for small scale stone quarrying close to Benson's Vein (**511**).

Mine level 455 and the lower dressing floors (507–509 and 513)

6.3 Mine level **455** was driven to join and drain the lower part of Benson's Vein. The initial section is a rock-cut trench, 3m deep by 6m long, which intersects the vein at its western end and follows it as an underground working. The trench also appears to cut and truncate a small, associated opencast excavation on the hillside above, which may possibly be the remains of an earlier surface working on the outcrop of the vein. According to Holland (1981, 82) a blocked sump—an internal shaft—within the level once provided a vertical connection with Deep or Waterfall Level, the late 18th-century drainage level (**458**) driven from the waterfall in Tilberthwaite Gill.

Plate 4: the entrance to mine level (455).

Plate 5: general view of dressing floor by the beck. Mine level 455 is to the right.

Plates 6: mortar stone by wall 508.

Plate 7: rock with drill holes by building 509.

6.4 Set in the ground at the north-east end of building **509** is a rock with a number of shallow drill holes. The rock may have been used to test the sharpness of hand drills and suggests that building **509**, or one of the associated structures, was a smithy. The chronological relationship between the ore dressing cabin and the smithy cannot be

established but it is likely that this, and other buildings on the site, had multiple and changing uses over time. Interestingly, a 'shed' is marked here on the 1850 six-inch OS map (Fig. 12) and suggests that building **509** was still in use in the mid-19th century. Inscribed on one of the stones forming the back wall of **509** are the letters or initials A and S; the lettering is of an archaic style, but the date of this graffiti is unknown.

Figure 12: extract from First Edition six-inch OS map (1850) showing Tilberthwaite mine in detail.

Opencasts 451–454 and tip 505

6.5 Four opencast workings (**451**, **452**, **453**, **454**) have been excavated on the surface outcrop of Benson's Vein between Muckle Beck and track **701**. The largest and best preserved is **454**, which survives to the east as a rock cut trench measuring 4.3m by 0.6m by 2m deep and has been cut and reworked further west to create a larger excavation, 6m by 2.7m by 3.5m deep (Plate 8). This later excavation has shot holes on the side walls, indicating the use of gunpowder for rock blasting.

Plate 8: opencast 454 from the south.

6.6 At the base of the opencast, a level, probably an extension of level **455**, has been driven west on the vein for 25.6m to a small working (Holland 1981, 82); the end of the level corresponds on the surface to opencast **452**. At the east end of opencast **454** is a large, flat topped spoil tip composed of small, mineralised rock fragments typical of hand dressing, and it is likely that ore and veinstuff from this section of the mine were sorted and dressed here.

6.7 Opencasts **452** and **453** are partially infilled and survive as linear hollows with overgrown, parallel linear spoil tips to the north. A section of mined rock face is exposed on the south side of **452** but otherwise the original form and depth of these two workings is unknown. Opencast **451** is in better condition and comprises a flooded working with a level platform and flat-topped tip to the east. Above the rock-cut working is a large boulder with three shallow drill holes, indicating perhaps an attempt to excavate the superficial surface deposits and expose any westerly continuation of the vein.

Building 503

6.8 Building **503** is an L-shaped structure located approximately 18m south of opencast **452** (Plate 9). The building measures approximately 1.9m by 3m and survives to a

height of 0.7m, built against a natural rock outcrop with an opening on the north side. It is rubble built, the south-west wall built against and incorporating part of an earlier structure. At the north end of the building a mortar stone (0.25m by 0.25m by 0.15m) was identified amongst the rubble and to the south-east there was a low heap of hand-dressed mineralised stone (**504**), both suggesting that the building was used as an ore-dressing shed for processing material raised from opencast **452**.

Plate 9: Building 503 from the south, with dressing waste (504) in front.

Opencast 450 and tips 501 and 514

6.9 Opencast **450** is the highest and most westerly working on Benson's Vein. A narrow trench or entrance cutting leads to an 18m long vertical vein working. The excavated rock face, some 3.5m high, is exposed on the north side and to the west the vein has been mined in a series of benched cuttings, some of which have shot holes from blasting. The south face of the excavation has collapsed and forms a spread of angular rock.

6.10 On the southern side of the entrance cutting is a linear spoil tip (**501**) which is overlain to the west by a second tip (**514**) composed of more angular rock. Tip **514** appears to be partially covered by rock debris from the collapsed southern face of the opencast. Opencast **450** differs from the other opencasts on Benson's Lode in being

excavated in a series of horizontal steps or benches along the lode rather than vertically onto it. The regular form of both the entrance cutting and spoil tip **514**, and the presence of gunpowder shot holes, suggests a later period of working than the other opencasts on Benson's Vein.

Quarry 511 and building 502

6.11 Between opencast **450** and track **701** is a small stone quarry (**511**). The quarry has worked a 30m long outcrop of volcanic rock in two shallow benches, both approximately 0.75m high. The comparatively small size of the quarry suggests it was probably worked for building or walling stone.

6.12 Constructed against the quarried face are the tumbled footings of a rectangular building (**502**), with a doorway in the south-west corner (Plate 10). This was probably a small hut or workshop constructed either during a later phase of mining associated with opencast **450.**

Plate 10: Building 502 from the north.

Shaft Lode

6.13 The archaeological features associated with South Lode include a shaft (**350**), a spoil tip (**343**) and a series of retaining walls (**344**, **347**, **351**, **352**, **353**, **354**), as well as an

area of probable subsidence or collapse (**351**).

6.14 Historic mine plans mark a single shaft on South Lode (CRO Kendal, WDRY/6/4/5) (Fig. 7). It was probably sunk during the 18th century, and by 1824 had reached a depth of at least 21 fathoms (38.4m). It was connected to North Lode by an underground cross-cut and may have been the main drawing shaft for both mineral veins. By the 1840s, Waterfall Level (**458**) had reached South and North Lodes and was draining the workings to a depth of 145 feet (44.2m).

6.15 Shaft Lode shaft (**350**) is run in at the surface, visible as an irregular oval hollow (**351**), measuring 8m by 9m, with excavated rock faces exposed to the west and south (Plate 11). The western rock face incorporates a backfilled vein working, which is spanned at the top by a short length of retaining wall over a stone relieving arch (**347**). This joins with another length of retaining wall (**348**) to the south. The backfilled vein is likely to be all that survives of an early opencast working on Shaft Lode which pre-dates shaft **350**. Walls **347** and **348** are probably contemporary with the shaft and were constructed to prevent spoil from tip **321** running into the workings. A curving wall (**354**), west of the back filled vein, may be the remains of an outer protective wall that once encompassed shaft **350**.

Plate 11: Shaft lode shaft (350) from the east.

6.16 Immediately east of shaft **350** is an oval hollow (**351**), measuring 6m by 7m. This appears to be an area of subsidence, probably associated with a collapse on Shaft

Lode. The south side of the hollow is defined by a linear bank of mine spoil, which is retained on its outer face by a low stone wall (**352**). This bank runs parallel with Muckle Beck and may have been constructed to prevent water flowing into the shaft when the stream was in spate.

6.17 East of shaft **350** and hollow **351** is a large flat-topped spoil tip (**343**). This tip is composed principally of waste from shaft **350** combined, to the north, with waste from the dressing floor associated with features **338** and **341**. The tip's level surface would have been the obvious location for equipment—perhaps a horse gin—used to haul material out of shaft **350**, but there is no surface archaeological evidence to support this suggestion. A boulder wall (**353**) has been constructed at the base of the tip to prevent erosion from the beck.

North Lode

6.18 North Lode is the largest and most productive of the three surface veins at Tilberthwaite and was worked intermittently from the late 16th century until the 1930s. Recorded features include opencast workings (**401**–**405**, **408**, **409** and **412**), shafts (**411**, **413**, **415**), prospection trenches (**414**, **415**), dressing floors (**355**, **325**) and spoil tips (**321**, **324**, **328**, **329** and **334**).

The opencasts (401–405, 408, 409 and 412)

6.19 The surface outcrop of North Lode is marked by a series of opencasts with areas in between of unworked or backfilled ground. West of the beck are two opencast workings (**408**, **409**), both partially backfilled and flooded and varying in width from 1.5m to 2.5m.

6.20 Some 6m north of **408** is a large earthfast boulder (**331**) with two sets of multiple shallow mortar hollows (0.06m–0.12m diameter), while immediately south is a low, overgrown spoil mound (Plate 12). Between the boulder and the opencast, and running down slope towards the beck, is a sunken rectangular feature (**355**), measuring 3m by 1m, with some stone edging at the north-east end. This could be interpreted as a small buddle. Closer to the opencast are traces of a possible water channel and another low spoil tip (obscured by thick grass at the time of the survey). These features comprise a good and well-preserved example of a small dressing floor where ore and veinstuff from opencast **408** were broken by hand on a boulder/mortar stone and then washed and concentrated in a small running buddle. There is no sign of a primary spoil tip on the north or downslope side of opencasts **408** and **409**, but

there are faint traces of a low, overgrown tip on the hillside above the two workings.

Plate 12: boulder used as mortar stone (331).

6.21 There is a small, trial-like working (**405**) where the vein is exposed in the beck, and immediately east is a large opencast working (**404**) measuring 1.5m by 19m. At the eastern end, the working descends steeply on a rubble slope to a depth of around 6m, at which point it appears to be a cut by a broad, vertical excavation of unknown depth. This is probably the 'Old Drawing Shaft' marked on one of the 19th-century mine plans (CRO Kendal WDRY/6/4/5) (Fig. 7) and is a good example of an early opencast that was reused to provide access to later, deeper workings.

6.22 Between opencasts **404** and **402** is a linear channel with a V-shaped profile that appears to follow the course or outcrop of the vein. This may be a narrow, backfilled opencast working. Alternatively, it might be a surface trial on what proved to be an unproductive section of the vein.

6.23 Further east are two larger, conjoined opencasts (**402** and **401**). Opencast **402** is 22m long and approximately 2m wide (Plate 14). At the eastern end it forms an open, rock-cut trench (2m deep) but further east the north face has collapsed and filled the working with a number of large, tabular stone blocks. Opencast **401** is smaller, measuring 3m by 8m, and has a depth of around 4m at the western end where it may continue as an underground or gallery-type working. Opencast **401** is a continuation

of opencast **402**. The two workings are slightly displaced along the vein with the result that the north face of **402** continues as the south face of **401**; this suggests that **401** was exploiting a localised area of rich ore at the side of the main vein.

Plate 13: opencast 404 from the east.

Plate 14: opencast 402 looking east towards building 100.

6.24 The east end of opencast **401** has been backfilled and the course of the surface

working survives as a line of shallow discontinuous hollows. Unusually—and perhaps dangerously—the north wall of building **100** has been built over the worked-out vein and it may be that the backfilling east of **401** was undertaken to create a level construction area for the new building. The remaining section of the vein is fenced off and could not be surveyed in detail, but examination of the drone images shows a partially infilled opencast (**412**) flanked by two shafts (**411** and **413**).

6.25 Some 28m east of shaft **413** is an irregular trench working (**414**) with a spoil tip thrown up on the west or downslope side. This appears to have been a prospection trench, excavated in search of the continuation of the North Lode. At this point, however, a geological fault has displaced the vein to the south by 12m, where it has been explored in another, larger prospection trench (**415**). Trench **415** follows the course of the vein upslope for around 22m, but there is no indication that it was ever anything more than a prospection or trial excavation.

6.26 South of the vein outcrop, and on the north bank above the beck, is an enigmatic rectangular feature (Plate 15), comprising the footings of an L-shaped stone structure with an internal stone bench (**325**) and a low, parallel earth bank (**323**); immediately west is an isolated stretch of walling (**323**). This feature, which may have been disturbed by overflow channel **322** from pond **310**, could be the remains of a small rectangular buddle (similar to **355**) for processing ore and veinstuff from hand-dressing floors associated with opencasts **401** and **402**.

Plate 15: probable buddle structure 325, with bank 323 to left.

Shafts 411, 413 and 415

6.27 Within the fenced enclosure at the east end of North Lode are two shafts (**411** and **413**). Shaft **413** is at the east end of a small, and presumably earlier, opencast working. The shaft, which has run in at the surface, has an exposed rock-cut face to the north and the remains of stone wall—perhaps a masonry collar around shaft top—at the south side. Shaft **411** is obscured by vegetation and may be partly covered with timber.

6.28 There is some ambiguity concerning the functions of the two shafts. In the 1840s, shaft **411** is marked as 'New Shaft' and shaft **413** as 'Footway Shaft' (CRO Kendal WDRY/6/4/5) (Fig. 7). A 'footway' shaft was an access or climbing shaft for the miners, which suggests that 'New Shaft' may have been the haulage shaft. Conversely, the Lampton mine plan, dating from the 1870s (Fig. 9), shows shaft **413** as 'drawing shaft' and shaft **411** is marked simply as 'shaft'.

6.29 A single 'Shaft Top' is annotated on a 1937 plan of the site (not illustrated) in the approximate location of shaft **413** and this is likely to be the ladder-way put in all the way to the surface from Horse Crag Level during the re-examination of the mine in the 1930s (Holland 1986, 268). Most of the material in spoil tip **334** appears to be associated with shaft **413**, suggesting that this was the main haulage shaft.

The North Lode spoil tips (321, 327, 328, 329 and 334)

6.30 The North Lode has been worked and reworked on a number of occasions and the surviving spoil tips relate to more than one period of exploitation.

6.31 In their simplest forms, the spoil tips create upcast mounds close to the opencasts. Examples of this are the linear mound running parallel to trench **403**, which probably represents the waste from a single episode of mining or prospection, and the small tip (**327**) at the side of opencast **401**. Similarly, spoil tip **328** is the waste from opencast **404** but in this case the tip belongs to more than one operational phase with the material from the later drawing shaft masking earlier spoil; it is probable that the flat top of tip **328** was designed for a horse gin hauling material out of the drawing shaft within the opencast.

6.32 Other spoil tips are harder to interpret. Spoil tip **321** is a large flat-topped mound, which is probably composed of waste from opencasts **401** and **402** and the backfilled working below building **100**. This tip spills down slope to the east towards building

200 and the walls (**347**, **348**) around shaft **350** on South Lode. Examination of the tip material indicates that it is a combination of waste rock, hand dressing waste and fine spoil from a secondary dressing process, all of which has operational and chronological implications for our understanding of how spoil tip **321** was formed. In addition, a number of later features—leat **311**, holding pond **310** and tip **324**—overlie spoil tip **321** and may have altered its original form.

6.33 The east end of North Lode is marked by a massive flat-topped spoil tip (**334**), which is composed primarily of material from shaft **413**. This tip is a comparatively late feature (Plate 16) and may relate to shaft development and deep mining in the period immediately before Horse Crag Level reached North Lode. At that time, all the material from the mine still had to be hauled to the surface, either via the North Lode shafts or shaft **350** on South Lode. Along its southern edge, the tip overlies drain **335** and dressing waste mound **337** and probably covers other earlier dressing floor features. A horse gin for haulage may have been located on the tip's flat top but there is no surface archaeological evidence to confirm this.

Plate 16: spoil tip 334 at the east end of North Lode, with the stamp building 200 to the left.

The North Lode dressing floor (335–342)

6.34 Between South Lode spoil tip (**343**) and tip **334** on North Lode is a large dressing floor

characterised by a surface spread of finely crushed mineralised stone and gravel. The working area appears to continue to the north under tip **334**, and the original size and layout of the dressing floor is unknown. The area is in a poor condition and many of the surface features have been eroded or truncated.

6.35 At the northern end of the dressing floor is a stone-sided drain (**335**). To the north it is covered by tip **334** and to the south it runs under boundary wall **803** in a stone culvert with a probed length of at least 3m. The drain and culvert presumably carried water onto or across the dressing floor.

6.36 South of boundary wall **803** are a number of isolated features, including a low rectangular platform retained by a stone wall (**338**), two short sections of walls (**336**, **342**) and what may be the fragmentary remains of a rectangular building platform (**341**) (Plate 17). There are no obvious relationships between these individual features and their functions are unknown. The only exception is low a mound (**337**) at the north-eastern side of the dressing floor, which contains mineralised and finely crushed sand and gravel, the typical waste from jigging or buddling. This suggests that some sort of mechanical ore concentration was carried out in the immediate vicinity.

Plate 17: view north across the dressing floors with structure 341 in the foreground.

Building 100 (Fig. 13–17)

6.37 Building **100** is a roofless, single cell, rubble-built structure, open on the south side, and internally measuring 3.2m by 3.8m (Plate 18). Three walls (**110**, **120** and **130**) are standing, although none survive to their full height and the original forms of the wall heads and gables are unknown. All three walls are keyed at the corners, suggesting the building is broadly single phase. There is no evidence for either a stone or timber wall at the south end of the building; as a result, it is assumed that it was open fronted.

6.38 Three building phases were identified. Associated with the initial phase of construction was a hearth or fireplace (**121**) in the north wall (**120**) and a rectangular window with a large stone lintel (**111**) in the west wall (**110**) (this was later infilled with stone). During the second phase, a substantial free-standing stone plinth (**140**) was constructed in the northern part of the building, close to wall **130**. This is believed to be the base of a blacksmith's forge, an interpretation supported by the presence of a spread of cinder and hearth waste immediately south of the building (**133**). The space between the hearth base and wall **110** probably accommodated a set of hand-operated bellows associated with the forge, and a horizontal line of joist holes above blocked window **111** may be the setting for a timber structure supporting the bellows and bellows' lever.

Plate 18: building 100 from the south showing hearth 121, with the plinth for the smithy hearth (140) in front.

6.39 The third building phase is represented by a roughly-built extension (**133**) at the southern end of wall **130** and a partial rebuild of the top courses of this wall. The extension butts against the quoins of wall **130** and is built over a boulder forming the west end of boundary wall **802** (Plate 21).

Plate 19: wall 110 of building 100, from the west, showing blocked window 111. In the foreground is boundary wall 801.

Plate 20: building 100; internal face of wall 110, showing timber slots above blocked window 111.

Plate 21: building 100; wall 130 showing wall extension 133 and boundary wall 802.

Figure 13: extract from Third Edition six-inch OS map (1914) showing building 100 to the north of the shaft.

6.40 The various phases of modification suggest that building **100** was possibly originally constructed as a store, shelter or office with a window and fireplace but was later converted for use as a blacksmith's forge. The date of the building's construction is unknown but post-dates the main period of opencast mining, as the north-west corner of the structure is built over a section of backfilled opencast vein working.

