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SCORDALE, CUMBRIA
THE ARCHAEOLOGY OF A NORTH PENNINE VALLEY

AN ARCHAEOLOGICAL INVESTIGATION

Abby Hunt and Stewart Ainsworth

ARCHAEOLOGICAL
SURVEY AND INVESTIGATION

ENGLISH HERITAGE

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SCORDALE
CUMBRIA

The archaeology of a North Pennine valley

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SUMMARY

Between 2005 and 2009, English Heritage's Research Department undertook a multi-disciplinary investigation of approximately 343 hectares in Scordale, Cumbria, encompassing a 4km-long stretch of the valley. The project was undertaken primarily to inform conservation measures in partnership with the Defence Estates Environmental Support Team and also contributes to the 'Joint Accord' between English Heritage and AONB Staff Units. Using rectified aerial photography as a base, archaeological features were recorded at 1:2500 scale across the whole survey area, with windows of detailed survey (at 1:200 or 1:1000) around areas at risk from erosion by the Scordale Beck (RDRS 15/2007). The archaeological remains primarily relate to lead-mining and processing activities, spanning the later medieval period to 1895; barytes was also extracted and worked here between 1895 and the 1930s. In addition, clusters of settlement remains from the prehistoric, Romano-British and possibly early medieval periods were recognised, in some cases apparently connected with the mining activities. Towards the mouth of the valley, a Bronze Age field system with dispersed settlement, part of which was threatened by fluvial erosion and was dealt with in a previous report (RDRS 78/2006), was recorded in its entirety. The records from the investigation were compiled in a GIS to assist with analysis of the landscape and to inform ongoing conservation work by Defence Estates.

CONTRIBUTORS

The field survey was carried out by Abby Hunt, Stewart Ainsworth, Al Oswald, Trevor Pearson and Marcus Jecock of English Heritage's Archaeological Survey and Investigation team. Aerial photographic transcription was undertaken by Ann Carter of English Heritage's Aerial Survey team. A number of standing structures on the site were photogrammetrically recorded by David Andrews and Mick Clowes of the English Heritage Photogrammetry team. Ground photography was taken by Bob Skingle and Alun Bull of English Heritage's Photography team and by members of the Archaeological Survey & Investigation team. The cover photograph is by Alun Bull. English Heritage's Archaeological Science team carried out mineralogical and dendrochronological analysis on samples taken from the site. The historical sources were researched by the principal author, Abby Hunt. The text was edited by Al Oswald.

ACKNOWLEDGEMENTS

Thanks are extended to the MoD for their cooperation and assistance with this project and for allowing access to the survey area. In particular, Phil Abramson (Historic Environment Advisor, Defence Estates), Clare Louise Hethrington (Estate Surveyor, Defence Estates) and Andrew Clarke (Rural Estate Manager, Landmarc) are to be thanked for their support and assistance throughout the survey. Thanks also to North Pennines Archaeology, who made available the findings of their excavations in Scordale. The interest of the residents of Hilton village in the project has been most encouraging and the information about the history of the site that people have shared with us has been most gratefully received. Particular thanks also to John Crompton, John Sibson and Jean Winder who provided information, articles and copies of photographs relating to Scordale. The staff at Beamish Museum and The North of England Institute of Mining and Mechanical Engineers have also been helpful in providing copies of historic photographs and plans of Scordale.

ARCHIVE LOCATION

The site archive and copies of this report have been deposited in the English Heritage archive and library at the National Monuments Record Centre (NMRC), Kemble Drive, Swindon SN2 2GZ (ref AF00339). Copies of this report have also been deposited with the Cumbria Historic Environment Record and the British Library.

DATE OF INVESTIGATIONS

Vertical aerial photography for rectification (by Simmons Aerofilms): July 2005
Field surveys: May 2006 - July 2008
Aerial photography (by English Heritage): July 2006
Photogrammetric survey of buildings: July 2006
Aerial photographic transcription: August 2006 - June 2007
Rescue excavations (by North Pennines Archaeology): July 2007

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1. INTRODUCTION

Scordale is a dramatic and steep-sided valley at the south-western edge of the Pennine escarpment, immediately north-east of the village of Hilton in Cumbria; through it flow the Scordale and Hilton Becks (Figure 1). The valley lies within the North Pennines Area of Outstanding Natural Beauty (AONB) and the Appleby Fells Site of Special Scientific Interest (SSSI), designated by Natural England. The land, which is mostly unenclosed and used as rough grazing for sheep and cattle, also lies within the Ministry of Defence's (MoD) Warcop Training Area, an active military training area since 1942. As a result public access is restricted to the designated rights of way on a limited number of specified days when live firing is not taking place.

Between July 2005 and July 2008, English Heritage's Research Department undertook a multi-disciplinary investigation of approximately 343 hectares (848 acres), encompassing a 4km-long stretch of the valley. The project was undertaken in partnership with