6.41 The building is depicted as a roofed structure—with a small extension to the north-east—on the First Edition OS six-inch map of 1850 (Fig. 12) and is depicted as unroofed, and therefore abandoned, on the 25-inch edition of 1914 (Fig. 13). Intriguingly, both editions show a solid line at the southern end of the building, which might indicate the presence of a timber wall. The third phase seems to relate to the construction of boundary wall **800**, which probably dates to the late 19th century.

Building 200 (Fig. 17–20)

6.42 Building **200** is a roofless three cell structure of coursed rubble-built construction, which is open-fronted to the east (Plate 22). The west end of the the building has been constructed into the lower part of spoil tip **321**.

Plate 22: building 200 from the north.

6.43 The building has a complex structural history with at least three phases of rebuild and changes of function (Fig. 20). As constructed, the building comprised the rear (west) wall (described here as walls **230**, **235** and **240**) and the adjoining side walls (**205** and

210) of the south cell. A short length of wall (**225**), visible only as a surface course, appears to extend the line of the back wall further to the east, suggesting that that originally the building may have been larger, although its full plan, especially to the south and east, is currently unknown.

6.44 The top course of the rear wall appears to survive to its original height and corresponds externally with a level area, presumably a working platform, excavated from spoil tip **321**. Features associated with this phase are an opening in the central section of wall **210** and a floor level aperture (**211**) on the north face (interior) of the same wall, with through-stones above the void. On the east face of the adjoining wall (**235**) are two further holes (**236**) that appear to penetrate deep into the fabric (Plate 23).

Plate 23: building 200; wall 235 showing voids (235).

6.45 The second phase of building appears to have comprised the construction of walls **220** and **215**. Wall **220** butts against the rear wall (**240**) and is therefore later in date. The construction of this wall is associated with a reconfiguring and reduction in size of the original building. The new structure had a central opening—possibly a doorway—providing access from the north. Wall **215** is separated from the rear wall by a doorway **217** and has no structural relationship with the rest of the building but

can be interpreted as part of the second phase. The south face of wall **215** has a centrally-placed hearth (**216**) with an internal flue above.

6.46 In the third phase, a large stone plinth (**245**), identified as the base for a blacksmith's hearth, was built against the south face of wall **215**. Construction of the plinth also obscured the lower section of hearth **216**. A low stub wall (**250**) was built against wall **215**, which could have been a baffle wall for the hearth. The blocking of doorway **217** may also be associated with this phase, together with the insertion of a hearth **241** in the north cell and the infilling of doorway **221** to create a window.

6.47 A possible fourth phase is characterised by a series of small additions to the main structure. These include the construction of a stone wall (**251**) above baffle wall **250**, the heightening and rebuilding of the upper course of some of the walls (**212**, **218**, **222**, **231**, **237** and **242**) and the erection of possible buttresses (**255** and **260**). The insertion of a ceramic pipe and iron lintel into fireplace **241** might also belong to this phase.

Plate 24: building 200 from the south-east. The figure is standing on the side of the wheel pit.

6.48 Dickson's (1815) account of the mine (para. 5.18) refers to a stamp mill located somewhere near the mine, and it is tempting to interpret building **200**, at least in its first phase, as the structure housing the stamping machinery. If this interpretation is

correct then the building's narrow south cell (walls **205**, **210** and **230**) was the pit for a water wheel fed via a wooden launder from pond **310**. The wheel would have powered a set of stamps within the building and there may have been a series of chutes or hoppers on the top of the back or west wall (**235** and **240**) delivering ore to the mill.

6.49 The 1815 account states that the ore was "subjected to the power of the stamping machine in water", which suggests that water was run through the base of the stamps to help in separating the ore from the waste. It is possible that the two deep openings (**236**) in back wall **235** were culverts leading water to the stamps. The size and layout of the stamps is unknown, but the building may have accommodated a large mill, especially if walls **215** and **221** were not present during this phase. The only putative evidence for the stamping equipment is the large void (**211**) in wall **210**, which might be a joist hole for part the superstructure.

6.50 The second phase may correspond with the removal of the stamping equipment and the subdivision and re-planning of the building, including the construction of walls **215** and **221**. The presence of a fireplace in wall **215** suggests that part of the building was being used as an office or bothy (possibly both) during this period.

6.51 During the third phase, part of the building was converted for use as a smithy. It would be interesting to know if the conversion of building **200** coincided with the use of the smithy in building **100**. Most mines had a smithy or blacksmith's shop where tools could be sharpened, and equipment repaired and maintained, but it is unusual for a comparatively small mine like Tilberthwaite to have two smithies so close to each other. One explanation might be—and this assumes that the two smithies are contemporary—that there was a need for an additional smithing, especially for sharpening drills, during the deepening of the main shaft to Horse Level in the1850s. If building **200** was a smithy by 1850 this would imply that the stamp mill had been dismantled before this date, raising the question of how the ore was being dressed prior the opening of Penny Rigg Mill in the 1860s.

6.52 The final phase probably relates to the casual use of the building after the closure of the mine in the second half of the 19th century. It could also include the short-term reuse of the building during mining operations in the 1920s; the fitting of a ceramic pipe into fireplace **241** in the north cell might date from this period.

Water management

Dam 901, leat 311 and pond 310

6.53 As discussed above, building **200** housed a water wheel. Water for the wheel was brought along leat **331** to a holding pond (**310**) above and west of building **200**. A dam (**901**) constructed across Muckle Beck regulated the flow of water into the leat.

6.54 6.50 Dam **901** is 180m north-west of building **200** (Plate 25). The dam wall, which only survives on the eastern bank of the beck, comprises an earth bank, measuring3m by 13m, with 0.7m high dry stone retaining walls on both long faces. Immediately south of the dam is a quarried outcrop (**902**), which provided the stone for the dam walls. The footings of the stone retaining walls continue into the centre of the beck but could not be identified on the west bank. There is no surviving evidence for a sluice gate or any other sort of water control mechanism.

Plate 25: dam wall 901 from the north-west.

6.55 An unusual aspect of the dam is the absence of any water course leading to either the mine or leat **311**. This suggests that the dam was constructed primarily to regulate the flow of water in the beck and from there to leat **311**. This was achieved by impounding and flooding the southern part of Dry Cove Bottom and thereby creating a large head of water that could be released into the beck in times of drought.

6.56 Leat **311** starts on the east bank of the bank, just below a small waterfall. The take-off point must have been controlled by a sluice or small dam, but nothing survives. The leat, a narrow channel with a linear upcast bank, runs on the south side of the North Lode opencasts for 55m and then drops steeply down slope into holding pond **310**. The leat has been cut into the surface of spoil tip **329** and possibly tip **328**.

Plate 26: leat 311 from the west with Building 100 (left) and holding pond 310 (right).

6.57 Holding pond **310** is an oval hollow, measuring 4.4m by 6m and defined by a curving bank to the east and west. The dam has been cut into, and therefore post-dates, the surface of spoil tip **321**. A narrow overflow channel (**312**), also cut into spoil tip **321**, runs south-east from the pond towards the beck. It is likely that a raised wooden launder carried water from the east side of the pond to the wheel in building **200**. However, much of the pond's east bank is eroded and there is no surviving archaeological evidence for an outflow channel or launder.

The diversion channel (330, 600–604)

6.58 One of the most unusual aspects of the site is a large leat or channel constructed to divert the beck away from the mine workings (6**00**) (Plate 27). A boulder wall (**330**) at the base of tip **328** channelled the stream towards a weir—now destroyed but built across the beck on a natural step or bench—and then into a rock cutting (**603**) on the south bank of Muckle Beck. There must have been a sluice gate at the start of cutting

603 but nothing survives. Diverted water was carried in a substantial channel (**601**), measuring 3m wide, with an upcast mound on the east side; the initial section of this channel has a stone wall on its east side, presumably to protect the bank from erosion. The main channel (**601**) runs south-southeast for 72m and then bifurcates. A short leat on the east side leads to a large erosion or flood gully that descends steeply to Muckle Beck and to the south a 60m long embanked leat (**604**) leads to another erosion gully. At its southern end leat **604** appears to have been excavated through spoil from opencast **451**.

Plate 27: diversion leat 600 looking south across Muckle Beck.

6.59 The construction of the diversion channel must have been a major undertaken in terms both of labour and capital but was necessary to allow deep mining to continue. The shaft on Shaft Lode (**350**) was sunk on the north side of the beck and, although partly protected by bank **352**, was at risk when Muckle Beck was in flood. This would have been a particular problem before the completion of Waterfall Level, as any flood water running into the shaft could have backed up and inundated the workings on both South and North Lodes.

Additional mining features

6.60 In addition to the archaeological remains associated with Benson's Vein, North Lode and South Lode, there are other mining-related features within the survey area.

Waterfall Level (458)

6.61 A comparatively large (3m by 1.5m) rock-cut level on the south side of the waterfall at the head of Tilberthwaite Gill. The level, also known as Deep Level and Gillhead Level, has been driven on—and may have exploited—the eastern outcrop of Spedding's Vein, a mineral vein running parallel to Benson's Vein. The level is above the beck and at the entrance there is short rock-cut drainage channel at floor level. There is no spoil tip and it must be assumed that any surface features associated with the level have been removed by flooding.

Plate 28: Waterfall Level (458), driven on an exposure of Spedding's Vein.

6.62 Waterfall Level (**458**) may represent more than one phase of development. The entrance section follows the outcrop of Spedding's Vein and could be comparatively early, possibly from the 16th century. The underground section towards Benson's Lode may relate to the activities of Tissington or Roe in the later 18th century, and the final stretch towards North Lode dates from the 1840s. Until the construction of Horse Crag

Level, this was the mine's principal drainage level.

Prospection trench 406

6.63 Between track **701** and diversion channel **601** is a prospection trench (**406**). A broad trench, measuring 16.5m by 3m by 1.5m deep, has been excavated east of a small vein exposure. The trench, open at the eastern end, was cut into superficial boulder clay deposits in an abortive attempt to find a continuation of the vein. There are grass-covered spoil tips along the south side of the trench.

Trial working 407

6.64 North-west of prospection trench **406** is a small rock-cut trial (**407**) (Plate 29). A shallow, narrow opencast (10.1m by 0.9m by 1.2m to 1.4m deep) has been excavated onto the surface exposure of an unnamed mineral vein. There is an area of spread and crushed mine spoil—possibly a small dressing floor—on the north side of the trench. The shallow nature of the excavation suggests that this was a trial working designed to test the quality and extent of the vein.

Plate 29: trial working 407 from the south-east.

Opencast 456 and trial level 457

6.65 An unnamed mineral vein is exposed on the hillslope on the eastern side of Muckle Beck, 35m north-east of the footbridge. The exposure has been worked in a small

opencast (**456**), measuring 4.6m long and 3.1m deep, with the vein exposed on the east face. Further to the south-east, a shallow prospection trench has been dug along the brow of the hill, presumably in search of a continuation of the vein. In addition, a rock-cut trial level (**457**) has been driven into the base of the cliff below the opencast to test the vein at depth. According to Holland (1981, 82), the level is only 3m long. The square-cut, regular profile of the level suggests a 19th-century date, but the opencast could be considerably earlier.

Level 515 and tip 510

6.66 On the east side of Muckle Beck, just north of trial level **457**, is a low spoil tip (**510**). The tip, measuring 18m by 4m by 1.5m high, has been constructed against the base of the slope and at its northern end, parallel to the beck, are a linear trench and tip. This trench is probably the entrance cutting to a now lost mine level marked as 'Shallow Adit' on the 1840s mine plan (CR Kendal WDRY/6/4/5) (Fig. 7). This level appears to have been driven north-east to explore the eastern continuation of Shaft Lode and North Lode.

Tracks

6.67 There are a number of tracks and footpaths within the survey area but only one of these (**703**) appears to be associated with the mine. Track **703** is on the western side of Muckle Beck. To the south, it has been truncated and destroyed by the two erosion gullies connected with diversion channel **601** and to the north it stops on the southern bank of the beck opposite the base of tip **343**. The track must have crossed the beck at this point on a bridge but any continuation on the north bank has been obscured by the construction of tip **343**.

6.68 The relationship between track **703**, tip **343** and the two erosion gullies show that the tack is an early feature, perhaps the original access route to the mine. To the south and east it might have forded the beck close to the modern footbridge and then followed the current footpath—track (**706**)—to the well-engineered route on the north side of Tilberthwaite Gill which leads to Low Tilberthwaite.

6.69 With the development and growth of Shaft Lode tip (**343**), track **703** was abandoned and other routes must have been used to access the mine. It is probable that the modern footpath from the head of Tilberthwaite Gill to Dry Cove Bottom—track **705**—was used, with side tracks **702** and **704** leading to the mine.

6.70 The other major path is track **701**, which runs from the mine to Coppermines Valley via Hole Rake. This is probably a fairly old shepherds' track, but from the 1820s onwards, when Coniston and Tilberthwaite were operated by the same company, it would have provided a short, high-level link between the two mines. It is also possible that dressed ore from Tilberthwaite was taken by this route to the Bonsor Mill in Coppermines Valley for reprocessing.

Enclosure wall 800

6.71 The site is crossed by an earth and stone enclosure wall **800**. In its northern section, close to Dry Cove Bottom, the wall is a low earth bank or dyke, but closer to North Lode it is replaced by a tumbled stone wall (**801**), which still retains the fittings for an iron pole and wire fence. The south-east end of **801** terminates in a large boulder that abuts the south-west corner of building **100** and another length of wall (**802**) runs between the south-east corner of building **100** and the north-west corner of building **200**. East of building **200**, the wall continues for 29m and in this section (**803**) appears to overlie the North Lode dressing floor and also incorporates one of the dressing floor drains (**335**). The boundary then turns south and follows the east side of Muckle Beck to the top of Tilberthwaite Gill, its line marked by isolated stretches of walling and occasional boulders, which have been drilled to take iron fence supports.

*Plate 30: boundary wall **803** with building **200** in the middle distance.*

6.72 Holland (1981, fig. 37), identifies the wall as the manor boundary between Tilberthwaite and Coniston and the respective estates of Muncaster and le Fleming, but this seems unlikely. By the 1850s, the division between the two manors was Muckle Gill (see Fig. 3) and it is likely that this natural boundary, making use of obvious topographical features, is of some antiquity. Wall **800** is not shown on the First Edition six-inch OS map, surveyed between 1847 and 1848, but is marked on the revised map of 1914 (Fig. 13), where it forms the south-west part of a much larger enclosure, Blake Rigg Plantation, which includes much of the ground north of Tilberthwaite Gill and west of Blake Rig Gill. A comparatively late date for the wall is confirmed by the archaeological evidence, which shows the individual wall sections aligned on and abutting buildings **100** and **200**.

7.0 PHASING

7.1 Tilberthwaite mine has a long history and the survey was able to identify a number of broad operational phases. However, because of the comparatively large project area, it is best to examine the activity phases associated with mining on the individual mineral veins (Table 1). The relative phases of buildings **100** and **200** have already been discussed in the above section.

Table 1. Activity phases at the main mineral veins.

Benson's Lode				
Phase 1	Phase 2	Phase 3		
Opencasts: 450, 451, 452, 453, 454. Tips: 501, 504, 505, 513. Dressing sheds: 503, 507, 508, 509.	Opencast: 454. Level: 455. Level wall: 512	Opencast: 450 Tip: 514. Building: 502. Quarry: 511		
Shaft Lode				
Phase 1	Phase 2			
Opencast: 350	Shaft: 350. Walls: 347, 348, 352, 353, 356. Tip: 343			
North Lode				
Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
Opencasts: 401, 402, 403, 404, 405, 408, 409. Tip: 329. Mortar stone: 331. Buddles: 325, 331.	Opencasts: 401, 404. Shafts: 411, 413. Tips: 328, 321.	Shafts: 411, 413. Opencast: 401. Tips: 324, 328. Building 100. Building 200. Dam: 900. Leat: 311.	Shaft: 413. Tip: 343 Building 100. Building 200.	Enclosure wall 800 (801-804). Shaft: 413. Building 100. Building 200.

		Pond: 310 Dressing floor features: 334, 335, 336, 337, 338, 340, 341, 342, 344, 345, 346.		

Benson's Lode

Phase 1

7.2 This phase relates to the initial excavation of the opencast workings on the vein outcrop, the creation of linear spoil tips at the sides of the opencasts and the construction of hand dressing floors and associated dressing sheds with mortar stones. This phase probably covers the period from the 1590s to the end of the 17th century.

Phase 2

7.3 The reworking and deepening of the opencasts and the driving of the beck-side adit to explore and drain the vein to the west. The presence of shot holes in opencast **454** suggests a date no earlier than the mid-18th century.

Phase 3

7.4 The reworking and possible extension of the western end of the vein outcrop (**450**) and may also include the small stone quarry (**511**) and building (**502**). This phase is probably 19th century but the reworking of the vein could be later and may relate to early 20th-century prospecting. The rebuilding and reuse of building **503** could belong to either Phase 2 or Phase 3.

Shaft Lode

Phase 1

7.5 An opencast vein working represented by the backfilled rock-cut excavation at the west end of shaft **350**. This could be late 16th or 17th century in date.

Phase 2

7.6 This phase is represented by the sinking of shaft **350**, the construction of the associated shaft top walls (**344**, **352**, **356**, **357**) and the creation and build-up of spoil tip **343**. The construction of the beck diversion channel (**600**) belongs to this phase too. The phase covers the approximate period of 1700–1840.

North Lode

Phase 1

7.7 The initial excavation of the opencast workings on the vein outcrop (**401**–**405**, **408**–**409**, **412**), the creation of linear spoil tips at the sides of the opencasts, the construction of hand dressing floors with mortar stones (**331**) and simple buddles (**325**, **355**). This phase probably covers the period from the 1590s to the end of the 17th century.

Phase 2

7.8 The reworking and deepening of some of the opencasts (**401**, **404**), the sinking of new shafts (possibly **411**, **413**) and the construction of new spoil tips south of the vein (**328**, **321**). This phase relates primarily to 18th-century activity.

Phase 3

7.9 The construction of buildings **100** and **200**, the latter associated with dam **900**, leat **311** and holding pond (**310**); the pond and leat are both excavated into the surface of Phase 2 tips. The dressing floor south of tip **334** and the tips (**328**, **324**) associated with the reworking of opencast **401** may also belong to this phase. Phase 3 covers the period from 1800 to approximately 1850.

Phase 4

7.10 This phase, which relates to the driving of Horse Crag Level, includes the deepening of shaft **413**, the creation of the associated spoil tip (**343**) and the reuse of buildings **100** and **200** as smithies. It covers the period from 1850 until the closure of the mine in the 1870s.

Phase 5

7.11 This phase includes the final decade of the 19th century and the first half of the 20th century. The principal feature from his phase is enclosure wall **800**, which had been built by 1912. Shaft **413** was re-equipped in the 1930s as a ladderway connecting with Horse Crag Level, and it is likely that building **200** was reused as a shelter for the miners during this period.

Dating other site features

7.12 Trial opencasts **407** and **456** are simple trench workings with linear spoil tips and, on morphological grounds, have the potential to be relatively early, perhaps 16th–17th

century in date. Opencast **456** is certainly earlier than level **457**, which has been driven beneath the former to test the vein at depth; level **457** has a square profile indicative of 19th-century mining.

7.13 Prospection trenches **406**, **414** and **415** have no archaeological associations with other features and lack any defining morphological characteristics. They could belong to any period within the mine's operational history. Prospection trench **417** has jagged sides suggestive of the use of high explosives and may be a comparatively late, 20th-century feature.

7.14 The only feature outside of the main vein complexes that can be dated with any precision is Waterfall Level (**458**). It appears to have been started in the late 18th century and was reworked and extended as far as Shaft and North Lodes in the 1840s.

8.0 STATEMENT OF SIGNIFICANCE

8.1 The heritage significance of Tilberthwaite mine derives from a wide range of values and perspectives, encompassing not just the physical fabric of the mine but also its setting, use, traditions, local distinctiveness and ability to bring together local people and communities.

8.2 The following section considers the significance of the mill according to four high level themes as set out in *Conservation Principles, Policies and Guidance for the Sustainable Management of the Historic Environment* (English Heritage 2008):

- **Evidential Values**: the potential capacity of the site to yield primary evidence about past human activity (layout, rarity, group value, extent of survival, etc.).
- **Historical Values:** the potential of the site to advance the historical narrative—the connection between the present and the past through association with people, events and aspects of life.
- **Aesthetic Values:** the potential for people to derive sensory and intellectual stimulation from a place through design, art, character and setting.
- **Communal values:** the potential for the site to bring people together through collective experience or memory.

8.3 Overall, Tilberthwaite copper mine is considered to be of exceptional significance (regional and national) as a well-preserved example of a multi-period mining and ore dressing site. Its historic value is closely allied with the development of Penny Rigg

copper mill, which was established in the mid-19th century specifically to process ore from the Tilberthwaite mine. There are also important historic and evidential parallels with a number of small multi-period copper workings in the immediate area, such as Hawkrigg, Borlase, Hellens and Man Arm mines, the Greenburn mine further to the north and Coniston copper mine to the west, as well as Goldscope mine in the Newlands Valley, and smaller workings that include Long Work and Dale Head in the Newlands Valley, Hay Gill and Carrock End in the Caldbeck Fells, and Seathwaite Tarn in Coniston. These all form part of the Cumbrian group, together constituting the largest concentration of copper mines in England outside of Devon and Cornwall and have had a considerable impact on both the historic development of the region and the character of the surrounding landscape.

8.4 Tilberthwaite mine stands out from the other mines in the Cumbrian group as a largely intact example of a multi-period mine where specific technological and historical phases of operation survive and can be related to historical and documentary records. The quality of the historical archive, the comprehensive nature of the remains, and good preservation of the site, also all contribute to make it of exceptional evidential value, and an exemplar of the development of copper mining and dressing between the later 16th century and the early 20th century.

8.5 The Tilberthwaite complex includes evidence of all of the key aspects associated with copper mining and processing, except for smelting, which was conducted off site. More more significantly, it demonstrates how particular technological elements, such as mining, haulage, pumping, ore dressing and water management, developed during the post-medieval period. This evidence includes: prospecting (trial trenches); opencasts (surface workings on the three main veins); deep mining and drainage (the reworked opencasts and Waterfall Level); hand-dressing of ore (the dressing sheds, mortar stones and buddles); mechanical ore dressing (the stamp mill in building **200**); power transmission (building **200**'s wheel pit); water management (dam, leat, holding pond and stream diversion channel), and transportation and movement around site (original mine tracks).

8.6 In addition to the visible surface evidence, there is also a high potential for the preservation of sub-surface archaeological remains, particularly around the stamp mill and at the dressing floors associated with mortar stones. Underground mining remains are known to be preserved with the recently reopened Horse Crag Level and additional remains may be identified during future underground exploration

elsewhere at the mine.

8.7 The mortar stones at Tilberthwaite are of particular interest and value. Mortar stones occur at other Cumbrian sites but are often found in secondary contexts, like the ones reused as building stone in the mine cabins at Back Strings, Levers Water or mixed with spoil on the tips at Red Dell, Coniston. The Tilberthwaite mortar stones appear to be directly associated with stone-built ore dressing sheds and find their only local parallels at the Dale Head and Long Work copper mines in the Newlands Valley, both sites believed to have been worked by the Company of Mines Royal. Outside Cumbria, ore dressing sheds with mortar stones are rare but 17th-century examples have been recorded at Cwmystwyth, Ceredigion and Tyndrum, Stirlingshire.

8.8 The probable stamp mill (building **200**) at Tilberthwaite is also of exceptional value. Although once common, early (pre- to mid-19th century) water powered stamp mills rarely survive as standing structures and no other examples are known at Cumbrian mines. They are also rare elsewhere in Britain, although examples are known from Dartmoor and an early 18th-century stamp mill has been excavated at Cwmystwyth, Ceredigion.

8.9 The historic values of Tilberthwaite mine contribute considerably to the significance of the site. Of particular importance in this respect are the various primary source documents held in the CATHMS archive at the Armitt Museum and Library, as well as those held in the Cumbrian Record Office at Whitehaven, Kendal, Carlisle and Barrow. Recent analysis of this material as part of the wider Coniston Copper Project, and in particular the historic research by project volunteer Jeremy Rowan Robinson, has expanded our understanding and knowledge of the mine's development and has been invaluable in helping to interpret the site's often complex archaeology.

8.10 The site has close connections with a number of significant groups, many of which were involved in mining operations elsewhere in the region and further afield. The earliest workings, in the late 16th century, were undertaken by the Company of Mines Royal's specialist German workforce and the surviving remains on Benson's Lode and the western part of North Lode may relate to their activities. The Company of Mines Royal was a national organisation that, in addition to its mining and smelting operations elsewhere in Cumbria, was also involved in mining in Cornwall and south Wales. During the late 18th century, Tilberthwaite was worked by the Macclesfield Copper Company, which had copper mines and smelters in Cheshire and was

responsible for the discovery of the hugely rich copper deposits on Parys Mountain, Anglesey. From the 1820s, Tilberthwaite—and Coniston—were associated with the mining engineer and entrepreneur John Taylor and his manager John Barratt who had both begun work in the Devon and Cornwall ore fields and developed their technical and managerial skills at the Grassington lead mines in Yorkshire. By completing Waterfall Level, driving Horse Crag Level and establishing Penny Rigg mill, Barratt oversaw the full and final development of Tilberthwaite mine.

8.11 The ruinous nature of the buildings, the extensive opencasts and tips and the mine's isolated location all contribute to the site's aesthetic value and unique sense of place. Decayed structures like these are not expected on the fells and they evoke a strong emotional response from visitors to the site, further enhanced by changes in the weather and seasons. The site is frequently visited by walkers on the popular route from Tilberthwaite car park to Wetherlam via Tilberthwaite Gill. The site's aesthetic value is increased through its association with one of the Lake District's best-known writers, artists and historians, W. G. Collingwood. His 1910 historical novel, *Dutch Agnes her Valentine*, includes an imaginative account of the German miners' workings at Tilberthwaite as seen through the eyes of the curate of Coniston and owes much to Collingwood's first-hand knowledge of the site and its history.

8.12 The site also has considerable communal value for mining enthusiasts and industrial archaeologists. Members of CATHMS have spent a number of years working on clearing Horse Crag Level in an attempt to push through to the old workings on Tilberthwaite North Lode. Despite numerous setbacks, the team have been successful in clearing much of the adit, continuing a legacy dating back almost to the foundation of the level 150 years ago

9.0 RECOMMENDATIONS FOR FURTHER WORK

9.1 It is recommended that consideration should be given to scheduling Tilberthwaite mine in order to protect the exceptional heritage significance of the site. Future risks to the site that may be protected by scheduling would include changes to stock or land management regimes, the erection of fencing and fossicking (prospecting).

9.2 A Scheduled Monument is afforded statutory protection under the Ancient Monuments and Archaeological Areas Act 1979. This is the highest level of protection that can be placed on a heritage site and would make it a criminal offence to demolish, destroy, damage, remove, repair, alter, or add to the site unless prior

Scheduled Monument Consent was obtained from the Secretary of State for the Department of Digital, Culture, Media and Sport (DCMS).

9.3 The following tables assess Tilberthwaite mine according to the scheduling criteria for industrial sites, as detailed in *Designation Scheduling Selection Guide: Industrial Sites* (English Heritage 2013). The mine was previously recommended for designation following the 1995 English Heritage Monument Management Protection Programme assessment (Hedley and Cranstone 1995).

Table 2: *Summary of significance according to scheduling criteria*

Period	Tilberthwaite mine is a well-preserved example of a multi-period mining and ore dressing site and closely allied with the development of the 19th-century Penny Rigg copper mill. Evidence of operations at the mine extend from the 16th through to the early 20th century
Rarity, representativity and selectivity	There are a number of multi-phase copper mines in the area (see Group Value) but of particular significance with regards Tilberthwaite is the connection with Penny Rigg mill and the tremendous investment represented in driving the Horse Crag Level between the two. The mortar stones at Tilberthwaite also contribute to the rarity value of the site. In particular that these appear to be directly associated with stone-built ore dressing sheds and are believed to date to the working of the site by the Company of Mines Royal in the 17th. Such evidence is rare, and recorded locally at only two other sites, Dale Head and Long Work in the Newlands Valley. Outside of Cumbria there are examples recorded at Cwmystwyth, Ceredigion and Tyndrum, Stirlingshire. The presence of a stamp mill building at Tilberthwaite also adds to the site's rarity value. Standing stamp mills buildings associated with tin working survive in Devon but are uncommon elsewhere in the country.
Documentation	Tilberthwaite mine stands out from the other mines in the Cumbrian group as a largely intact example of a multi-period mine where specific technological and historical phases of operation can be related back to historical and documentary records. As such, it has strong parallels with the mines in the Coniston Coppermine Valley.
Group Value	The mine forms part of the Cumbrian group which constitutes the largest concentration of copper mines in England outside of Devon and Cornwall and has had a considerable impact on both the historic development of the region and the character of the surrounding landscape. mill There are important parallels in the immediate area with Hawkrigg, Borlase, Hellens and Man Arm mines, the Greenburn mine further to the north and Coniston

	copper mine to the west, as well as Goldscope mine in the Newlands Valley, and smaller workings such as Long Work and Dale Head in the Newlands Valley, Hay Gill and Carrock End in the Caldbeck Fells and Seathwaite Tarn in Coniston.
Survival	The Tilberthwaite complex is largely intact and shows evidence of all the key aspects associated with copper mining and processing (except for smelting) and demonstrates how mining technologies such as extraction, haulage, pumping, ore dressing and water management, developed during the post-Medieval period. In those areas explored by CATHMS, the ground working has also been shown to be relatively well-preserved.
Potential	There is the potential to develop a greater understanding of the operation and development of the mill via: further archaeological investigation and potentially environmental sampling. Improvements could also be made to public interpretation, although any onsite interpretation would need to take into consideration the environmental demands of the site as well as the setting of the monument. As such, online options might prove more suitable.

Archaeological investigation

9.4 Targeted excavation might be considered in the future to advance a greater understanding of how the site operated and the nature and preservation of the below ground archaeology. This would make an interesting and engaging community project, providing that an appropriate risk assessment was in place, particularly in the areas of the open stopes.

9.5 Potential areas for consideration would be:

- one of the putative hand-dressing sheds (for example, **509**) to increase understanding of the hand-dressing process and retrieve sample of processed copper ore;
- the area on North Lode containing mortar stone **331** and buddle **332**, in order to increase understanding of the early (17th century?) ore dressing process and to retrieve potential samples for radiocarbon dating;
- the interior of building **200** to further understand structural, functional and chronological changes and to examine any surviving evidence for the location and operation of the water-powered stamps;
- part of the dressing floors, to further understand the ore dressing process.

Interpretation

9.6 In order to widely disseminate the information gathered during both the Penny Rigg and Tilberthwaite survey projects, a popular publication on the mine and mill is being prepared as part of the Coniston Copper project. This will sit alongside the two survey reports, providing key information in a more concise and accessible format. This will be made available online and at key points in the village, with the aim of hopefully increasing both local and visitor engagement and enjoyment in the industrial heritage and history of the Coniston area.

9.7 Other opportunities for improving interpretation might include onsite interpretation panels. These would need to be suitably robust and placed in a location which would not have an impact on the remote and isolated setting of the mine. A board at the Penny Rigg Quarry carpark might be viable option, combining information on both the mill and mine.

9.8 An industrial self-guided walking trail should also be considered, downloadable from the LDNPA website onto a mobile phone or as a printable PDF[2]. CATMHS have already produced several trail leaflets of the Coniston area, which may be used as the basis for this, including one on Tilberthwaite that covers the mine and the mill (I. Matheson *pers. comm.*).

[2] See http://www.northyorkmoors.org.uk/visiting/enjoy-outdoors/walking/our-walks/walking-routes/rosedale-mineral-railway/rosedale-mineral-railway.pdf for an example.

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2016.687: Abstract of title of the trustees of Coniston and Tilberthwaite Mining Company.

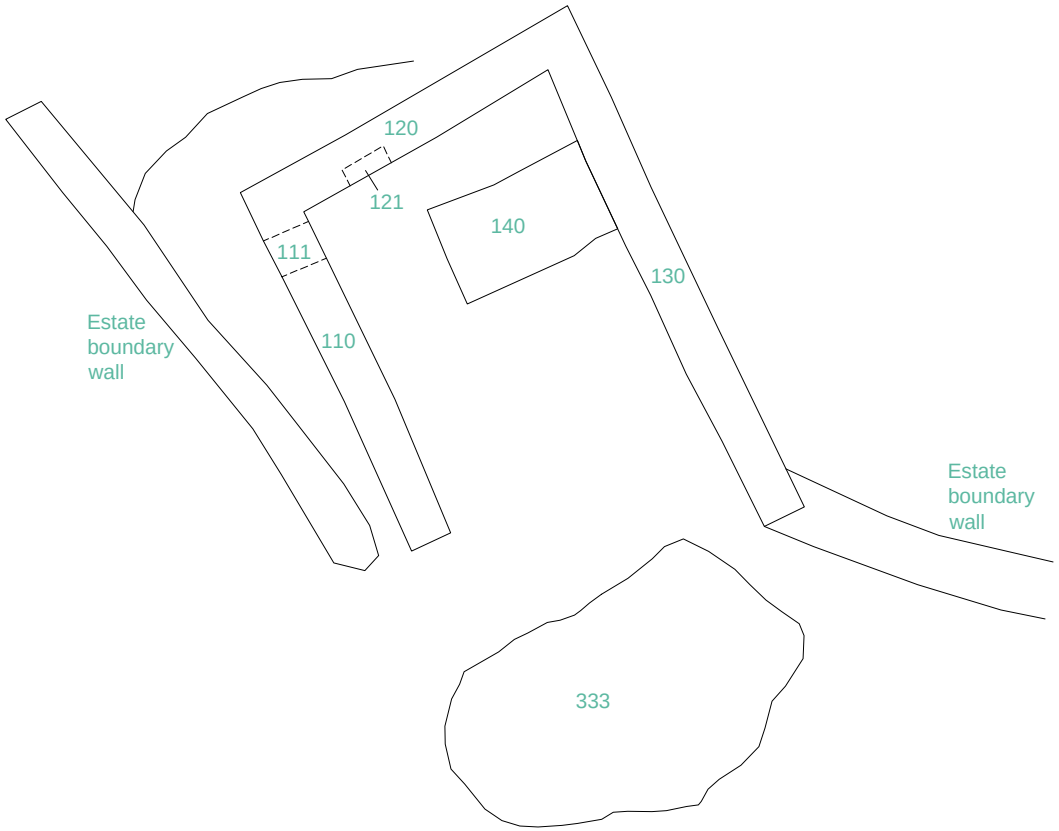
2016.800–1: Copies of original letters and photographs relating to Coniston, Tilberthwaite and Greenburn Coppermines (Peter Fleming Collection).

2016.884: Notebook of material received, Coniston & Tilberthwaite mines 1865–1877 (Eric Holland Collection).

2016.887: Ledger of Coniston. Letter book 1837–1861; copies of letter from Feb 1837 to 1841 signed W.T; John Barratt's letter 1858 to 1861.

2016.888: Ledger: Coniston day book 1871–1872: Tutwork at Tilberthwaite. (Eric Holland Collection).