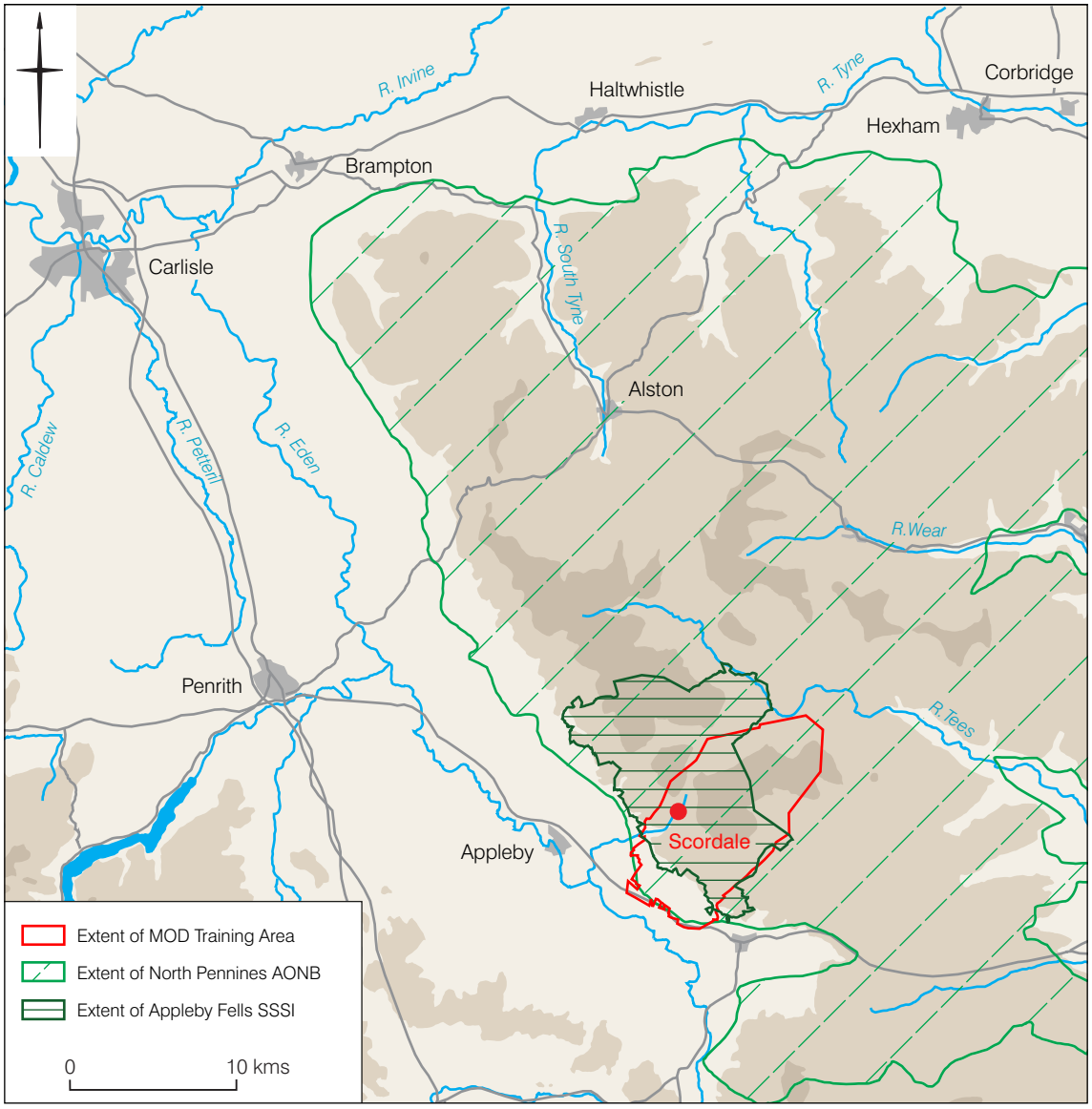

Figure 1 Location map

the Defence Estates Environmental Support Team and contributes directly to the implementation of their Integrated Land Management Plan (Defence Estates 2003). It also contributes to the 'Joint Accord' signed in 2004 between English Heritage and the country's AONB Staff Units to work together to further the understanding, conservation and public enjoyment of the historic environment within the AONBs.

Many of the archaeological remains in Scordale are well-preserved and they include six Scheduled Ancient Monuments (SAMs); five of these are prehistoric sites while the other encompasses medieval and post-medieval lead-mining remains. A proportion, including some of the most important and sensitive Scheduled lead-mining features, are threatened by flash-flooding. However, the historic environment is not the over-riding concern in terms of flood damage; fluvial erosion has led to sediment redistribution in the lower reaches of the Hilton Beck, which has in turn caused the stream to migrate, causing further erosion towards the mouth of the valley and downstream from Hilton village, where roads and bridges have been damaged. Therefore, in 2005 the Defence Estates Environmental Support Team, in collaboration with the Eden Rivers Trust, commissioned Durham University to undertake a scientific study exploring the problems and to prepare a set of recommendations for managing the severe problem of sediment redistribution. The resulting report outlined a basic model for the fluvial system and pointed out that historic human activities in Scordale have been important factors in causing the flash-flooding (Lane and Dugdale 2006a). The prime contributory factors were identified as:

- the legacy of lead mining, specifically the technique known as 'hushing', which involves the sudden release of volumes of water down the hillsides to expose new deposits, and the redistribution of old mine waste by streams and watercourses
- prehistoric land use changes, which were hypothesised to have sensitised the catchments to climate changes in terms of sediment delivery
- climate change, which is thought to have brought about more frequent and severe rainfall episodes

In 2005, a site meeting was organised to discuss the state of Scordale's historic remains, particularly the threatened Scheduled monuments, and agree possible ways of mitigating the impact of the fluvial erosion itself and the potential counter-measures; this meeting was attended by representatives of the MoD, English Heritage, the AONB Staff Unit and Cumbria County Council. Following the meeting, as a first step, a vertical aerial photographic survey was commissioned by English Heritage on behalf of Defence Estates to provide high resolution, digital, colour photographic record covering most of the valley, including all the affected areas. English Heritage's Metric Survey Team provided the expertise to digitally rectify the data to produce a geo-referenced 'orthophotograph', which was supplied in July 2005 to the Historic Environment Advisor in the Defence Estates Environmental Support Team.

At a review in February 2006, it was agreed that the aerial photography alone did not constitute an adequate record of the archaeological remains and that analytical survey on the ground was needed to identify and prioritise the key areas at immediate risk, clarify their interpretation and significance, and devise appropriate management responses. This

research could also underpin an overarching management and conservation strategy for the medium- to long-term. It was therefore agreed that English Heritage's Archaeological Survey and Investigation Team would assess and advise on an appropriate archaeological survey and recording project. The project design resulting from that assessment was finalised in July 2006 (Ainsworth 2006) and had the following aims:

- to address both short-term, emergency recording needs in areas of greatest threat within the Scheduled Ancient Monuments, and medium- to long-term management and conservation by the MoD of the archaeological remains within the valley overall
- to contribute to the understanding of the relationship between the historic environment and fluvial mechanics, particularly in relation to the impact of climate change, in the light of the Durham University report (Lane and Dugdale 2006a)
- to allow, through high quality analysis and coordinated, multi-disciplinary research, a fuller understanding of the archaeological remains and appreciation of their significance, by all the relevant organisations and the local community
- to contribute to the North Pennines AONB management plan and in particular those objectives relating to the historic landscape and the historic lead industry (North Pennines AONB Partnership 2001; Forbes *et al* 2003)
- to respond to wider strategies for the historic environment, especially similar extensive lead and minerals mining landscapes (Brennand 2006; Barnatt and Penny 2004) and help formulate future strategies. Chief amongst the future programmes in development at that time was English Heritage Research Department's multi-disciplinary project investigating 'miner-farmer' landscapes within the North Pennines AONB (Ainsworth 2008)

The Scordale project had five principal phases, as set out in the project design (Ainsworth 2006). Phase 1 was the delivery of the orthophotography in July 2005. Phase 2 was an analytical survey of a proposed sedimentation zone likely to impact on SAM 32821, a Bronze Age field system and dispersed settlement. In order to establish the context of the threatened remains, the survey, which was undertaken at 1:1000 scale and Level 3 standard (as defined in Ainsworth *et al* 2007), covered almost half of the Scheduled Ancient Monument and an adjacent undesignated area where probable Bronze Age remains were recognised for the first time. A report on the findings of this phase has already been produced (Hunt and Oswald 2006). Phase 3 was the identification and detailed ground survey of key areas at risk from river erosion within SAM 27842, the principal lead mining area. To achieve 'preservation by record', the threatened areas and their immediate context were also surveyed at 1:1000 and at Level 3 standard, with further detailed survey, at 1:200 scale, of the areas at highest risk. Photogrammetric recording of threatened structural remains was also undertaken as part of this stage of the project. An interim report designed to address the urgent management and conservation needs, outlining the overall understanding of the site at that time, as well as specifying the extent of the erosion threats and the nature and significance of the threatened remains was produced (Hunt and Ainsworth 2007a). Using the survey results as a basis, the Historic Environment Advisor in the Defence Estates Environmental Support Team commissioned a series of five small-scale rescue excavations which were carried out by North Pennines Archaeology in July 2007 (Giecco

2008). The principal findings of the evaluation trenches included a series of wooden chutes associated with the main crushing mill, further information about the construction of a series of three circular buddles and structural and mechanical remains within a second mill, possibly used for supplementary processing. Mineral samples obtained at the time of the excavations were analysed by English Heritage's Archaeological Science Team (Paynter 2009). Phase 4 comprised an aerial photogrammetric transcription and rapid ground survey of the whole survey area at 1:2500 scale at Level 2 standard, scheduled for completion at the end of summer 2007. This was intended to further contextualise the threatened areas and to provide a fuller understanding of the landscape, both for research purposes and to inform medium- and long-term management and conservation strategies. In the event, the aerial photogrammetric transcription proved much less effective than anticipated and therefore had to be supplemented by more intensive fieldwork than had been planned. Because English Heritage's access on the ground was limited to non-firing days, and a number of the potential opportunities were denied by heavy snowfalls in winter 2007-8, the 45 days of fieldwork were spread over two years and completed in July 2008. The underground mine workings were not investigated at any stage in the project and this report relies entirely on historic maps and plans for information about the subterranean activities. The final phase of the project, phase 5, is a programme of publication and outreach, of which the present report is part. Articles summarising the work at Scordale have appeared in other publications, such as *The Archaeologist* (Hunt and Ainsworth 2007b) and English Heritage's *Research News* (Ainsworth and Hunt 2007). Talks have also been given to local audiences by English Heritage staff and others. This report draws together the findings of all the previous reports and presents a synthesis of the historic development of the whole valley.

2. TOPOGRAPHY, GEOLOGY AND MODERN LAND USE

The south-western escarpment of the North Pennines rears up abruptly to more than 300m above the broad valley of the River Eden. Scordale is one of a series of steep-sided V-shaped valleys, each of which penetrates several kilometres into the massif. At the head of Scordale, where the Scordale Beck emanates, the land is at approximately 600m above sea level, falling rapidly to approximately 370m above sea level where Great Augill joins the beck, just over 1km to the south. From here, Scordale Beck, which becomes Hilton Beck further down the valley, descends more steadily to a height of some 232m above OD in Hilton village itself, a further 3.5km to the south-west, eventually joining the River Eden to the south-east of Appleby. The upper reaches of the valley have very steep sides, with the Scordale Beck flowing along a deeply-incised channel, in places descending the initial steep gradient in a number of waterfalls. Other watercourses feed into Scordale Beck as it flows down the valley, principally Great Augill, Stow Gill and Swindale Beck, further south (Figure 2). During the course of the fieldwork the flow of Scordale Beck has been observed to fluctuate greatly, ranging from fast-flowing torrent to completely dry in certain places and at certain times; this characteristic is typical of streams in limestone environments, especially those where natural underground fissures have been augmented by mine workings.

The valley cuts through a number of different geological strata. Various beds of limestone, including Melmerby Scar, Smiddy, Lower Little and Jew, form the bulk of the

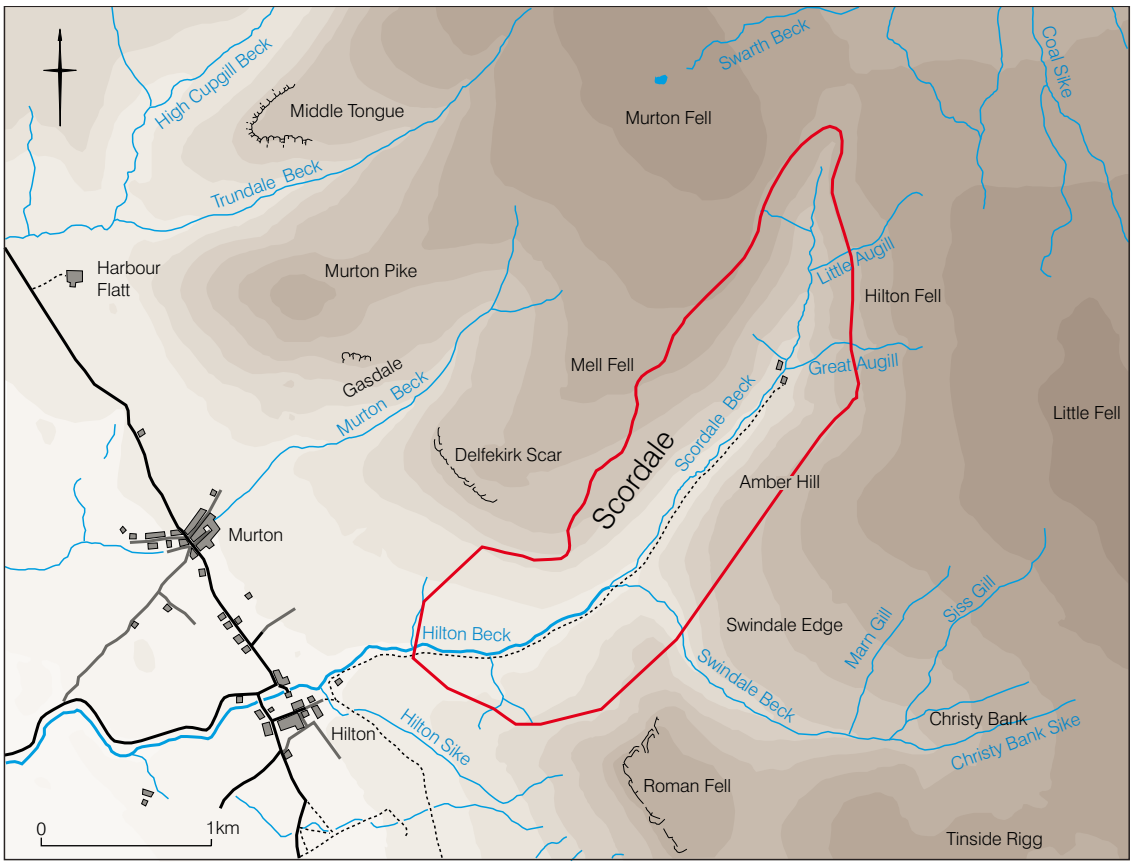

Figure 2 Scordale and its immediate environs. The extent of the English Heritage field survey is shown by the red line.

slopes, with the sequence broadly mirrored on both sides of the valley. The differential erosion of the stratified deposits has led to the creation of natural terraces in the valley side; there is evidence that these terraces have, in places, been exploited for agriculture and settlement. An extrusion of the Whin Sill, a hard, quartz dolerite, at the top of the Melmerby Scar limestone creates the distinctive outcropping crags mid-way up the valley side, particularly visible on either side of Great Augill. Toward the western end of Scordale valley, where it begins to open out from the edge of the main west-facing Pennine escarpment, it is joined by the deeply-incised valley of the Swindale Beck. This confluence marks a general change in the topography, with a fringe of more gentle slopes alongside the Scordale Beck, particularly on the north side where the main Pennine escarpment turns to the north along the line of the Swindale Beck Fault. There is a marked change west of this fault line, where the Ordovician rocks of the Kirkland Formation dominate. There is also considerably more drift deposit of boulder clay on these gentler slopes, along with deposits of sands and gravel (Institute of Geological Sciences 1972). There are also occurrences of sandstone within the survey area, generally on the higher ground. Mineral veins in Scordale occur within both the Carboniferous rocks and the Whin Sill and there are also extensive 'flats', where minerals occur in horizontal beds; these both generally trend ENE to WSW across the valley (Forbes *et al* 2003, 17). The most common minerals within these veins and flats are galena (PbS, lead ore with a high silver content, historically the mineral most commonly sought for silver extraction), barytes, witherite and fluorite; the latter occurring as amber crystals which are unique to this valley. Up until the middle of the 19th century it was only the lead ore that had a recognised value and was therefore intensively exploited; the lead was widely used, amongst other things, in glazing, roofing, for water pipes, in paint and as a component of ceramic glaze. As understanding of other minerals' properties developed, their commercial uses, and therefore profitability, were realised and extraction became economically viable. Barytes ($BaSO_4$), or barium sulphate, was discovered by Carl Scheele in 1774, first refined in 1808, and was subsequently used as a fluxing agent in the manufacture of a variety of products including lithopone paints, munitions and plastics. Witherite ($BaCO_3$), the carbonate form of barium, was first recognised in the 1780s and was utilised in the paper and explosives industries. Witherite was being worked in the Alston district as early as 1850 (Dunham 1990, 4), but in Scordale, the switch to barytes and witherite extraction and processing occurred in 1896. However, by 1921 it was only barytes that was being worked in Scordale (Wilson *et al* 1922, 46). These later activities covered a much smaller geographic area of Scordale than the earlier lead workings.