Building 100 - plan

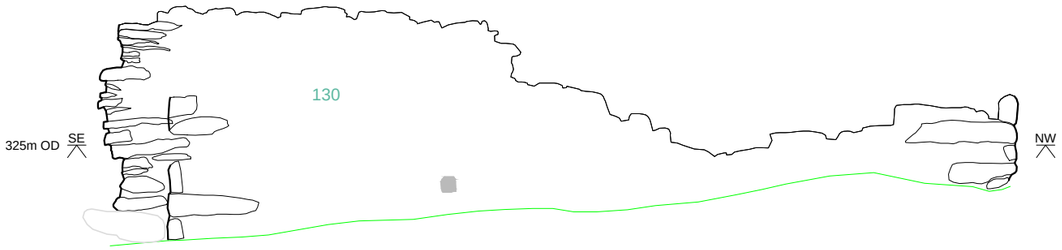


Tilberthwaite Mine, building 100: plan

Figure 14

Building 100 - exterior elevations

A



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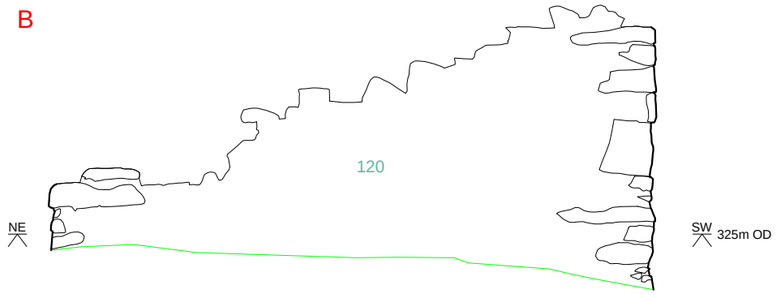

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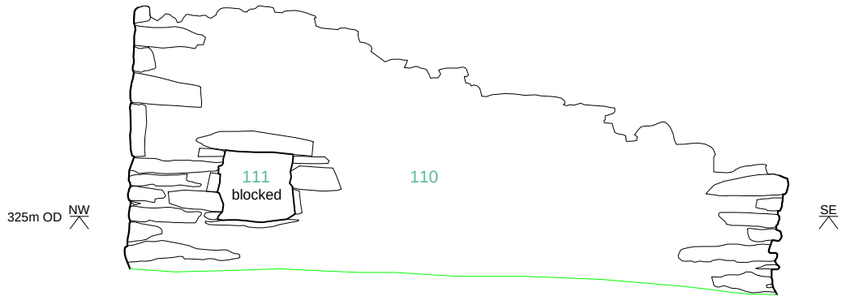

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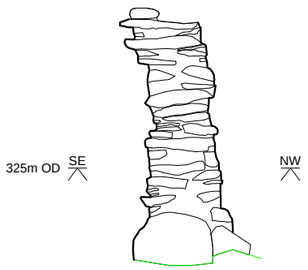

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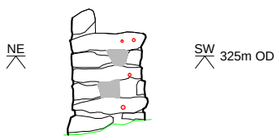
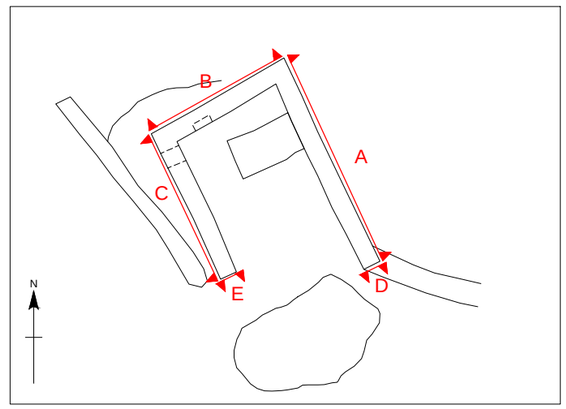


Key

void

ground level

drill hole



0 2m

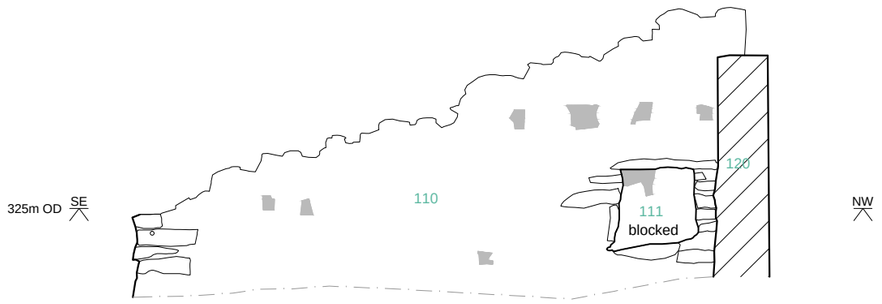
scale 1:50 @ A3

Tilberthwaite Mine, building 100: exterior elevations

Figure 15

Building 100 - interior elevations

A



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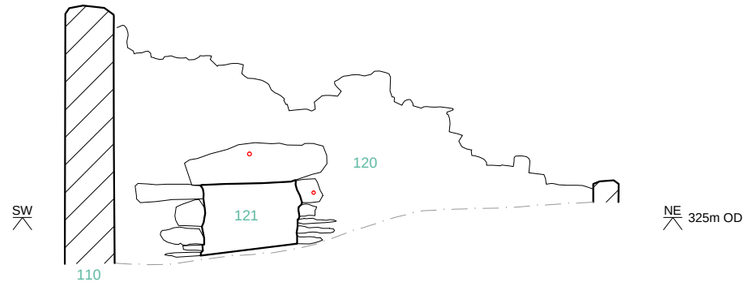
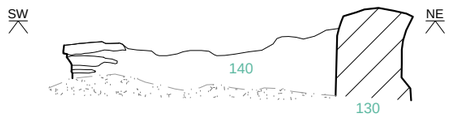


C

D



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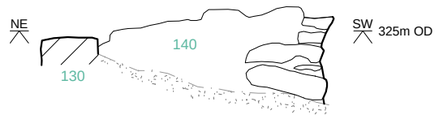
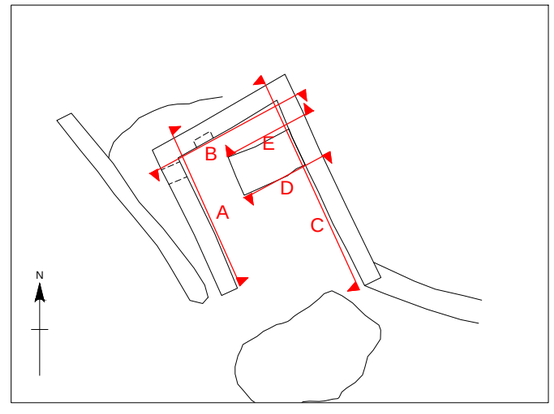




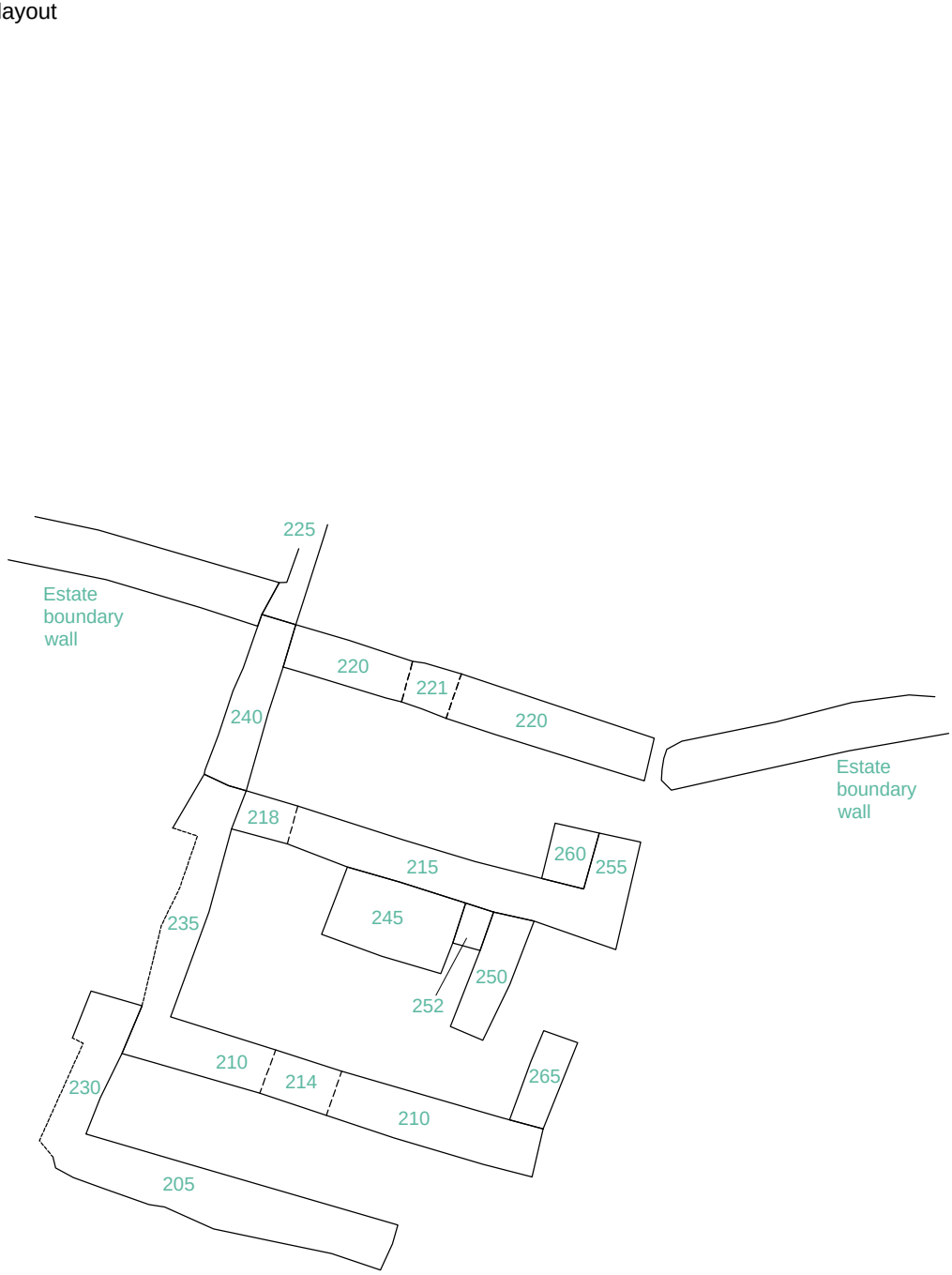
0 2m

scale 1:50 @ A3

Tilberthwaite Mine, building 100: interior elevations

Figure 16

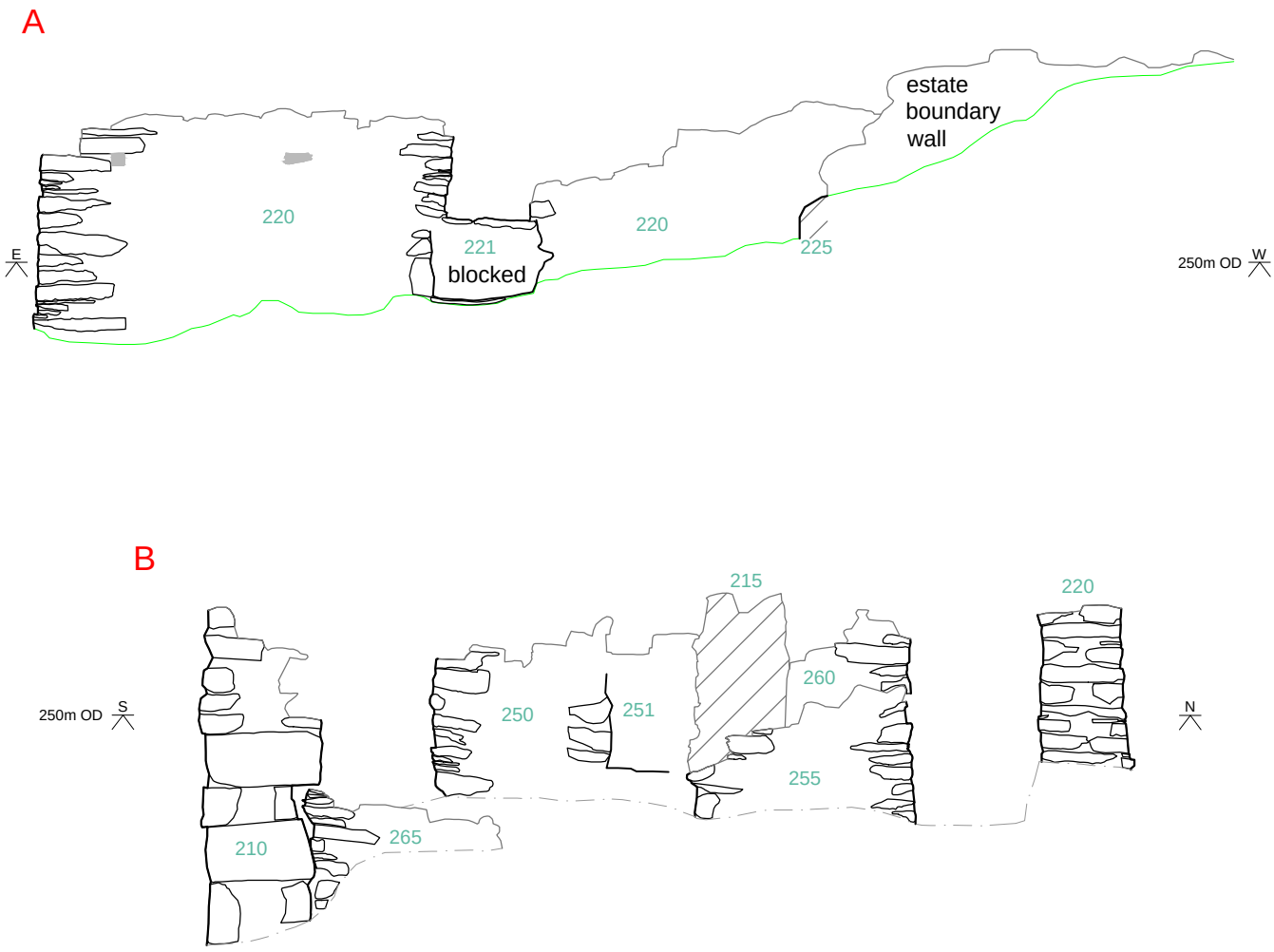
Building 200 - layout

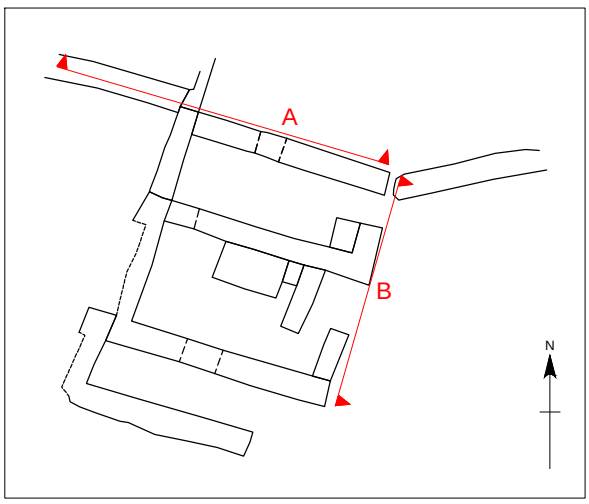


Tilberthwaite Mine, building 200: plan

Figure 17

Building 200 - exterior elevations





Key

void

ground level

ground level obscured

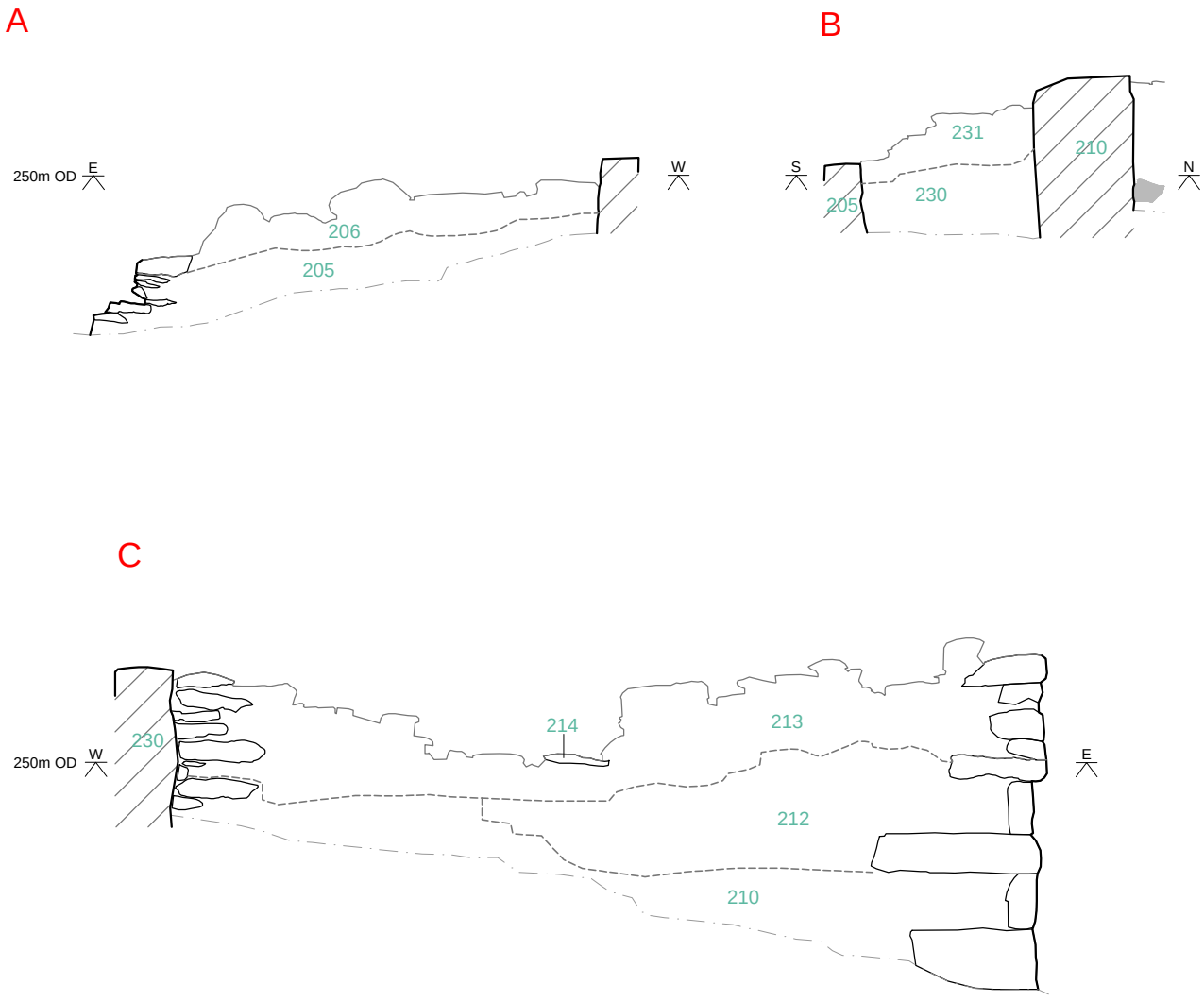
projecting wall

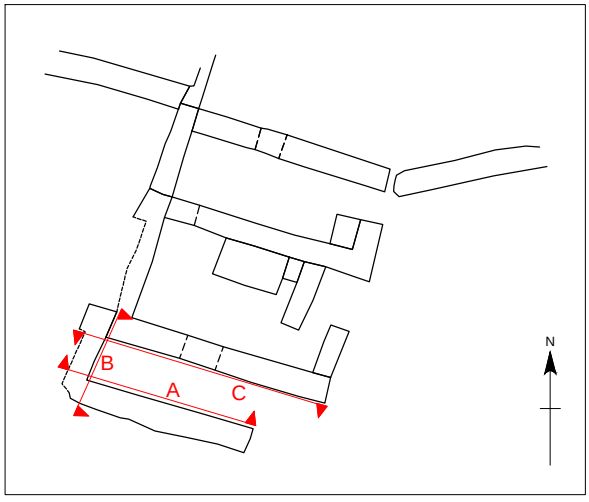
0 2m

scale 1:50 @ A4

Tilberthwaite Mine, building 200: exterior elevations *Figure 18*

Building 200 - interior elevations





Key

void

ground level obscured

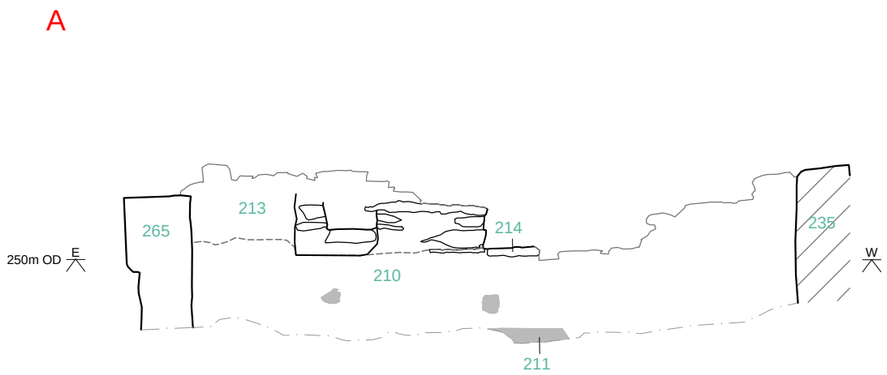
projecting wall

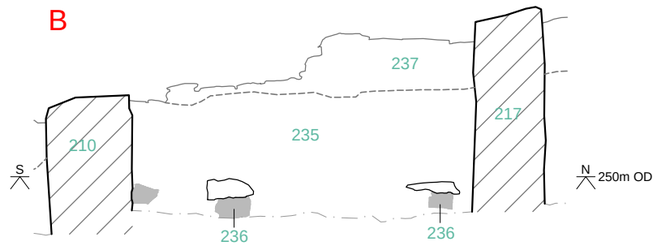
0 2m

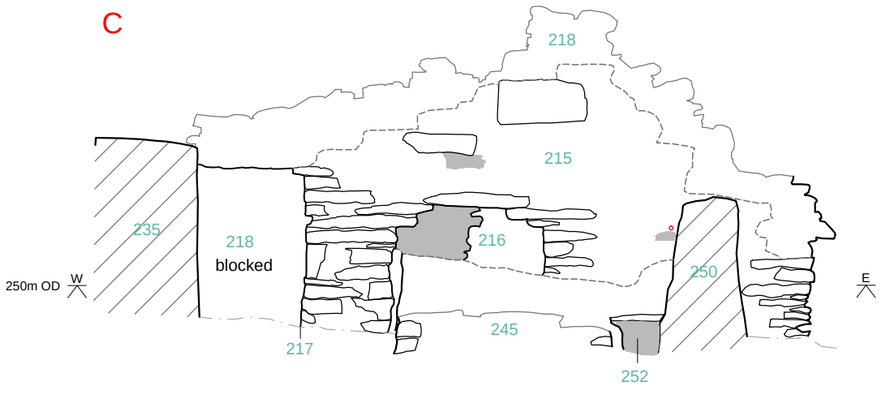
scale 1:50 @ A4

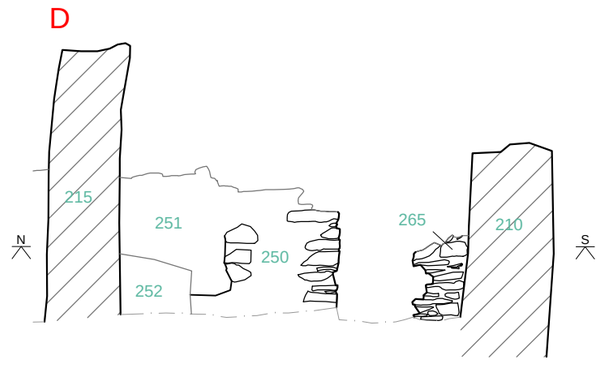
Tilberthwaite Mine, building 200: room 1 interior elevations *Figure 19a*

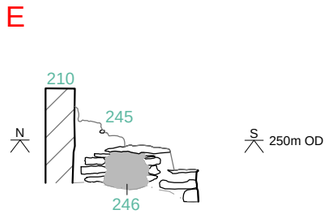
Building 200 - interior elevations

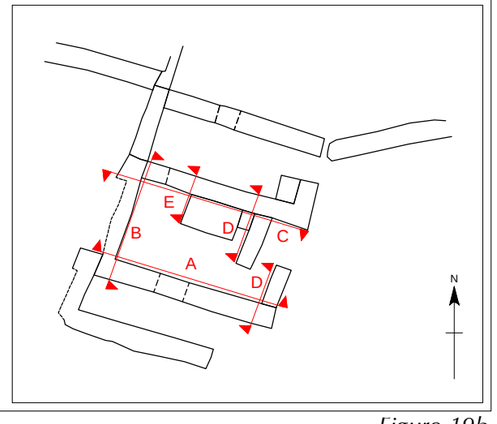












Key

- void
- ground level obscured
- projecting wall
- drill hole

0 2m

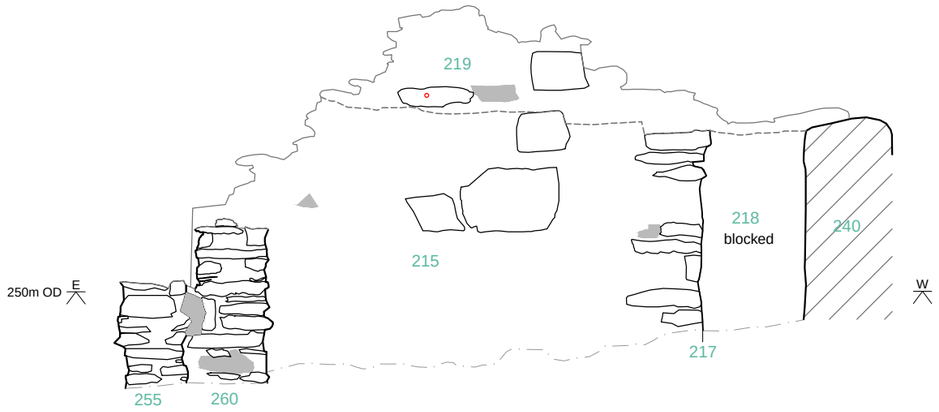
scale 1:50 @ A3

Tilberthwaite Mine, building 200: room 2 interior elevations

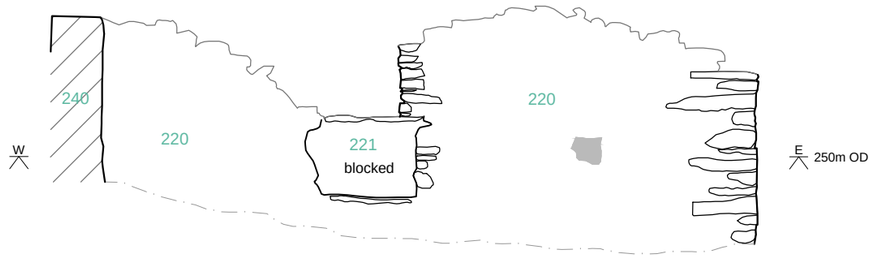
Figure 19b

Building 200 - interior elevations

A



B



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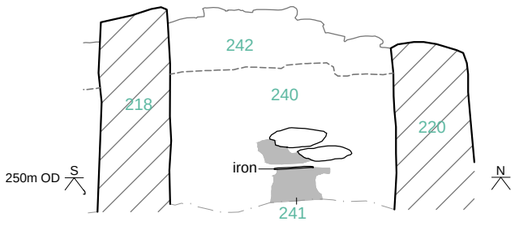
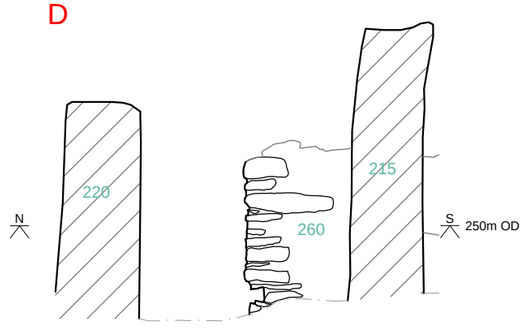


D

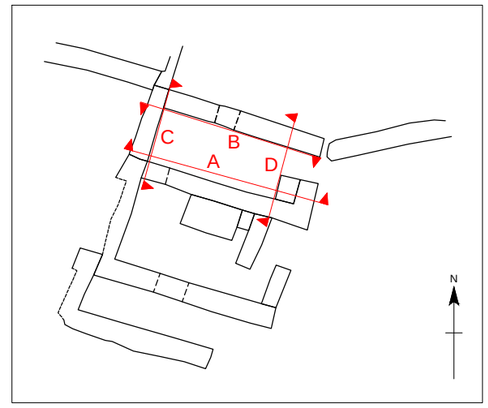


Key

- void
- ground level obscured
- projecting wall
- drill hole

0 — 2m

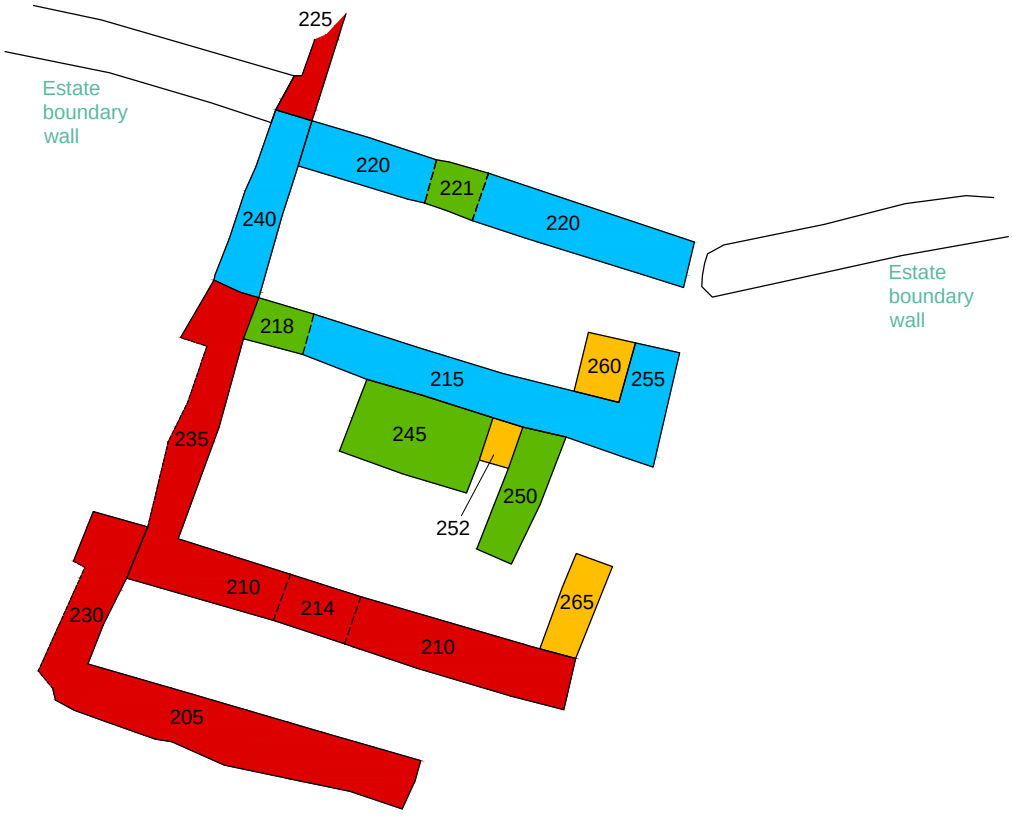
scale 1:50 @ A3



Tilberthwaite Mine, building 200: room 3 interior elevations

Figure 19c

Building 200 - layout



Tilberthwaite Mine, building 200: phased plan *Figure 20*

APPENDIX 1 TILBERTHWAITE COPPER MINE: SITE INVENTORY

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
100 **Group**	**Building (Smithy)**: Single cell structure of coursed random rubble comprised of three walls keyed at each corner. Open to the south, with no evidence of a fourth wall. Rear wall features a hearth, and there is a second hearth/forge projecting internally from the east elevation; this may be a later addition. West wall has a blocked window and internal joist holes, suggesting a second storey. Building is probably a smithy associated with the mine.	**High** evidential and historical (illustrative) value as building 100 contributes to the understanding of the chronological development of the mine and illustrates the role of the mine smithy in the wide site.	Walls (110) (120) (130) Hearth (140) Boundary walls (801) (802) Spoil tip (333)	High	18th–19th century	 
110	**West wall:** Coursed random rubble construction, large, rectangular quoins at corner with north wall (120) and at southern end of 110. Through-stones at end with evidence of drill holes (3 visible). Includes blocked window (111) and internal joist holes (112)	**High**: evidential value as 110 contributes to understanding the chronological sequence and adaptation of the building	Building (100) Window (111) Joist holes (112)	High	18th–19th century	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
111	**Blocked window:** West wall (110) includes a blocked window with large, rectangular blockwork forming the lintel, sill and uprights. Infill blockwork is not coursed and is comprised of irregular blocks.	**Medium**: evidential value as 111 contributes to understanding of the changing function of the building	Wall (110)	Medium	18th–19th century	
112	**Joist holes:** Series of four intact joist holes, measuring approx. 20cm by 30cm, and a partially collapsed fifth hole. Potentially for a second storey or platform, located above blocked window (111) or more likely for a timber support frame for the hearth bellows.	**Medium:** evidential value as 112 contributes to understanding the original form of the building	Wall (110)	Medium	18th–19th century	
120	**North rear wall:** Coursed, random rubble wall, keyed at each corner with quoins present formed of large rectangular blocks. Substantial collapse at east corner. Includes hearth/fireplace (121) and internal chimney/flue. Mortar present where the line of the chimney runs inside the wall.	**High:** evidential value as 120 contributes to understanding the chronological sequence and adaptation of the building, along with its function.	Building (100) Hearth (121)	High	18th–19th century	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
121	**Hearth:** Fireplace and chimney in wall (120). Large, rectangular blockwork supporting large, sub-rectangular lintel, with a drill hole through. Lintel is very thin.	**High:** evidential value as 121 contributes to understanding of the chronological sequence and adaptation of the building, along with its function.	Wall (120)	High	18th–19th century	
130	**East wall:** Coursed random rubble construction with quoins in-situ at southern end. Southern end, along with part of the upper wall, has been rebuilt (132) so original quoins are now part of wall fabric. Includes small hole low on the wall (131)	**High:** evidential value as 130 contributes to understanding of the chronological sequence and adaptation of the building	Building (100) Hole (131), Rebuild (132)	High	18th–19th century	
131	**Void:** Small hole, 10cm by 15cm, through wall (130) positioned low on elevation. Function unclear.	**Medium:** evidential value as 131 contributes to understanding of the development and function of the building. Value would be higher if the function of 131 were better understood.	Wall (130)	Medium	18th–19th century	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
132	**Rebuild:** The southern end of wall (130) has been rebuilt on a slightly different alignment. The rebuild section extends beyond the original end quoins to an iron fence post set in a large boulder, on the line of the boundary wall/fence (802), creating a continuous line between the wall of the building and the boundary. The change in the blockwork, and more crude construction method, suggests a portion of the upper wall is also part of this rebuild.	**High:** evidential and historic (illustrative) value as 132 contributes to understanding of the chronological sequence and adaptation of the building and illustrates its relationship to the manor boundary and the implications this had for the ownership and operating of the mine.	Wall (130) Boundary wall (802)	High	19th century	
140	**Hearth:** Rectangular platform of coursed random rubble construction with occasional thin slate tiles between courses. No evidence of bellow hole although rubble collapse obscures all three sides of the hearth. Not keyed into east wall (130) so added later.	**High:** evidential and historical value (illustrative) as 140 contributes to understanding of the chronological sequence and adaptation of the building and illustrates its function as a mine smithy.	Building (100) Wall (130)	High	19th century	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
200 **Group**	**Building:** Three cell structure of coursed random rubble construction, comprised of a rear wall to the west with four walls projecting from it aligned east-west, (205) (210) (215) (220), open fronted to the east with no suggestion that the building was ever fully enclosed. Three free-standing walls have been added to the east to create partially enclosed interior spaces (250) (255) (260). A hearth/forge (245) is present in the central cell. There is evidence of a number of phases of modification and rebuild. The building is aligned with boundary wall (802) which meets its NW corner and departs from the NE corner as (803). The surviving structure is entirely to the south of the boundary.	**High:** evidential and historical (illustrative) value as building 200 contributes to understanding of the chronological sequence of development at the mine and illustrates the role of the mine smithy within the wider site.	Walls (205) (210) (215) (220) (225) (230) (235) (240) (250) (255) (260) Hearth (245) Floor (265) Wall (436) Boundary wall (802) Boundary wall (803)	High	18th–19th century	  