The occurrence of mineral deposits in both veins and flats has resulted in different types of extraction in order to win the ore. Where the vertical mineral veins were visible on the surface, they have been worked using open face and opencut techniques, sometimes in conjunction with hushes, to clear away waste material accumulated during the mining process. Where flats occur close to the surface in Scordale, they have also been worked using open cast techniques; the massive gouge in the valley side known as Mason Holes is a prime example of this, an open cast mine created by prolonged open face extraction, progressively working back the rock-face. Flats and veins have also been worked underground in Scordale, particularly where the steepness of the valley sides has precluded easy access from the ground surface. These are generally accessed by quite simple looking level entrances which often give access to extensive networks of underground workings.

The principal current land-use in Scordale is military training within the Warcop Training Area military firing-range. Defence Estates are concerned to ensure that this land-use co-exists harmoniously with the needs of the historic environment as far as possible. The military activity restricts public access to the valley to around 24 days per year, thus diminishing the potentially harmful effects on the historic environment of visitor erosion and deliberate damage. Observations on other historic mining landscapes suggest that visitors are often keen to explore away from established footpaths, in the process widening the extent of erosion and damage, but the obvious disincentives for such exploration on a live firing range bring marked benefits for the protection of many of the individual historic features within Scordale, many of which currently lie outside scheduled areas. One of the outcomes of the current research has been the erection of four interpretation panels presenting information on the historic environment as a whole and specific features within it; these too have been designed to discourage exploration away from the established footpaths. Whilst live firing is not carried out within the valley itself, it does occur in adjacent areas, with ordnance occasionally falling into Scordale. English Heritage's research has found no evidence that this has caused significant damage to archaeological remains in the valley, and this is likely to remain the case. The presence of dug-outs and small shelters indicates that there has been military activity on the site itself in the relatively recent past; such digging has detrimentally affected some archaeological remains. The military activity also limits the potential secondary land-uses to rough grazing, predominantly for sheep, which is one of the most benign management regimes available for the historic environment. However, grazing does have some potential to impact adversely on some of the archaeological remains, particularly where sheep may be using features to shelter or to scratch against; this could exacerbate any existing erosion damage, or create new erosion problems. The principal vehicular access through the valley is along the former mine road, which leads up to just beyond Great Augill. This mine road is, in places, suffering from severe river erosion and it is in large part due to the actions of Defence Estates that this historic feature remains more-or-less intact and still in use. Vehicular access along the valley is infrequent and generally limited to MoD vehicles and those of a handful of tenant farmers.

3. HISTORY OF RESEARCH

Prior to the start of the current programme of research, there had been little detailed archaeological study of Scordale, in part due to the restricted access to the valley since 1942. It might be expected that the prehistoric remains in the valley would have attracted interest and comment from antiquarians or local enthusiasts, but this appears not to have been the case; it was not until August 1998 that the extensive and well-preserved prehistoric field system with dispersed settlement remains was recognised by independent archaeologist Tim Gates and reported to the Historic Environment Record for Cumbria. Much of what little recent research has taken place into the lead mines has focused, quite typically, on their documented history, the geology of the area and the subterranean mining remains, with the above-ground industrial remains relatively overlooked. Prior to the 1960s, 'industrial archaeology' was not really recognised as a topic for field research, indeed the term itself was noy widely adopted until the late 1950s (Nevell 2006, 31). Thus earlier studies of the valley's industrial heritage are predominantly historical, geological or related to industrial engineering.

Parts of Scordale were designated as Scheduled Ancient Monuments in 1999 following examination by the Monuments Protection Programme (RSMs 27840, 27841, 27842, 32821, 32850 and 32851; Figure 3). As part of the scheduling process, background research and basic field survey were undertaken to provide supporting evidence for the Schedule entry. The largest scheduled monument is monument 27842, known as Scordale mines, which encompassed the lead mines and associated infrastructure. The other scheduled monuments comprised prehistoric stone hut circle settlements, some with associated enclosures and cairns (27840 and 27841), and one with a field system and cairns identified by Tim Gates in the previous year (32821).

In 2002, English Heritage's Aerial Survey Team undertook an aerial photographic transcription of the Warcop Army Training Estate, which includes Scordale, as part of the National Mapping Programme (NMP) (Boutwood 2002). This involved the mapping of archaeological sites at a scale of 1:10 000 based on all the available air photographs held in English Heritage's public archive, the National Monuments Record. Records were created for all the newly mapped sites, or amended for existing sites, and were added to the English Heritage's Historic Environment Record (then known as NewHIS, now as AMIE). The NMP survey recorded 53 new sites and resulted in amendments to 55 existing records. The sites recorded ranged right through from the Neolithic to the 20th century.

Following Phase 3 of the current project (Hunt and Ainsworth 2007a), a decision was taken by English Heritage and Defence Estates to initiate excavation of directly threatened lead-mining remains within the Scheduled Monument (SAM 27842). This work was jointly funded by English Heritage's Historic Environment Enabling Programme and the MoD. The excavation took place in July 2007 and was undertaken by North Pennines Archaeology (Giecco 2008). Five evaluation trenches were dug at locations identified by initial, rapid ground survey (Hunt and Ainsworth 2007a, 19), all of which were to the south of the confluence of Great Augill and Scordale Beck, within a distance of 100m of each other. The principal findings of the evaluation trenches included a series

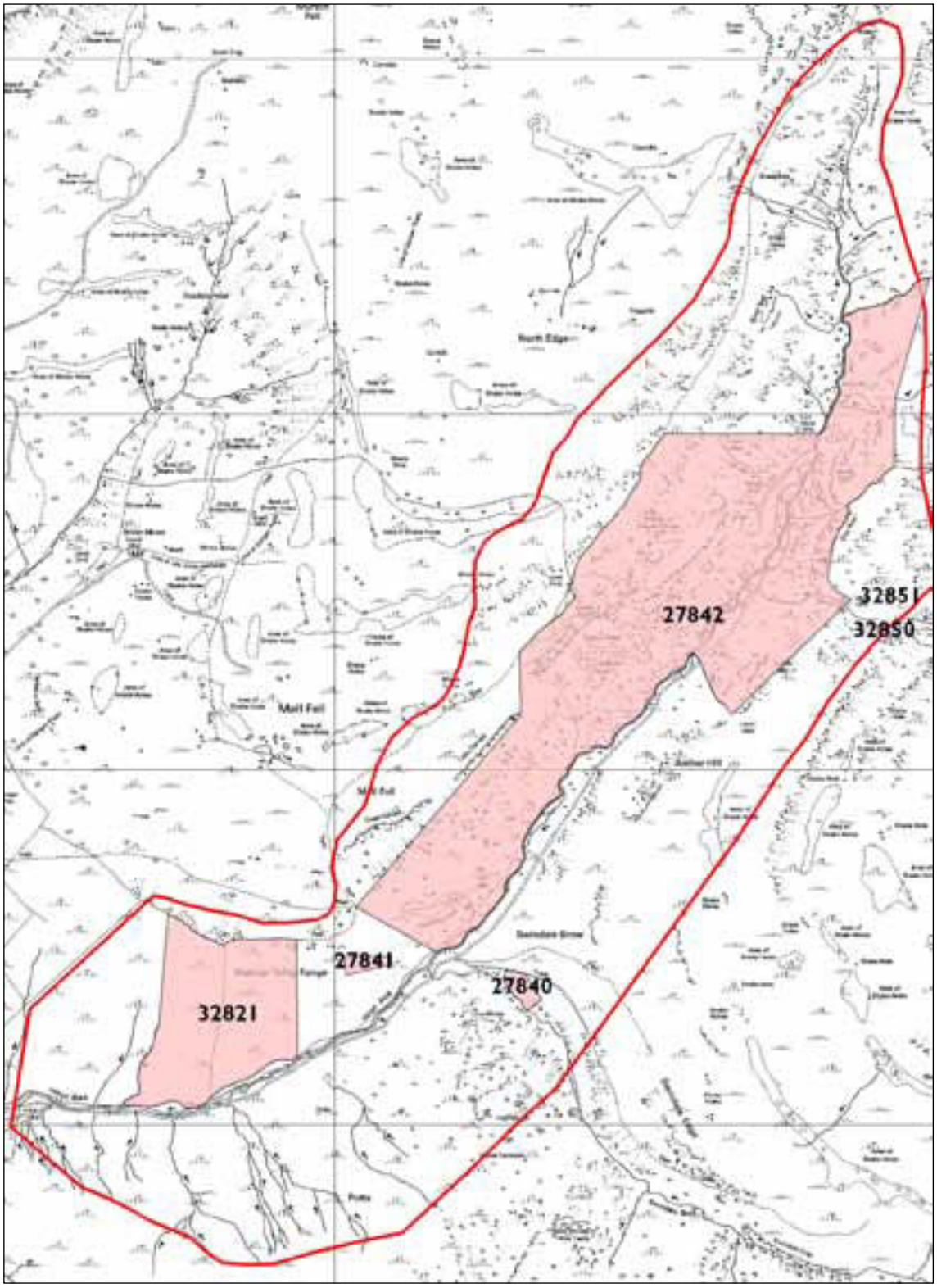

Figure 3 Map showing Scheduled Ancient Monuments within the survey area (illustrated by the red line); the Scheduled Ancient Monuments are labelled with their RSM number.

of wooden chutes associated with the main crushing mill, further information about the construction of a series of three circular buddles and structural and mechanical remains within a second mill, possibly used for supplementary processing (Giecco 2008). Mineral samples obtained at the time of the excavation were analysed by English Heritage's Archaeological Science team (Paynter 2009).

A condition survey of all the recorded archaeological and historical sites and monuments within the Warcop Training Camp area was instigated by Defence Estates and undertaken in 2008 (Hopkins 2008), although this excluded a number of sites in Scordale known to be covered by the current English Heritage survey.

4. DOCUMENTED HISTORY OF THE MINES

A rapid search of the readily available records and written sources, both online and in repositories in northern England, revealed that few written records relating to the mining activities in Scordale survive. There may be more information about the site buried within company records, for example, those of the London Lead Company, but a full investigation of primary resources was beyond the scope of the current project. Cartographic evidence for the site is also relatively sparse, but there are maps depicting the site at key stages of its development, particularly in its later history.

The date at which lead mining was first undertaken in Scordale is unclear but, according to Wilson *et al*, 'records are known of galena workings in Scordale dating from the 14th century' (Wilson *et al* 1922, 48). However, during the course of the present project, no references specifically relating to galena extraction at this early date were found. The earliest primary source referring to lead mining at the Hilton and Murton mines is a document of 1698, which records an agreement between Colonel William Beale, the landowner, and George Bacon, setting out the terms by which Bacon and his partners could exploit the lead mines of Hilton and Murton (CRO(K) 1698). The lease was to last for 21 years and entitled Bacon and partners to 'all the lead mines within the lordship of Hilton and Murton……Paying to the said lord [Beale] thereof the one tenth part.' The document also contains a reference to mills at Hilton, stating that 'they shall have one of the mills at Hilton for a smelting mill'. Clearly, these comments imply a prolonged earlier history of mining activity.

Large-scale exploitation of the Hilton and Murton mines appears to have started in 1824 under the London Lead Company, also known as 'The Governor and Company for smelting down lead' (Mitchell 1842, 4). This period saw a number of major technological advances which contributed to the scale of the operation. One of the earliest maps to show the mine workings in Scordale dates to 1824 and is within the collection of London Lead Company plans in the North of England Institute of Mining and Mechanical Engineers (NEIMME; *see* Figure 27). The title of the plan indicates that it depicts the mineral ground leased by the 'Governor and Company' (a common abbreviation of the official name) from the Earl of Lonsdale. It can be inferred that there was a dispute over land ownership at this time, as the map depicts two possible boundaries at the north-eastern edge of the area, the boundaries 'claimed' by the Earls of Thanet and Lonsdale. The fact that the London Lead Company's activities on the site commenced around this date may have been the impetus for this plan to be produced. A number of the levels and veins being exploited at the time are depicted and named and the fairly extensive infrastructure which is shown in place at this date on the plan hints at intensive mining activity on the site in the preceding years. This plan has clearly served as a working document as, although it is dated 1824, there are annotations, both in pencil and in ink, with dates ranging from 1827-31; this extra information seems only to have been added to the levels on the east/south-east of Scordale Beck, in the area known as the Hilton Lead Mines.

Hodgson's map of Westmorland, which was surveyed in 1823-5, depicts a number of mines along the upper reaches of Scordale, including Helton Fell Mines, Hard Side Mine,

Murton Mine, Amberhill Mines and Low Field Mine (CRO(K) 1828). The small scale of the map means that it is difficult to be sure of the precise location of these mines, but it is clear that there were a number of active mines prior to the recorded arrival of the London Lead Company in 1824. Hodgson's plan shows a mine at 'Low Field' and more mines referred to as 'Murton Mines' towards the south-west of the valley. These are not shown on the 1824 map and it is possible that Hodgson's plan was surveyed a year or so earlier, showing workings outside the area of interest of the London Lead Company or which were no longer operational by the time the 1824 plan was made.

The first edition of the Ordnance Survey maps to cover this area, at 25-inch to the mile scale, was surveyed in 1856-60; regrettably, the precise year of survey cannot be pinned down as closely as is usually the case (Ordnance Survey 1861; Figure 4). This edition of the mapping contains a wealth of useful information, as the depictions of structures, levels and general infrastructure are clear and relatively detailed, giving an idea of the extent of the London Lead Company's activities on the site. Unfortunately, this scale of mapping does not extend to cover the whole area examined by the current programme of research, but excludes Lowfield Hush and Swindale Brow. However, the 6-inch to the mile map, surveyed in 1859 and published in 1863 (Ordnance Survey 1863), does cover the whole survey area and shows broadly the same features as the larger scale map.

The London Lead Company operated the Scordale mines for just over 50 years until 1876; the total production during this period was around 10,060 tons of lead concentrates (Dunham 1948, 137). Their departure coincided with a dramatic fall in the value of lead: the price of a ton fell from £21 9s to £16 7s 6d between 1861 and 1880 (Burt 1982, 64), as lead output in Germany, Spain and America increased greatly, flooding the market. By the 1880s Britain's imports of lead were outstripping the quantity produced domestically (Raistrick and Jennings 1989, 283). The end of the London Lead Company's tenure signalled the end of large-scale lead extraction in the valley and the mines then apparently lay idle for around 15 years. Sales particulars from February 1895, relating to the leasehold of the Scordale Lead Mines, include machinery, plant and buildings which were 'equal to new, having been erected in 1892 and 1893 at a cost of nearly £7000' (CRO(K) 1895). The sale was held due to the liquidation of the Scordale Lead Mines Syndicate Ltd. There are no other available records relating to this company and the description of the capital items as being 'equal to new' suggests that it was unable to follow up its very substantial investment with the anticipated levels of production.