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
205	**Wheel pit?** External south wall. Coursed, random rubble wall surviving to 40cm internally. Externally the wall is built into the hill/spoil, or it has built up against it over time. (205) forms the external southern wall of the building and is 4.54m long. Formed of very large, rectangular blocks, with quoins to east (open) and west ends. West corner section is tied into rear wall (230) in both lower and upper sections. The evidence suggests that the upper section of both (205) and (230) belong to a later phase of rebuilding, numbered (206) and (231) respectively. Its construction (it includes some very substantial blockwork) and location indicates this was a water wheel pit for a wheel providing power to the stamps.	**High:** evidential value as 205 contributes to understanding of the chronological sequence and adaptation of the building	Building (200)	High	18th–19th century	
210	**Internal south wall:** Substantial wall, standing 1.40m high and considerably higher than (205) to the south. Not full height but nor surviving evidence of a gable. (210) forms the external elevation of the Building 200. Very large, rectangular foundation stones and	**High:** evidential and historical (illustrative) value as 210 contributes to understanding of the chronological sequence and adaptation of the building and illustrates its changing	Building (200) Rear walls (230) (235) Rebuilds (212), (231) (237) Floor (265) Beam slot (211)	High	18th–19th century	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
	quoins, also large through stones at the east end. The size of the foundation stones suggest that the structure was constructed to withstand vibration from internal machinery such as stamps. At the rear corner (210) abuts rear wall (230) at the lower courses, and the upper courses are part of a rebuilding phase numbered (212) and (231) respectively. (210) is keyed into rear wall (235) at the lowest courses, with the upper courses part of a rebuilding phase numbered (212) and (237). The corner created by walls (210), (230) and (235) is offset. As the external rear wall of the building is buried under spoil.	function from stamp mill to smithy.	Window (214)			
211	**Beam slot:** Wall (210) has a linear recess internally, located above the present floor of the building. Possibly for a wooden beam inserted to support and internal frame for machinery, possibly stamps.	**High:** evidential and historical (illustrative) value as 211 contributes to understanding of the chronological sequence and adaptation of the building and illustrates its function as a stamp mill.	Wall (210)	High	18th–19th century	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
212	**Rebuild:** At the east end of (210), a rebuilding phase is apparent numbered (212).	**High:** evidential value as 212 contributes to understanding of the chronological sequence and adaptation of the building.	Wall (210) Floor (265) Rebuild (266)	High	19th century	
214	**Window:** Wall (210) includes the partially collapsed remains of a window or opening, now traceable through the large, rectangular sill stones and eastern uprights	**Medium:** evidential value as (214) contributes to understanding of the chronological sequence and adaptation of the building.	Wall (210)	Medium	18th–19th century	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
215	**Internal north wall:** Coursed, random rubble construction, standing 2.76m high, and tapering to support the apex of the roof so almost full height survives. Mortar patches present on both north and south faces of the wall. North face has no features but some unusual large stonework corresponding with the internal flue of hearth (216) on the south face. An infilled former doorway to the west (217) obscures the relationship with the rear wall/s of (200) making it impossible to place the phasing of wall (215) and its associated features within the chronological sequence of the building as a whole. (215) includes a phase of rebuilding to the upper courses (218) and has a number of key diagnostic features relating to the buildings evolving function over time.	**High:** evidential and historical (illustrative) value as 215 contributes to understanding of the chronological sequence and adaptation of this part of the building and illustrates its changing function from stamp mill to smithy.	Building (200) Walls (235) (240) (250) (255) (260) Hearths (216) (245) Infilled door (217) Rebuilds (218) (237) (242)	High	18th–19th century	 

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
216	**Hearth:** Wall (215) includes a former hearth with a flue/chimney internally within (215). The hearth was later infilled with blockwork for the construction of forge (245). The presence of (216) is denoted by construction breaks in (215) forming the now infilled arched opening.	**High:** evidential and historical (illustrative) as 216 contributes to understanding of the chronological sequence and adaptation of the building and illustrates its function as a smithy.	Wall (215) Hearth/forge (245)	High	18th–19th century	
217	**Infilled door:** Wall (215) contains a former doorway (217) which has been infilled. The infill masonry is of less formal coursing than the rest of (215) and contains mortar. No lintel is present above the doorway, although the stonework above the door is part of a later phase of rebuilding across walls (215) and rear walls (235) and (240), numbered (218) (237) and (242) respectively. It is likely the removal of the lintel and infilling of the door were carried out during a phase of rebuilding and consolidating of (200)	**Medium:** evidential value as 217 contributes to understanding of the chronological sequence and adaptation of the building.	Wall (215) Rebuilds (237) (218) (242)	Medium	18th -19th century	
218	**Rebuild:** Wall (215) includes a rebuilt upper section (218) that spans doorway (217) and continues across the upper portion of (215). It	**High:** evidential value as 218 contributes to understanding of the chronological	Wall (215) Rebuilds (237) (242)	High	19th century	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
	is of a different construction to the earlier phase, with more random construction and less formal coursing with no mortar. Rebuild (218) is keyed into rebuilding of the upper courses of rear wall (240) numbered (241). (241) and (218) are therefore part of the same phase of rebuilding.	sequence and adaptation of the building.	Wall (250)			
220	**External north wall:** Coursed random rubble construction surviving to 2m, with mortar present on infilled and rebuilt sections. No indication surviving of the roof profile. Includes an infilled door (221). (220) abuts rear walls (225) and (240) at the lowest courses and includes a rebuilt phase (222) that is tied into the rebuilt upper section of (240) numbered (242). (222) is built over rear north wall (225) and therefore postdates it. (220) is aligned with boundary wall (802) (803)	**High:** evidential and historic (illustrative) value as 220 contributes to understanding of the chronological sequence and adaptation of the building and illustrates its relationship to the manor boundary and the implications this had for the ownership and operating of the mine.	Building (200) Walls (240) (225) Infilled door/window (221) Rebuild (222) (242) Boundary walls (802) (803)	High	18th–19th century	 

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
221	**Infilled doorway/window:** (220) includes an infilled doorway (221). The doorway is discernible through construction breaks in the fabric of (220) and an in-situ door sill, at ground level on the external north face and approx. Interpreted as a doorway rather than an ore shoot. The door was later infilled to form a window or opening, the sill and east reveals of which survives. The western portion of this feature is part of (222), a later phase of rebuilding. The door is infilled with roughly rectangular, coursed rubble stone that includes traces of lime mortar.	**Medium:** evidential value as 221 contributes to understanding of the chronological sequence and adaptation of the building.	(Wall 220) Rebuild (222)	Medium	18th - 19th century	
222	**Rebuild:** (220) includes a phase of rebuilding (222) that only appears to extend as far as door/window (221 (222) is keyed into, and considered to be the same phase as, rebuilding of rear wall (240) numbered (242).	**High:** evidential as 222 contributes to understanding of the chronological sequence and adaptation of the building	Walls (220) (240) (225) Rebuild (242) Window (221)	High	19th century	
225	**Rear wall, north:** Projecting from the extant building to the north was a section of rear wall comprised of coursed random rubble	**High:** evidential and historic (illustrative) value as 225 contributes to understanding	Building (200) Wall (220) Rear walls (240)	High	18th century	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
	blockwork, standing 0.75m high. This may be the last surviving remnant of a fourth cell. A faint, poorly aligned row of east-west stones and a flattened area to the north of (200) are the only other scant evidence that the building may once have had four cells. It should be noted that if a fourth cell were present it would lie over the manor boundary. Wall (220) abuts rear wall (225), with the rebuilt upper section (222) built over the top. (225) is assumed to be the same phase as the lower courses of rear walls (240) and (235) and likely to be one of the earliest surviving elements of building (200)	of the chronological sequence and adaptation of the building and illustrates its relationship to the manor boundary and the implications this had for the ownership and operating of the mine.	(235) (230) Boundary wall (802) Rebuilds (222) (242)			
230	**Rear wall, south:** The surviving rear wall of (200) has been assigned four numbers south - north (230), (235), (240), (225) to allow for phasing as it is not clear, because of the projecting east-west walls, whether the rear wall is, or ever was, one continuous wall. (230) is the rear wall of the southern cell of the building. It is coursed, random rubble drystone construction and has an upper	**High:** evidential value as 230 contributes to understanding of the chronological sequence and adaptation of the building	Building (200) Walls (205) (210) Rebuilding phase (206) 231) (212)	High	18th–19th century	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
	rebuild (231) visible in its relationship with walls (205) and (210).					
231	**Rebuild:** Wall (230) includes a phase of rebuilding of the upper section (231)	**High:** evidential value as 231 contributes to understanding of the chronological sequence and adaptation of the building	Wall (230) Rebuilding phase (206) (212)	High	19th century	
235	**Rear wall, internal south:** (235) is the rear wall of the central cell of (200) of coursed random rubble construction with mortar present across the elevation. (235) is keyed into wall (210) at the lower courses making them contemporaneous. Where walls (235) and (215) meet, the relationship between the two walls is obscured by the presence of doorway (217). The upper courses of (235) are part of a phase of rebuild along with (210) and (215)	**High:** evidential value as 235 contributes to understanding of the chronological sequence and adaptation of the building.	Building (200) Walls (210) (215) Rebuilding phase (237) (212) (218) Holes (236) Infilled door (217)	High	18th–19th century	
236	**Voids:** 0.20cm above the existing rubble covered floor two holes were recorded in the rear wall (235). These are too small to be ore chutes, too low down to be floor joists, and too high up the wall (with no corresponding holes elsewhere) to be an inserted wooden floor. As the area behind building (200) is now covered by spoil, it is unclear whether the	**High:** evidential and historical (illustrative) value as 236 contributes to understanding of the chronological sequence and adaptation of the building and illustrates its function as a stamp mill (DO THEY?)	Wall (235)	High	18th–19th century	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
	holes ever extended fully through the rear wall (they were examined and found to extend approx. 0.6m into (235). It is possible that they lined up with recess/beam slot (211) in wall (210) and together provided wooden supports for machinery.					
237	**Rebuild:** Wall (235) includes a phase of rebuilding of the upper section (237). Rebuild (237) is keyed into rebuilding of the upper courses of walls (210) and (215) numbered (212) and (218) respectively. (237) (212) and (218) are therefore part of the same phase of rebuilding.	**High:** evidential as 237 contributes to understanding of the chronological sequence and adaptation of the building	Wall (235) (210) (215) Rebuilding phase (212) (218)	High	19th century	
240	**Rear wall, internal north:** Rear wall of the northern cell, coursed, random rubble construction with mortar across the elevation. Wall (220) abuts (240) making the latter the earlier structural element. Where wall (240) meets wall (215) the phasing relationship between them is obscured by the presence of doorway (217)	**High:** evidential value as 240 contributes to understanding of the chronological sequence and adaptation of the building	Building (200) Walls (215) (220) Rebuilding phase (218) (242) (222) Hearth (241)	High	18th–19th century	
241	**Hearth:** A hearth structure is inserted into rear wall (240), comprised of a now partially collapsed fireplace with an internal (obscured)	**High:** evidential value as 241 contributes to understanding of the chronological	Wall (240)	High	19th century	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
	lintel formed from an iron rail supported on bricks. Inside the flue at least two sections of partially collapsed salt-glazed pipe had been inserted, running vertically behind (240). The flue/chimney would have an opening on the external face of (240) however this is buried in spoil and not visible. Could the pipe have been inserted to keep this open as spoil was built up against the building? While construction breaks in the fabric of (240) to insert the hearth are hard to discern, slight changes to both construction method and stonework indicate (241) it is a later insertion.	sequence and adaptation of the building				
242	**Rebuild:** Wall (240) includes a phase of rebuilding of the upper section (242) Rebuild (242) is keyed into rebuilding of the upper courses of walls (215) and (220) numbered (218) and (222) respectively. (242) (218) and (222) are therefore part of the same phase of rebuilding.	**High:** evidential value as 242 contributes to understanding of the chronological sequence and adaptation of the building	Wall (240) (215) (220) Rebuilding phase (218) (222) Hearth (241)	High	19th century	
245	**Hearth/forge:** Wall (215) originally included hearth (216), later infilled and a new forge structure built (245).	**High:** evidential and historical (illustrative) value as 245 contributes to understanding of the	Building (200) Wall (215) (250) Hearth (216) Bellow hole	High	19th century	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
	The infill and forge are of one construction phase, and the feature includes a bellows hole (246) to the west. The original height of the forge is unclear as a build-up of rubble has accumulated on top of the forge, but it is assumed to be similar to that which survives.	chronological sequence and adaptation of the building and illustrates its final function as a smithy.	(246) Recess (252)			
246	**Bellows hole:** To the west of hearth (245) is a hole into the structure believed to be for the application of air via bellows during forging.	**High:** evidential and historical (illustrative) value as 246 contributes to understanding of the chronological sequence and illustrates function of the building as the mine smithy.	Hearth (245)	High	19th century	
250	**East wall:** Three freestanding walls have been constructed at the eastern (open) front of building (200). Abutting the eastern end of wall (215) and partially enclosing the central cell is wall (250) a random rubble, roughly coursed block of drystone walling 1.83m x 0.58m. Potentially inserted at the same time as hearth (245) the function of this structural element is assumed to be to provide some shelter to a previously open-fronted building	**Medium:** evidential value as 250 contributes to understanding of the chronological sequence and adaptation of the building.	Building (200) Hearth/forge (245) Rebuild (251) Recess (252)	Medium	19th century	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
	while smithing took place within.					
251	**Rebuild:** (250) includes a rebuilt section discernible as a construction break, possibly for the insertion of a large slab used to create a recess between wall (250) and forge (245)	**Medium:** evidential value as 251 contributes to understanding of the chronological sequence and adaptation of the building	Wall (250) Recess (252)	Medium	19th century	
252	**Recess:** A small recess is located between wall (250) and forge (245). This opening has no connection internally with either the forge or wall (215), making its function unclear. The presence of large quantities of rumble on, in and around the feature also make ascribing a function difficult. (250) has been partially rebuilt to allow the insertion of a large slab to create recess (252) and as (250) is considered a late addition to the building, this recess is accordingly assumed to belong to a late phase - and may even post-date mining operations.	**Medium:** evidential value as 252 contributes to understanding of the chronological sequence and adaptation of the building	Wall (250) (215) Rebuild (251) Hearth/forge (245)	Medium	19th century	
255	**East wall:** A second freestanding block of wall partially enclosing the open east end of the building and abutting wall (215) and wall	**Medium:** evidential value as 255 contributes to understanding of the	Building (200) Wall (215) (260)	Medium	19th century	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
	(260). Largely collapsed but appears to have been roughly coursed random rubble drystone construction. (255) is assumed to be either a buttress for providing stability or to partially enclose the buildings northern cell providing some shelter for the interior.	chronological sequence and adaptation of the building				
260	**East wall:** A third freestanding wall abutting the north face of wall (215) and wall (255). It is not clear what function (260) served, nor whether it or (255) are earlier structural element. Coursed, random rubble construction, drystone although mortar is present at the (not keyed) corner formed between (260) and wall (215)	**Medium:** evidential value as 260 contributes to understanding of the chronological sequence and adaptation of the building	Building (200) Wall (255) (215)	Medium	19th century	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
265	**Floor:** The floor of building (200) has been raised and levelled more than once to counter the rise of the hill. The earliest phase of coursed, random rubble blockwork used to raise the floor is (265)	**High:** evidential value as 260 contributes to understanding of the chronological sequence and adaptation of the building		High	18th–19th century	
266	**Rebuild:** Floor (265) has a rebuilt upper section that includes a heavily collapsed wall stub which is also keyed into (212) the upper rebuilt section of wall (210). This phase of rebuilding therefore occurred at the same time.	**High:** evidential value as 266 contributes to understanding of the chronological sequence and adaptation of the building		High	19th century	
310	**Pond:** Earthwork remains of sub-rectangular pond or holding tank, 4.4m x 6m, designed as holding pond for water wheel associated with building (200). Surrounded to E and W by	**High:** considerable evidential value as it contributes to our understanding of water management on site,	Leat (311) Overflow channel (312) Building (200)	High	19th century	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
	grass-covered banks, 2.8m wide x 0.8m high; bank to W 3.5mwide x 0.6m high. Feeder leat (311) enters pond from W and overflow channel (312) exits from S. Pond constructed on—and so postdates—tip (321).	especially the use of water-power at building (200) during its use as a stamping mill. Its relationship with tip (321) adds to an understanding of site chronology.	Tip (321)			
311	**Leat:** Shallow, discontinuous leat, 2m wide, running W-E for approx. 78m between the beck and holding pond (310). Excavated into the S-facing slope, for most of its length the leat has an upcast bank on its S side. The leat may cut through upcast and spoil (possibly tips (328) and (329)) but direct relationships are confused by vegetation cover and erosion.	**High:** considerable evidential value as it contributes to an understanding of water management on site. It also contributes to an understanding of relative site chronology.	Pond (310) Tips (328) and (329)	High	19th century	
312	**Overflow channel:** A shallow gully, 22m long, running SW from pond (310) towards the beck. The gully is narrow and 0.4m wide at the pond bank and thereafter is shallow and 0.7m wide. It can be followed along the W edge of tip (321) and may then turn SW towards structure (325). The gully is assumed to be an overflow for pond (310).	**High:** considerable evidential value as it contributes to an understanding of water management on site. It also contributes to an understanding of relative site chronology.	Pond (310) Tip (321) Structure (325)	High	19th century	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
321	**Spoil tip:** Large, flat-topped spoil tip, overlain to the W by tip (324) and cut into by leat (311) and pond (310). The original contours of the tip are preserved to S and SW where it is retained by wall (322) but much of the E side has been eroded. The relationship between the tip and building (200) cannot be established. The tip is composed of medium (<10cm) and fine (<5cm) rock, probably hand-dressing waste associated with mine opencasts (401) and (402).	**High:** considerable evidential value and historical value because of its relationship with the opencast mine workings. It contributes to our understanding of the ore dressing process and is also chronologically significant because of its stratigraphic relationships.	Pond (310) Channel (312) Wall (322) Tip (324) Opencast (401) and (402) Building 200)	High	18th century—overlying earlier tip?	
322	**Wall:** Short length of dry stone retaining wall, random rubble construction, 3.2m long x 0.6m high. Built against part of W facing slope of tip (321). Possible return to E at S end.	**Medium:** good evidential value for control and demarcation of surface spoil dumps.	Tip (321)	Medium	18th century	
323	**Wall or bank:** Low earth bank (at right end of ranging rod on image), 3.9m long x 0.6m wide x 0.15m high. Parallel with wall (325) and probably forms part (S wall?) of structure associated with (325); this may be a building for hand-dressing or possibly a buddle. Overflow channel (323) might cut through the	**Medium:** good evidential value (potentially) for hand-dressing or buddling activities. The value would increase if the function of this feature could be established.	Structure (325) Channel (323)		18th century earlier	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
	putative structure.					
324	**Spoil tip:** Low, irregular grass-covered spoil tip, approx. 10m x 10m. Probably derived from reworking of opencast (401) and possibly contemporary with area of unvegetated spoil (328) on S edge of (401). To the W spoil tip (324) overlies tip (321).	**High:** good evidential value relating to the reworking of the mine. Also contributes to an understanding of the site's relative chronology.	Opencast (40) Spoil spread (328) Spoil tip (321)		18th century	
325	**Structure:** Foundations of an L-shaped stone-built structure with a benched internal wall parallel to the main E-W long wall. The long wall is also parallel to earth bank (323) and the two features may be part of a single structure (hand-dressing shed or buddle). Overflow channel (312) might cut through the putative structure.	**Medium:** good evidential value (potentially) for hand-dressing or buddling activities. The value would increase if the function of this feature could be established.	Bank (323) Channel (312)		18th century or earlier	
326	**Wall:** A short length of low, stone wall immediately W of but separate from structure (325); 1.9m x 0.9m x 0.6m wide. Function unknown but may relate to (326).	**Low:** ambiguous nature of this feature reduces its significance. The value would increase if the feature's function could be established	Structure (325) - possibly	Low	18th century or earlier	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
327	**Spoil tip:** Thin spread of mineralised spoil, 4.5m x 2.5m on S edge of opencast (401). Much of spoil within the range 2-10cm and some finer material at <2cm. The small size of the spoil suggests sorting and hand-dressing. May be contemporary with spoil tip (324).	**High:** good evidential value relating to hand-dressing and reworking of main vein.	Opencast (401) Spoil tip (324)	High	18th century	
328	**Spoil tip:** Large, partially grass-covered spoil tip with flat top. On slope above beck and immediately S of opencast (404). Probably derived from working/reworking of (404). Boulder wall (330) at beck level revets and protects tip. Leat (311) has been excavated into the area between the tip and the S edge of (405) but the stratigraphic relationship between tip and leat cannot be established.	**High:** good evidential value as provides direct relationship between mine workings and spoil disposal.	Opencast (404) Wall (330) Leat (311)	High	19th century overlying earlier tip	
329	**Spoil tip:** Area of unvegetated spoil on the slope between leat 311) and the beck. May be separated from the E edge of tip (329) by a short length of boulder walling. Spoil probably derives from opencast (403) – if this is the case then the N part of tip (329) might be cut by leat (311).	**Medium:** potential evidential value for relationship between mine workings and spoil disposal but lack of archaeological relationships reduces the core value.	Tip (328); Opencast (403) Leat (311)—possibly cut by.	Medium	16th–17th century	