However, in 1896 the mines were re-opened by the Scordale Mining Company, presumably the successful bidders in the 1895 sale, who worked the mines for barytes and witherite, since lead extraction remained comercially unviable due to cheap foreign imports (Carruthers *et al* 1916, 31; Dunham 1948, 138). In some cases, mine levels originally opened for the extraction of lead were revisited, but the new owners were also able to extract the minerals they were seeking from old spoil heaps, because barytes and witherite had previously been discarded as waste products. By the late 19th century, the entire refining process was highly mechanised or mechanically assisted (Burt 1982, 10). The Second Edition 6-inch map (Ordnance Survey 1899b), revised in 1897, shows significantly more structures in the 'core' processing area, near the confluence of

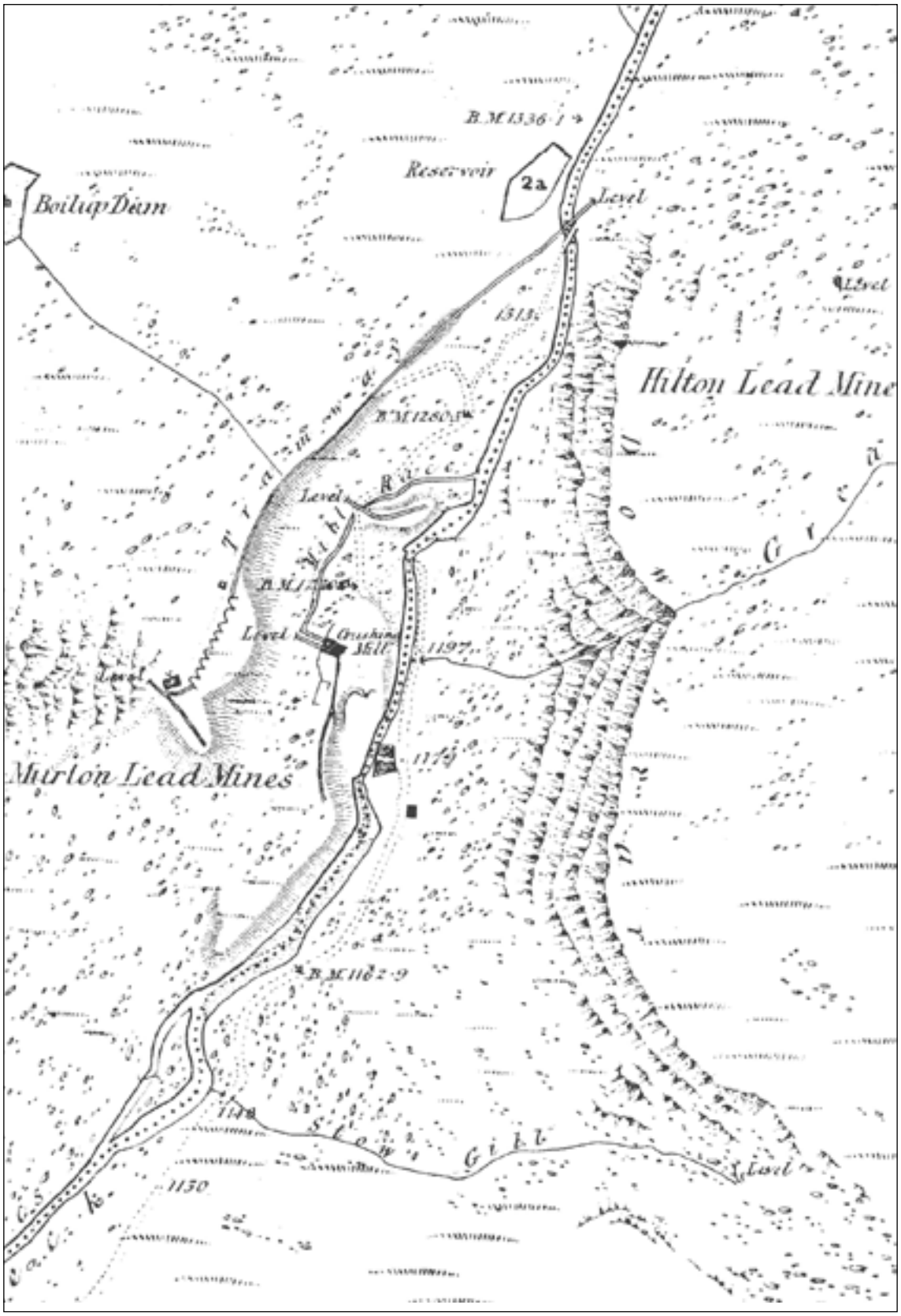

Figure 4 Extract from the Ordnance Survey First Edition 25-inch to the mile map, surveyed 1856-60. Reduced from original at 1:2500 scale.
Reproduced from the 1861 Ordnance Survey map.

Great Augill and the Scordale Beck, presumably reflecting development and the capital investment of the preceding 5-6 years (CRO(K) 1828). The operation changed hands once again in 1906 when the Brough Barytes Company took over; they worked the mines for a further six years, until 1912 (Wilson *et al* 1922, 48; Dunham 1948, 138). After 1912 Scordale Barytes Ltd took over the working of the mines and, according to Wilson *et al*, (1922, 46), they were still working the mines in April 1921, but solely for barytes. The Third Edition 6-inch map (Ordnance Survey 1920), revised 1911-13, is broadly similar to the previous edition and there are few significant additions or alterations. The exact date at which barytes extraction ceased is unclear, as Wilson mentions activity continuing in 1921, while Dunham states that Scordale Barytes Ltd 'ceased work after 1919' (Dunham 1948, 138). In any case, the end of the boom in the demand for barytes created by the munitions industry in the First World War seems likely to have brought about a sharp and ultimately terminal decline in the Scordale mines' commercial viability, as it did at many other barytes mines. Dunham refers to further work at the mines in 1930-39, but this is described as 'a little work…done here by W Wharton', suggesting that it was a small-scale trial, rather than extraction on a large, commercial scale (ibid 1948, 138). Some other mines with proven lead and barytes deposits experienced a new lease of life during the Second World War, but Scordale appears not to have been considered viable. According to documentary sources, by 1945 the grinding mill at Hilton had been dismantled (Dunham and Dines 1945, 42).

Whilst the cartographic evidence for Scordale is invaluable, it must be viewed with the usual caveat applicable to maps, which is that depictions only reflect a single snapshot in time and were constrained by scale and mapping conventions to omit smaller or less significant features, particularly those considered to be temporary or outside the scope of the mapping exercise. As a result, ephemeral features, such as working and processing areas would might not be depicted on maps even if they had existed. It must also be remembered that industrial sites often saw extremely rapid change and regeneration, which may have occurred in between map editions, so not all changes are captured within the mapping of a site and these cannot be viewed as infallible, definitive documents.

5. THE FIELD REMAINS

Given the project's extensive study area, it is unsurprising that the ground survey has revealed a vast quantity of surviving archaeological remains. A total of 872 features were recorded, ranging from iron artefacts to Bronze Age field systems. Of the recorded features, approximately 75% have been interpreted as post-medieval in date, the vast majority of which relate to the mining activity in the valley. Prehistoric features, predominantly Bronze Age, account for around 7.5% of the features recorded (although it is worth noting that the chronological distribution data is not directly comparable as, for example, the Bronze Age field system forming SAM 32821 was recorded as one single feature, rather than being broken down into its component parts as most of the mining remains were). Of the post-medieval mining remains, the vast majority are components of the water management associated with the site (33%) or relate to extractive activity (31.3%), with transportation features making up approximately 17% of the records. These three feature types also displayed a broad geographical spread, visible in most parts of the project area, indicating their intrinsic link with mining processes.