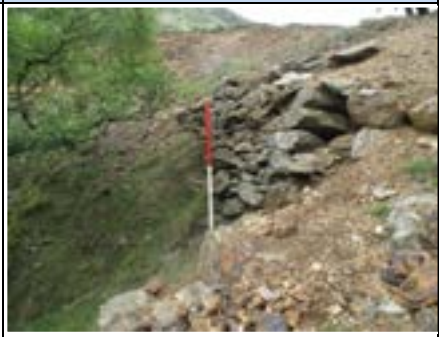
Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
330	**Boulder wall and weir:** Short length of wall of boulder-dump construction separating and protecting the SW base of tip (328) from the beck. It continues across the beck where it forms a weir above a natural bench and connects with the beck diversion channel (600G).	**High:** important evidential value relating to water management and flood control.	Tip (328)	High	Early 19th century	
331	**Mortar stone:** Earth-fast boulder, (possibly bedrock exposure), 1.1m x 0.6m x 0.45 high. Two sets of multiple shallow mortar hollows on top surface ranging from 6-12cms in diameter. The mortar stone is 9m N of opencast (408) and appears to be associated with buddle (?) (355).	**High:** considerable evidential and historical value relating to the earliest phase of mining and ore dressing. Unique association with buddling.	Buddle (?) (355) Opencast (408)		16th–17th century	
332	**Buddle:** Shallow linear hollow, 3m x 1m with some stone edging at NE end. Probable shallow spoil tip to SE might be associated.	**High:** considerable evidential and historical value relating to the earliest phase of mining and ore dressing. Unique association with hand dressing.	Mortar stone (331) Opencast (408)		16th–17th century	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
333	**Spoil tip:** Shallow spread of stone, burnt rock and cinder, 5m x 3.7m, immediately S of building (100). Probably waste from building (100) and the smithing forge.	**Medium:** good evidential value relating to activities and processes within building (100)	Building (100)		19th century	
334	**Spoil tip:** Large, flat topped spoil tip forming prominent linear landscape feature on S edge of opencasts (411-413). Covers drain feature (335) and may mask other, earlier dressing floor features. Most of spoil derives from deepening in 1850s of shaft to link with Horse Level and so is one of latest dateable features on site.	**High:** considerable evidential and historical value as the tip relates directly to the deepening of the main shaft to connect with Horse Level. Also of aesthetic value because of its landscape impact.	Drain (335) Tilberthwaite mine Horse Level	High	Mid-19th century	
335	**Drain:** Short length of open, stone-sided drain, 1.6m x 1.4m x 0.2m deep. Covered to N by tip (334). To S continues under boundary wall (803) for at least 2.5m as an inclined culvert with stone slabbed top. May continue under wall (338). Wall (803) respects and incorporates drain (335).	**High:** good evidential value for dressing floor features now buried beneath later tip. Also contributes to understanding of site chronology.	Tip (334) Wall (803)	High	18th–19th century	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
336	**Wall:** Short length of retaining wall immediately S of boundary wall (803), 1.65m x 0.45m high. Water flowing S from base of wall probably natural drainage rather than deliberate culvert. Possibly a relict dressing floor feature.	**Medium to Low:** reduced evidential value because of ambiguous nature of feature.	None	Medium-Low	18th–19th century	
337	**Spoil tip:** Small, cone-shaped spoil tip, 7m x 8m, truncated by later flood gully. To the N the tip is crossed by boundary wall (803) and to the S seals wall (342). The tip is composed of fine (<2cm) sand and gravel with a surface cover of small (<5cm), angular stones. The composition of the tip suggests jigging or more likely buddling waste.	**High:** good evidential value relating to dressing floor processes. Also contributes to understanding of site chronology.	Boundary wall (803) Wall (342)	High	18th–19th century	
338	**Wall:** Low retaining wall, 7.4m x 0.5m high, random rubble construction with a slight batter. Runs parallel with boundary wall (803) and retains a rectangular platform in front (S) of and crossed by (803). Top of platform covered with spread of mineralised spoil (dressing waste?) which to the SE extends beyond and down slope of the wall.	**High:** good evidential value relating to dressing floor processes. Also contributes to understanding of site chronology.	Boundary wall (803)	High	18th–19th century	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
340	**Wall:** Foundations of a wall, 6m x 1m, with external face to W. Forms the W side of platform (341). Wall may return E at S end.	**High:** good evidential value relating to dressing floor processes	Platform (341)	High	18th–19th century	
341	**Platform:** Rectangular level platform, 9m x 3m, bounded to the W and possibly S by wall (340). To the E the platform has been damaged by stream erosion and its original size and form cannot be established. Possibly a building platform but more likely a level activity area related to ore dressing.	**High:** good evidential value relating to dressing floor processes	Wall (340)	High	18th–19th century	
342	**Wall:** Short length of wall, 1.2m long, exposed in stream gully and covered by tip (337).	**Medium:** reduced evidential value because of ambiguous nature of feature. But of some significance because of its stratigraphic relationship with tip (337)	Tip (337)	Medium	18th–19th century	
343	**Spoil tip:** Very large flat toped spoil tip	**High:** of considerable	Wall (353)	High	Multi-phase	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
	forming a dominant landscape feature at the SE section of the Tilberthwaite mine site. The tip, 22m x 30m, is bordered on the S side by the beck and a small stream runs along the E side of the tip. A boulder wall (353) protects the base of the tip from stream erosion. The tip is unvegetated and is composed of a mixture of dressing waste and mine waste (the latter from shaft (351) on South Lode). Some of the mineral rich rock has been naturally cemented and forms distinctive layers, especially on the eroded E side.	evidential and historic value because of the information it can provide on the development and changing management of waste disposal. Also of aesthetic value because of its landscape impact.	Shaft (351) N extension of Track (703)			
344	**Wall:** Fragmentary foundations of wall, 3.6m x 1.2m, running down slope on same alignment as wall (346). Eroded to S and original length unknown. May be of two-phase construction with suggestion of earlier wall face along W facing side. No structural association observed with walls (346) and (345). May have formed part of wall around shaft hollow (351).	**Medium:** fragmentary nature of this feature reduces it value, but it is still of significance in forming part of a group of features around shaft hollow (351).	Shaft hollow (351)	Medium	18th–19th century	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
345	**Wall:** Retaining wall, random rubble construction, 4.4m x 1.4m high. Forms corner to SE with wall (346) and forms SW side of spoil-covered platform on SW side of Building (200).	**High:** good evidential and historical value values relating to the chronology and changing uses of Building (200).	Wall (346)	High	18th–19th century	
346	**Wall:** Foundations of stone wall, 2.9m long, with outer face to SE. Forms SE edge of spoil-covered platform defined to NE by Building (200) and bordered to SE by wall (345). The spoil may be stamping waste and the platform may have housed a set of stamps.	**High:** good evidential and historical value values relating to the chronology and changing uses of Building (200).	Building (200) Wall (345)	High	18th–19th century	
347	**Wall:** Revetment wall, 1.35m x 0.9m high resting on shallow relieving arch spanning the top of opencast (350) The wall holds back an area of eroded spoil defined to the NW by wall (354). Wall (347) post-dates opencast (350).	**High:** good evidential value relating to different phase of mining on South Lode.	Wall (354) Wall (35?) Shaft hollow (351) Opencast (350)	High	18th–19th century	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
348	**Wall:** Short length of retaining wall, 2.8 x 0.45m high, constructed on top of bedrock exposure at SW corner of opencast (350).	**Medium:** fragmentary nature of this feature reduces it value, but it is still of significance in forming part of a group of features around shaft hollow (351) and opencast (350).	Opencast (350)	Medium	18th–19th century	
350	**Shaft and opencast:** shaft run in as partially backfilled opencast immediately W of shaft hollow (351). Rock cut faces to N and S at W end, approx. 1m apart and up to 2.6m deep. Opencast continues to W and is spanned by relieving arch carrying wall (347). May also extend to N towards wall (345). The opencast continues further to E and W but is buried beneath later spoil (tips 321 and 343)	**High:** good evidential value as example of early vein work reused by later mine features. Provides chronological depth.	Wall (347) Wall (348) Wall (344) Wall (345) Shaft hollow (351)	High	16th–17th century	
351	**Subsidence:** Large oval hollow, 6m x 6m x 2m deep, presumably collapse cone at top of drawing shaft on South Lode. May have been sunk within pre-existing opencast working (350). Much of the material in tip (343) is derived from this shaft.	**High:** good evidential value because it is the principal archaeological evidence for working on the South Lode and can be related to a named feature in documentary records.	Opencast (350) Tip (343)		18th–19th century	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
352	**Wall:** Irregular wall of boulders with smaller stone packing, 6m x 0.6m high, on N side of beck. Retains a linear spoil bank. Probably designed as a barrier bank to prevent the beck overflowing into the South Lode shaft (351) during floods.	**High:** good evidential value for flood prevention operations.	Shaft hollow (351)	High	18th–19th century	
353	**Wall:** Irregular wall of massive boulders at SW base of tip (343) and incorporating natural rock outcrops and naturally placed boulders. Presumably built to reinforce the base of the tip and to protect it from flood damage.	**High:** good evidential value for flood prevention operations.	Tip (343)	High	18th–19th century	
354	**Wall:** Curved section of wall, collapsed to N and S. Retains an area of spoil above and W of shaft hollow (351) and may be associated with wall (347).	**Medium:** fragmentary nature of this feature reduces it value, but it is still of significance in forming part of a group of features around shaft hollow (351).	Shaft hollow (351) Wall (347)	Medium	18th–19th century	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
356	**Peat working:** An area of shallow peat cutting at NY 29746 00948 extending to the NW and outside the survey area. The edges of the cutting are still relatively sharp, suggesting a comparatively recent (20th century) date.	**Medium:** Low. Unlikely to be related to mining and so of limited evidential value but still of significance as relates to broader use of the historic landscape.	None	Medium-low	20th century	
401	**Opencast:** Opencast on North Lode immediately W of Building (100); 8m x 3m x 4m deep (at W end). Triangular in plan with apex to N where small stream enters (on side fault?); hanging wall to N. The opencast is backfilled to the E and the original working appears to have extended under the N wall of Building (100). To the W, at the base of the opencast, workings continue underground. Area of hand dressing waste (327) on S side of opencast and short section of retaining wall on slope to N.	**High:** good evidential value relating to early vein working and processing.	Wall (327) Building (100)	High	16th–17th century and later reworking	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
402	**Opencast:** Opencast on North Lode N of opencast (401). Face to N, the hanging wall, has collapsed and large blocks infill the opencast. 22m long x 2m wide. No observable spoil tip.	**High:** good evidential value relating to early vein workings.	No direct association	High	16th–17th century	
403	**Opencast:** Shallow, V-shaped channel excavated on surface line of the North Lode with a possible spoil tip to the S which is cut on its S side by leat (311). This may be a prospection trench to test the vein or a section of deeper, backfilled working.	**High:** good evidential value relating to early vein workings and prospecting.	No direct association	High	16th–17th century	
404	**Opencast:** Deep and visually dramatic opencast on the North Lode, 22m x 1.5m wide. At the E end is a shallow trench working. The main working slopes steeply down to the W to connect with a vertical shaft at least 10m deep. The shaft is marked as 'old drawing shaft' on an undated (early 19th cent.) mine plan in the CATMHS collection. It is a reworking within the original opencast. The spoil tip to the S, (328), is probably associated with the opencast and/or drawing	**High:** good evidential value relating to early vein working and processing. Good historical, value because of association with archive map.	No direct association	High	16th–17th century and later reworking	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
	shaft.					
405	**Opencast:** Shallow, wedge-shaped open working on the North Lode immediately W of opencast (404) and just below the point where the vein crosses the beck. 3.5m long x 0.8 wide to W and 1.6m to E. The working is weathered and eroded and may continue W but is filled with rubble and flood debris.	**High:** good evidential value relating to early vein workings and prospecting.	No direct association.	High	16th–17th century	
406	**Opencast:** Shallow working on small vein outcrop, 16.5m x 3m x 1.5m deep. Vein exposed in outcrop at W end, rest of opencast is a U-shaped trench excavated in superficial boulder clay deposits with occasional boulders and sporadic outcrop. Trench open at E end. Grass-covered spoil mound on S side and possibly at E end.	**High:** good evidential value relating to early vein workings and prospecting.	No direct association	High	16th–17th century	
407	**Opencast:** Narrow opencast on surface exposure of small mineral vein, 10.1m x 0.9m x 1.2 to 1.4m deep. The trench is open to the E, has vertical rock sides and the vein is exposed at the W end. Partially exposed spoil tip and area of spread spoil on the N side.	**High:** good evidential value relating to early vein workings and prospecting.	No direct association	High	16th–17th century	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
408	**Opencast:** Opencast workings on North Lode. Lower or E working, 12.5m x 1.5m x 2m deep; with excavated bedrock exposed on N-facing side. Working possibly backfilled but flooded pit at E end. Probably associated with buddle (332) and ore dressing mortar (331) on N side.	**High:** good evidential value relating to early vein workings and ore dressing, especially hand dressing and buddling.	Mortar stone (331) Buddle (332)	High	16th–17th century	
409	**Opencast:** Opencast workings on North Lode. 10.6m x 2.5m x 3.3m deep to water. Excavated rock on N-facing side of trench. Spread of grass-covered spoil on slope to S probably derived from opencast. There is a shallow, surface working, 3.4m x 1.6m x 0.8m deep, just beyond the W end of opencast (409)—probably a trial on North Lode	**High:** good evidential value relating to early vein working and prospection.	No association	High	16th–17th century	
410	**Shaft(?):** A flooded hollow, overgrown with reeds and covered by a collapsed fence, may be a shaft sunk on North Lode. It is associated to the N with a semi-circular, flat-topped spoil tip, possibly the site of a horse gin?	**High:** good evidential value for later prospecting or mining on this section of the main vein. Confirmation of a horse gin on the soil tip would increase the relative value.	No association	High	Late 19th–early 20th century	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
411	**Shaft or vein working:** Shaft on North Lode, partly covered at surface. Within fenced area and not recorded in detail during survey for Health and Safety reasons.	**High:** good evidential and historical value because it relates to the reworking of the main vein at depth during the 19th century.		High	19th century	
412	**Opencast.** Opencast working on vein between later shafts (411) and (413). Possibly backfilled to W and E. Within fenced area and not recorded in detail during survey for Health and Safety reasons.	**High:** good evidential value relating to early vein working and significance increased because of its chronological relationship with other workings.			16th–17th century and later reworking	
413	**Shaft:** Collapsed at surface, sunk on North Lode and connecting with Horse Level. Excavated rock face exposed on N side and remains of stone wall – perhaps masonry collar around shaft top – at S side. Within fenced area and not recorded in detail during survey for Health and Safety reasons.	**High:** good evidential and historical value because it relates to the reworking of the main vein at depth during the 19th century.		High	19th century	
414	**Prospection trench:** Linear hollow, 12.1m x 4.5m and 1.5m deep on E side, excavated into hill slope E of shaft (413). Shallow upcast mound, 4.9m wide, on W side of trench is a spoil tip. The trench appears to have been dug to locate the extension of North Lode. The vein here has actually been displaced to the S.	**High:** good evidential value relating to prospection and prospecting techniques.	Trench (415)	High	?	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
415	**Prospection trench:** A broad prospection trench, 30m x 3.7m, excavated along the surface outcrop of the displaced North Lode and finishing just below track (705). There is a terrace mid-way along the trench suggesting the excavation may have been undertaken in two stages. There is a second, very shallow trench just above track (705) associated with a discrete spoil tip at the top or SE corner of the main trench. There is another flat-topped spoil tip on the S central side of the main trench.	**High:** good evidential value relating to prospection and prospecting techniques.	Trench (414)	High	?	
416	**Prospection trench:** A series of shallow excavations, 1m wide and up to 0.2m deep, on the outcrop of a quartz vein on the N bank of the beck. The excavations are eroded but appear hand-cut. Presumably a prospection trench to test the mineral content of the vein.	**Medium:** good evidential value relating to prospection and prospecting techniques.	No association	Medium	?	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
417	**Prospection trench:** A shallow trench, 1m x 4m, on a bedrock outcrop with a quartz vein. There are at least two shot holes within the trench and the jagged nature of the rock sides suggests the use of high explosives. Perhaps relates to 20th century prospecting.	**Medium:** good evidential value relating to prospection and prospecting techniques.	No association	Medium	20th century	
450	**Opencast:** Opencast working on the W outcrop of Benson's Vein. It survives as a narrow rock cut trench. The S wall has collapsed to the E but to the W the trench is benched, and the vein is exposed. Presence of shot holes at W end suggests reworking	**High:** good evidential value relating to early vein working with some evidence for reworking.	Spoil tip (514)	High	16th–17th century and later reworking	
451	**Opencast:** Narrow opencast on surface outcrop of Benson's Vein, 4m x 0.9m x 2m deep. Large boulder in space above the opencast has three shallow drill holes, suggestive of attempt to blast and remove it. In front of the opencast is a level platform, 4m x 2m, with a short retaining wall on the N side. Beyond the platform is a partly overgrown spoil tip which appears to be cut through at its base by the overflow channel (604).	**High:** good evidential value relating to early vein working.	Overflow channel (604)	High	16th–17th century and later reworking (?)	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
452	**Opencast:** Shallow, partly infilled opencast on Benson's Vein, 8.4m long x 0.8m wide at E end and 3.5m wide at W end x 1.2m deep. Bedrock exposed on S side. Possible spoil tip – eroded and overgrown – on N side and running down slope into overflow gully B.	**High:** good evidential value relating to early vein working.	Overflow gully B	High	16th–17th century	
453	**Opencast:** Shallow opencast working on outcrop of Benson's Vein, 4.6m x 3.6m x 1m deep. Partly backfilled, possible spoil tip – eroded and overgrown – on N side.	**High:** good evidential value relating to early vein working.		High	16th–17th century	
454	**Opencast:** Large opencast working on outcrop of Benson's Vein. At the lower, E end is a rock cut trench, 4.3m x 0.6m x 2m deep which opens into larger excavation measuring 6m x 2.7 x 3.5m deep. Shot holes on the long walls of this area suggest reworking. At the W end a level has been driven underground on the course of the vein.	**High:** good evidential value relating to early vein working and later reworking underground.	No association.	High	16th–17th century and later reworking	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
455	**Mine level:** A rock cutting, 9m x 1.2m x 3m high, leading to an underground level driven on the course of Benson's Vein. On the left, just within the level, is an opencast to the surface. On the S side of the entrance cutting is a retaining wall (512).	**High:** good evidential value relating to early vein working and later reworking underground	Wall (512) Spoil tip (506)	High	16th–17th century and later reworking	
456	**Opencast:** An opencast working on a surface vein exposed on the top of the bank above the beck. The working, in the rock face above level (457), is 4.6m long and 3.1m deep with the vein is exposed on the E face. The working continues for 19m SE along the top of the slope as a shallow trench, 1.1m wide; there is a linear spoil mound on the W side. There is a small retaining wall built into the N end of the opencast.	**High:** good evidential value relating to early vein working.	Level (457)	High	16th–17th century	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
457	**Mine level:** Rock cut entrance to a level, 1m high x 1.1m wide. Probably driven to test the vein worked at surface by opencast (456) Rectangular shape of the level suggests a 19th century or later date.	**High:** god evidential value relating to underground mini techniques and to prospecting.	Opencast (456)	High	19th–20th century	
458	**Mine level:** Major drainage level, known as Waterfall or Gillhead level, begun in later 18thcentury and extended in 1840s to drain and cut Tilberthwaite North and Shaft Lodes. Rock-cut level entrance 3m high x 1.5m wide, driven on outcrop of Spedding's Vein.	**High:** very good evidential and historical value relating to technological and financial development of mine.		High	Late 18th century	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
501	**Spoil tip:** Linear spoil tip, flat topped and grass covered, 12m x 6m. Forms S side of entrance cutting to opencast (450). Overlain to W by spoil tip (514).	**High:** good evidential value because it relates to early extraction and waste disposal.	Opencast (450) Spoil tip (514)	High	16th-17th century and later reworking	
502	**Building:** Rectangular building, 3.3m x 2.6 x 0.6m high with tumbled walls 0.6m thick, constructed against rock outcrop (the outcrop forms W wall of the building). Doorway, 0.9m wide, in SE corner. N wall possibly cut into bank or may make use of pre-existing quarried feature (post-dates quarry (515)?). Probably a workers' shelter or cabin.	**Medium:** evidential value relating to probable industrial activities. Value would increase if more information available on function and date.	Quarry (515)	Medium	Late 19th–early 20th century?	
503	**Building:** Remains of L-shaped stone building, 1.9m x 3m, with probable entrance to NE, constructed against natural outcrop. Rubble construction with SW wall built against and incorporating earlier wall. Wall thicknesses vary from 1m to 0.4m. Stone mortar amongst rubble by NE entrance, 0.25m x 0.25m x 0.15m deep with single circular depression, 0.07cm diameter, on one	**High:** good evidential value relating to the early hand-dressing process. Value increased by presence of a mortar stone.	Spoil tip (504)	High	16th–17th century and later reworking	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
	face. Probably an ore-dressing cabin.					
504	**Spoil tip:** Small tip of hand dressing waste, 3.6m x 2.9m, butting against E wall of building (503).	**High:** good evidential value relating to the early hand-dressing process. Value increased by presence of a mortar stone in associated building (503).	Building (503)	High	16th–17th century and later reworking	
505	**Spoil tip:** Large flat-topped tip immediately E of—and derived from—opencast (454). Composed of fine mineralised material, less than 5cm in size. Probably hand dressing waste. Grass may mask some additional surface features.	**High:** good evidential value relating to the early hand-dressing and waste disposal processes.	Opencast (454)	High	16th–17th century	
506	**Spoil tip:** Small, grass-covered tip derived from opencast working above level (455).	**High:** good evidential value relating to the early hand-dressing and waste disposal processes.	Opencast/level (455)	High	16th–17th century	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
507	**Wall:** Short length of retaining wall, 1.2m x 0.6m high, constructed against E- facing slope and partly supporting track (706). May be W side of larger rectangular structure destroyed to E by a flood gully. May also form a group of structures with (508) and (509).	**High:** good evidential value as one of a group of structures probably associated with early hand dressing on Benson's Vein.	Wall (508) Structure (509)	High	16th–17th century	
508	**Wall:** Foundations of a retaining wall, 3m long, with possible returns to N and S. May be an extension of the structure formed by wall (507) and destroyed to the E by a flood gully. Some 1m E of the wall's N end is a mortar stone, 0.34m x 0.22m x 0.10m with a single depression, 0.08m diameter, on both faces.	**High:** good evidential value as one of a group of structures probably associated with early hand dressing on Benson's Vein. Value increased by presence of a mortar stone.	Wall (507) Structure (509)	High	16th–17th century	
509	**Building:** Rectangular building, 2.8m x 3.5m x 0.8m high, constructed against E facing bank. Revetment walls to W and N, the latter butting against wall (508). The W wall may continue to S as a shallow terrace, perhaps part of an additional structure. The boulder at the NE corner has four shallow shot holes. Graffiti on E facing wall forms letters 'A S'.	**High:** good evidential value as one of a group of structures probably associated with early hand dressing on Benson's Vein.	Wall (508) Tip (513)	High	16th–17th century	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
510	**Spoil tip:** Long, low tip parallel to river and built up against natural slope to E, 18m x 4m x 1.5m high. May be spoil from level associated with trench and tip (515).	**High:** good evidential value as it relates to the waste disposal process from mine level (515).	Level (515)	High	Mid-19th century	
511	**Quarry:** Shallow, benched stone quarry excavated into E face of natural outcrop to N and W of building (502). 11m long x 1.5m high, no obvious tool marks. Outcrop continues to S but is not quarried. Quarry forms W side of building (502)	**High:** good evidential value because it relates to other industrial activities in the area of the mine.	Building (502)	High	Late 19th–early 20th century?	
512	**Wall:** Short length of retaining wall, 2.7m x 1.10m high, on S side of entrance cutting to level (455)	**Medium:** Some evidential value as it relates to the structure of the mine entrance.	Level (455)	Medium	16th–17th century or later reworking	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
513	**Spoil tip:** Low, grass-covered tip, eroded to the E and S by the beck. Appears to be built up against SE corner of building (509). Mineralised spoil, less than 5cm size, probably hand dressing waste.	**High:** good evidential value as relates to a group of structures probably associated with early hand dressing on Benson's Vein.	Building (509)	High	16th–17th century	
514	**Spoil tip:** Tip composed of large angular stone blocks. Forms the S side of the W end of opencast (450) and overlies tip (501). May be formed in part by the collapse of the SW side of opencast (450) but cannot be determined if collapse is natural or later mining activity.	**High:** good evidential value as one of a group of structures probably associated with early hand dressing on Benson's Vein.	Tip (501) Opencast (450)	High	19th–20th century?	
515	**Spoil tip and mine level:** Long, narrow spoil tip parallel to E bank of beck, 21m x 2.3m x 1.2m high. Contains large boulders, one with shot holes. Parallel with spoil tip to E is linear hollow, probably entrance cutting to now-lost level.	**High:** good evidential value relating to now-lost mine level.	Spoil tip (510)	High	Early 19th century	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
600 **Group**	**Diversion channel:** Linear channel diverting the beck away from the main workings on North and South Lode. This feature, some 132m long, includes a retaining wall and weir (330), a linear trench (601), a bank with stone revetment (602), a rock-cut channel and a secondary overflow channel (604). At the S end are two overflow gullies (A and B).	**High:** important evidential value relating to water management and flood control.	Wall and weir (330) Trench (601) Bank (602) Channel (603) Overflow channel (604)	High	Early 19th century	
601	**Channel:** The main diversion channel comprises a 3m wide trench aligned NW-SE with an upcast bank on the E side. To the S, just beyond a large boulder with a shot hole, the channel bifurcates to form overflow channel (604) and overflow gully A.	**High:** important evidential value relating to water management and flood control.	Bank (602) Overflow channel (604) Trench (603)	High	Early 19th century	
602	**Bank:** The upcast bank at the N end of channel (601) has a stone revetment on its inner face, presumably to prevent erosion and flood damage. The stone face is 1.2m high and there is some additional revetment on the outer face.	**High:** important evidential value relating to water management and flood control.	Channel (601)	High	Early 19th century	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
603	**Trench:** A rock-cut trench, 12m x 1.8m deep, excavated on a bedrock exposure on the S bank of the beck. To the NW it connects with the remains of the weir (330) and to the SE it runs towards channel (601). The SE end of the channel (603) is obscured by a slump in the E-facing slope.	**High:** important evidential value relating to water management and flood control.	Weir (330) Channel (601)	High	Early 19th century	
604	**Channel:** A narrow, 1.5m wide, channel running along contour for 75m from the S end of diversion channel (601). It leads to a large overflow or flood gully (B).	**High:** important evidential value relating to water management and flood control.	Channel (601)	High	Early 19th century	
701	**Track:** A broad track on the W side of the survey area connecting Dry Cove Bottom with Hole Rake and Coppermines Valley.	**Medium:** good evidential value relating to local transport a travel.	none	Medium	?	
702	**Track:** Short stretch of linear track running NE upslope between opencasts (402) and (403). Must post-date the opencasts and could be a sheep track.	**Low:** of some value in showing how tracks relate to mining features.	Opencast (402) Opencast (403)	Low	18th century or later	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
703	**Track:** Broad curving track on the W bank of the beck. Would have led to a now-lost bridge crossing the beck close to the later shaft on South Lode (351). Any continuation of the track on the N bank obscured by tip (343) and thus demonstrating that the track is earlier than the tip. To the S the track is cut by Flood Gully A.	**High:** important evidential value relating to early transport and access. The feature also provides chronological information on the development of the site.	Tip (343)	High	16th–17th century	
704	**Track:** Faint traces of track on hillside between NE corner of Building (100) and track (705).	**Low**: poor condition and ambiguous nature and so of restricted evidential value.	Building (100) Track (705)	Low	?	
705	**Track:** Footpath skirting E and N edges of boundary area.	**Low:** may have no association with mine.	Track (704) Track (706)	Low	?	
706	**Track:** Length of track between track (705) and the lower workings on Benson's Vein. Well-engineered with some edge revetment. Might be a continuation of the main track leading down to the valley bottom on the N side of Tilberthwaite Ghyll. Original route may be contemporary with 16th-17th mining operations.	**High:** important evidential value relating to early transport and access. The feature also provides chronological information on the development of the site.	Track (705) Workings on Benson's Vein	High	16th–17th century	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
800 **Group**	**Manor boundary:** A stone and earth bank feature on the E side of the beck and continuing N across Dry Cove Bottom.	**High:** important evidential and historical value relating to land ownership and the physical operation of the mine workings through time.		High	19th century an earlier	
801	**Boundary wall:** Wall, dry stone construction, constructed down slope and joining with SW corner of Building 100 where there is an iron support arm for a wire fence. To the NW the boundary continues across Dry Cove Bottom as a shallow earth bank.	**High:** important evidential and historical value relating to land ownership and the physical operation of the mine workings through time.	Building (100)	High	19th century	
802	**Boundary wall:** Foundations of dry stone wall between SE corner of Building (100) and N corner of Building (200). 0.65m wide.	**High:** important evidential and historical value relating to land ownership and the physical operation of the mine workings through time.	Building (100) Building (200)	High	19th century	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
803	**Boundary wall:** Continuation of manor boundary wall between NE corner of Building (200) and the E edge of the dressing floors. Crosses over and respects drain/culvert (335). Dry stone construction, 0.65m wide x 0.6m high.	**High:** important evidential and historical value relating to land ownership and the physical operation of the mine workings through time.	Building (200) Drain (335)	High	19th century	
804	**Boundary wall:** Discontinuous length of dry stone wall on E side of beck. In some sections survives only as boulder with support holes for iron fence arm suggesting that much of the line may have been marked by a wire fence rather than a single dry-stone wall.	**High:** important evidential and historical value relating to land ownership and the physical operation of the mine workings through time.		High	19th century	
900 **Group**	**Mine dam:** Dam across beck and impounding Dry Cove Bottom. No obvious leat system to mine so assumption must be that the dam was used to regulate water level and flow in beck.	**High:** good evidential value relating to water control and use.	Dam wall (901) Quarry (902)	High	19th century?	