The sheer quantity of field evidence recorded makes it undesirable, to describe every single feature in detail in this report; this level of information is contained in the project Geographical Information System (GIS). Each feature has been assigned a Unique Identifier (UID) number in the GIS; these numbers are referenced in brackets throughout this report. A gazetteer summarizing the recorded features and their locations can be found as an appendix to this report (see Appendix 1) This report synthesises the results of the survey under three broad headings: remains relating to settlement and agriculture (Section 5.1), industry (Section 5.2) and military activity (Section 5.3). Whilst the majority of the description and discussion relates of the field survey, information from the excavations and scientific analysis of the mineral samples has been taken into account where relevant.

5.1 Settlement and Agriculture

Prior to the current programme of research, evidence for settlement within the survey area was confined to seven sites, all interpreted as being of prehistoric date, of which five were Scheduled in the period 1999-2000 (RSM 27840; 27841; 32821; 32850; 32851 - see Figure 3; AMIE records for NY 72 SE 21, 20, 36, 23, 22 respectively). In 2002, the desk-based transcription of aerial photographic evidence for the Warcop ranges, undertaken by English Heritage to National Mapping Programme standards, identified two other small, probable prehistoric settlement sites (AMIE records for NY 72 SE 25 and 26). No settlements of any later period had entered the archaeological record prior to the current field survey.

The current survey has identified an additional 92 sites of all periods which relate to settlement and associated agricultural activity. Approximately 37 of these are likely to be prehistoric in date, with some possibly continuing in use through into the early part of the 1st millennium AD. The survey also shows that in the post-Roman, medieval and post-medieval periods Scordale has hosted settlements which related to both seasonal transhumance and more permanent, perhaps year-round, pastoral activities. In addition,

there is compelling evidence for miners' settlements which may be late medieval or early post-medieval in date.

One object found during the course of the current project, a stone possibly carved in Pictish style, found in the upper reaches of the valley, *ex situ* in the collapsed remains of a 19th-century mill (27), may point tantalisingly to activity in Scordale in the early medieval period (Brennand 2006, 104). However, some doubt remains as to whether the markings on this stone are of artificial or geological origin as similar markings have also been identified as the result of fossil trails (Bulman 2004, 66).

5.1.1 Prehistoric Remains

In general, evidence for prehistoric activity in Scordale is mostly in the form of unenclosed settlements of roundhouses (referred to in Scheduling and AMIE records as 'hut circles' or 'hut-circle settlements'), associated enclosures, clearance cairns, field systems and burial cairns. As no excavation has been undertaken on any of these sites, dating them relies on morphological comparison with other upland sites of this period.

Settlement in Scordale can be confidently identified in five main locations (Figure 5) and each has evidence for some level of agricultural activity associated with it, in the form of field systems, enclosures, clearance banks and clearance cairns. A few cairns which stand out from the majority, either by virtue of their size or structural elaboration, may well have a funerary function; these include a remarkably well-preserved, isolated cairn cemetery. A number of dispersed individual features have also been identified as being possibly of prehistoric origin, although the impact of later periods of agricultural and mining activity upon them preclude a fuller analysis of their context.

Within the area surveyed, all the settlements are unenclosed and some 31 individual probable roundhouse sites have been identified, all in association with either field systems, enclosures or plots. Although the sample is small, the settlements can broken down into four categories and comprise:

- Platforms set within clearance areas and field systems. Six examples have been recorded (274(5); 275).
- Ring banks (two with annexes) set within clearance areas and field systems. Fifteen examples have been recorded (617; 620; 635-8; 643-6; 652-4; 708; 851).
- Ring banks appended to the exterior of small enclosures, possibly forecourts or courtyards. Three examples have been recorded (252; 280(2); 589).
- Triple, conjoined stone structures within field clearance areas. Two examples were recorded (139(3); 598(3))

By far the largest area of prehistoric activity within the survey area lies towards the mouth of Scordale, where a dispersed settlement and field system (274), probably of Bronze Age date, covers an area of some 18 hectares (RSM 32821; NMR no NY 72 SE 36). The south-western part of this, comprising approximately half of the Scheduled area was surveyed at Level 3 and 1:1000 scale in 2006, during Phase 2 of the current project, to inform management of the Hilton Beck. Although the Phase 2 investigation only required the threatened portion of the Scheduled monument to be surveyed,

along with a sufficiently large additional area to put the threatened area into context, it was recognised that the field system extended much further to the east, and that the remaining areas would be subject to rapid survey at Level 2 standard during the final stage (Phase 4) of the project (Ainsworth 2006; Ainsworth *et al* 2007; Hunt and Oswald 2006). The terrain here, between the north side of the Hilton Beck and the base of the steep escarpment edge below Great Carrath, is a fringe of gentle, south-facing slopes between 270m and 330m above sea level, typical of the land generally favoured for