Context	Description	Significance	Assoc. with	Contribution to Site Significance	Date	Photo
901	**Dam wall:** On the E side of the beck, an earth bank with coursed retaining walls on NW and SE faces, 3m x 13m x 0.7m high. Continues across beck in damaged and reduced state. No evidence for dam wall on W bank.	**High:** good evidential value relating to water control and use.	Quarry (902)	High	19th century	
902	**Shallow quarry:** on outcrop. Excavated to provide walling stone for dam wall (901).	**High:** good evidential value relating to local sourcing and exploitation of stone for mine structures.	Dam wall (901)	High	19th century	

APPENDIX 2 A GLOSSARY OF COPPER MINING TERMS

Adapted from Cornish Mining World Heritage (2018).

ADIT	A horizontal tunnel driven into a hillside, often functioning as a drain.
BUDDLE	A device for concentrating ore. In the mid-19th century these most usually took the form of a circular pit with rotating brushes. The tin from the STAMPS was fed into the centre or side of the pit and was graded by gravity, concentrating the heavy ore near the inlet point. These were often mechanically worked. Earlier buddles were trapezoidal in shape and operated manually. A variation used in tailings works to treat sands and slimes was the ROUND FRAME: a freestanding, all wooden, mechanically actuated buddle, whilst a further variation was the dumb buddle, or dumb pit, which was not mechanically operated.
CULVERT	A small tunnel constructed to carry a channel of water.
CROSS-CUT	A passage or LEVEL driven through solid rock from one VEIN to another.
DRESSING	The concentration of the copper or other ores contained in the rock excavated from a mine. Carried out on DRESSING FLOORS.
DRESSING FLOORS	An (often extensive) surface area on a mine where the various processes of concentration of ore took place—these consisted of crushing or stamping to attain a uniform size range, sizing (particularly on later mines), separation of waste rock, concentration (generally mechanically and hydraulically on tin mines, manually on copper mines), the removal of contaminant minerals (by calcination, flotation, magnetic separation), and finally drying and bagging for transportation to the smelter.
FLOUCAN	A VEIN of clay.
FOOT WALL	The lower side of an inclined VEIN.
FINGER DUMP	A linear dump of waste material from a mine or quarry, flat-topped to allow material to be barrowed or trammed along it, and often equipped with a temporary tramway track.
FLOUCAN	A VEIN of clay.
HANGING WALL	The upper side of an inclined vein.
JIG	A large mechanically or hand-operated sieve set in a tank of water in which ore could be separated by waste.

LAUNDER	A wooden trough used to carry water or other liquids; often used to power a water wheel or to feed water or finely divided material in suspension around a dressing floor.
LEAT	An artificial watercourse built to carry a supply of water to a mine. Also known as an ADIT.
LEVEL	A horizontal tunnel (usually driven into a hillside) to give access to a mine and used for drainage or the hauling of broken ore. Deeper adits did not necessarily connect to surface and were used to carry water back from distant workings to a pumping shaft.
LODE	Cornish term fora mineral VEIN. Used at Tilberthwaite for the three principal veins: North LODE, South LODE and Benson's LODE.
OPENCAST	A mineral extraction site open to the surface and similar to a quarry, but usually distinguished by its elongated shape and steep sides.
PROSPECTING PIT OR FOSSICKING PIT	A small pit dug in search of minerals, and almost always found in linear groups, often arranged cross-contour, or at right angles to the projected strike of known lodes.
RAGGING	Initial breaking up of sorted ore into uniform-sized pieces using a sledgehammer. Generally done by men or older boys prior to sending material to a mechanised crusher.
SETT	The boundaries of a mine or mining area.
SHAFT	A vertical or near-vertical tunnel sunk to give access to the extractive areas of a mine.
SPOIL TIP, DUMP	A pile of waste material from a mine, which may contain primary waste (where this could not be disposed of underground), or waste from various stages in the dressing process. TAILINGS LAGOONS stored the extensive slimes from the final stages in the process; in earlier mines these were flushed over cliffs or allowed to wash away in streams or rivers.
STAMP	A mechanical device for crushing ore-bearing rock to fine sand. Heavy, vertically-mounted beams (or later iron rods) carrying cast or forged iron heads were sequentially lifted and dropped onto the prepared ore beneath them by a series of cams mounted on a rotating drum; this usually being driven by a water wheel or rotative steam engine.
STOPE	Excavated area produced during the extraction of ore-bearing rock. Often narrow, deep and elongated, reflecting the former position of the lode. Where open to the surface, stopes are termed OPENWORK.
TAILINGS	The waste sand and slime from a mine DRESSING FLOOR, not containing workable quantities of mineral.

VEIN	A linear area of mineralisation underground. Sometimes referred to as a seam. Generally vertical or near-vertical, and often extending for considerable distances along its strike.
VEINSTUFF	The part of a vein which is not ore.
WHEEL PIT	A structure built to house a water wheel, often excavated and stone-lined, but sometimes freestanding.