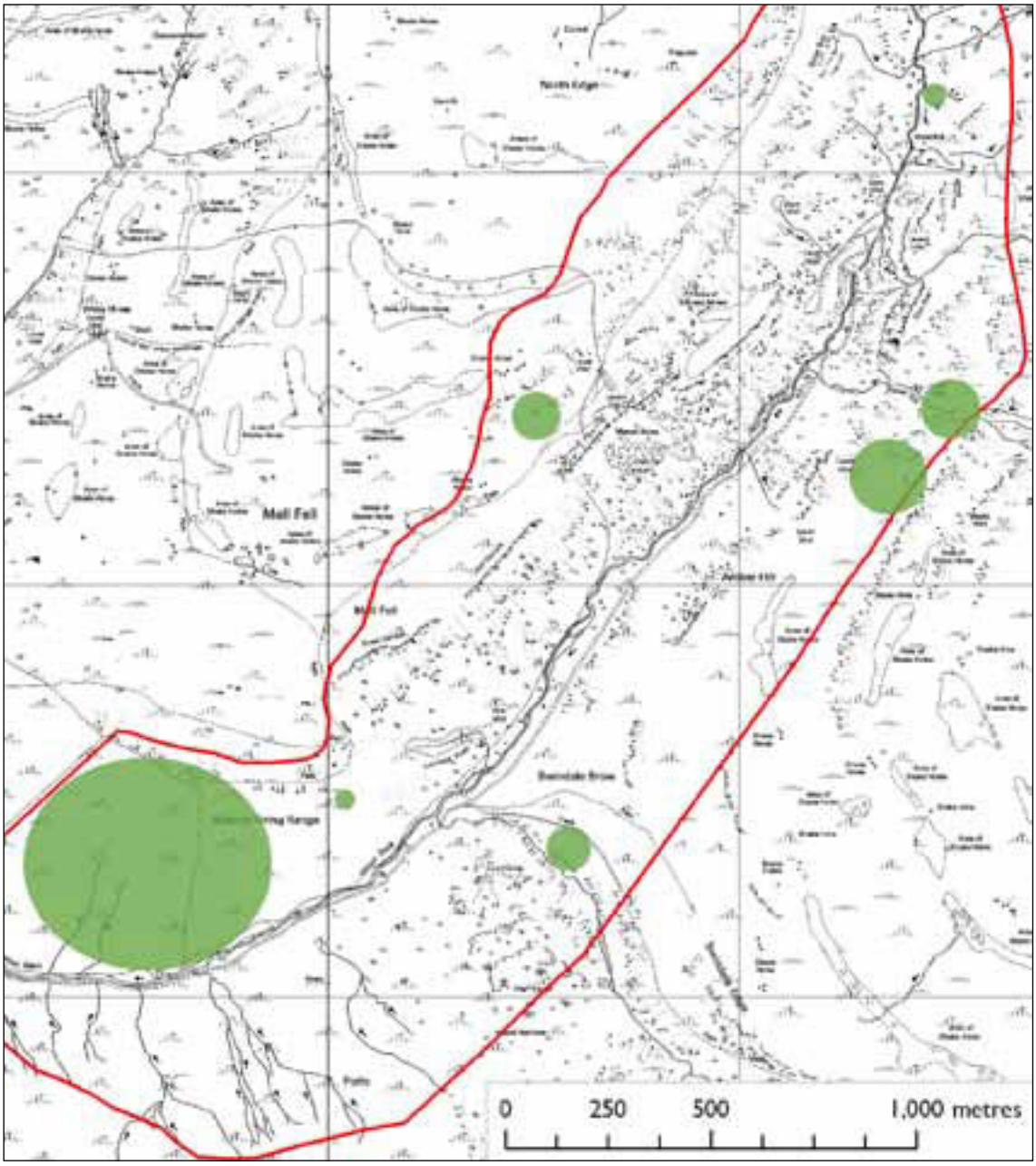

Figure 5 Map showing the five main locations of prehistoric settlement remains, along with two minor areas. The survey area is defined by the red line.

Bronze Age upland settlement and agriculture (Figure 6). To the west of these slopes, the ground opens out into an undulating landscape of fertile, enclosed farmland, whilst to the north and east, in extreme contrast, rise the severe slopes and high moorlands along the western escarpment of the North Pennine massif. At the east, the gentle slope narrows and eventually ends where the steep, deeply-incised valley of Scordale itself cuts into the escarpment edge below Great Carrath. The field system comprises a series of irregular, but generally quadrangular fields, whose boundaries are mostly formed by a mixture of long stony banks and lynchets, some with attached roundhouse platforms. In general, the longer banks of the field system run north to south, perpendicular to the slope, with lynchets running east to west along the contours defining the north and south boundaries of small fields. This pattern of fields extends for some 500m along the contour within the survey area, although its full extent to the west has not been determined as this falls outside the area investigated. Within this field system there are also large numbers of small clearance cairns (some 40 were identified in the area surveyed during Phase 2 of the project). It was noted during the Phase 2 survey that clearance cairns at the western end of the field system were larger than those at the east, possibly suggesting more intensive or prolonged cultivation. Given the nature of the fields, it is likely that they were ploughed for cultivation of cereal crops. Only one cairn was identified during the Phase 2 survey whose unusual form could suggest a primary use for burial. However, at the eastern end of the field system, in the area examined during Phase 4, three more possible burial cairns have been identified (276; 278; 283), one of which (278) has been extensively robbed during the construction of a later building. Four possible roundhouse platforms, which are dispersed throughout the field system, and a small number of enclosures or paddocks, were also identified in the area surveyed during Phase 2. The roundhouse platforms, which range from 5-10m in diameter, are likely to have supported circular timber buildings, since no stone-built 'hut circles' or ring

Figure 6 View across Hilton Beck to the large Bronze Age field system (274)

banks were identified. One further platform was identified to the north of the previously surveyed area during Phase 4. The Phase 2 survey supported the earlier hypothesis of a broadly Bronze Age date for the settlement and associated field system and a worked flint consistent with this was noted in a molehill (Hunt and Oswald 2006, 3-6). However, the results of the survey during Phase 4 may suggest a change in settlement form, possibly of a later prehistoric date, at the east of the area (*see below*).

Within the remainder of the eastern area of the field system which was not surveyed during Phase 2 (east of clearance bank 277), there is a marked increase in the number and concentration of stony banks, defining fields which are generally smaller and with more sinuous boundaries. In a number of places, the field boundaries (including bank 277 itself) show clear stratigraphic relationships with each other. It is possible that this implication of change over time results simply from the fact that the fringe of more favourable slopes becomes narrower and slightly steeper here, with more surface stone present. This area is always likely to have been more marginal for cultivation than the more favourable land to the west, and the adverse qualities could have resulted in an increased volume of stone being repeatedly cleared into boundary banks over a relatively short time-span, and could have limited the scope for division into larger fields.

However, it is possible that some of this change at the east end of the field system is also indicative of much greater chronological depth here, since there is also a change in the morphology of the settlement remains. Integrated into one of the stony field banks is an apparent curvilinear enclosure (280) measuring 18m by 13m, which comprises two stone-built roundhouses overlooking what appears to be a single, small, shared courtyard although it may be that two once separate courtyards in front of the houses have been amalgamated at some later date (Figure 7). Both roundhouses protrude slightly beyond

Figure 7 Roundhouse formed by a stony ring bank and appended to the western side of a small courtyard (feature 280)

the enclosure, but have their entrances within it, and the enclosed courtyard appears to be stepped into two levels. The larger of the roundhouses (at the north) is 7-8m in diameter, defined by a kerb of larger stones, and is partly cut into the slope above. It appears that the southern roundhouse has been superimposed on a pre-existing courtyard belonging to the northern one, as it truncates the enclosing bank at the south-west and possesses its own, smaller courtyard on the south, which is at a lower level than the pre-existing yard, thus producing the 'stepped' appearance of the enclosure as a whole. This small, enclosed, stone-built settlement is very different from the isolated platforms for timber roundhouses seen at the western end of the field system on this slope; although it is likely to be of a later date, it is still likely to be of late prehistoric date (discussed further below).

It is possible that the long and relatively prominent boundary bank (277) marks the eastern limit of the dispersed, unenclosed settlement and larger fields to the west, while the banks and smaller fields to its east are associated with the small enclosed settlement unit. There are also a number of clearance cairns in this locale which might be associated with either settlement. The courtyard settlement is set into a bank which itself forms a boundary within the pattern of smaller fields, and is partly overlain by a later, collapsed field wall of uncertain date. It seems probable that this courtyard settlement is that recorded as RSM 27841 although there are some discrepancies with the monument description, which appears to confuse parts of the complex of field boundaries and courtyards with walled enclosures, and only identifies one roundhouse. However, this area is complex, because two, if not three periods of occupation and field systems may overlap here. Surface evidence for the prehistoric chronology is further complicated by the presence of a possible medieval building (764) some 125m to the south-west, whose occupants have evidently adapted some of the earlier boundaries to form fields and enclosures around it (*see* Section 5.1.2). There has also been significant mining activity immediately to the east which may have removed further evidence of the relative chronology within the earthworks.

Elsewhere along the more severe valley slopes of Scordale itself and the penumbra of higher ground within the survey area, prehistoric settlement can be identified in four other main areas, three on the east side of the valley and one on the west (*see* Figure 5). In every case, the scale of activity is much more limited than that noted above on the gentle slopes towards the mouth of the valley. It is possible that there was further settlement along other terraces on the west side of the valley, since possible evidence for prehistoric field clearance has been found during the course of this survey amongst the extensive mining areas, but the supposed prehistoric remains are so fragmentary that this suggestion must remain speculative (*see below*). Topographically, the surviving settlements tend to favour sheltered, level or near-level limestone terraces on the higher valley slopes. However, one (features 706-10) is located on a small patch of gently sloping ground on the lower, very steep slope on the north side of the Swindale Beck, close to its confluence with the Scordale Beck.

The largest of these other concentrations of settlement activity is located on the east side of the valley, on the higher limestone terraces which run in a south-west to north-east direction along the valley side, high above the confluence of Scordale Beck and Stow Gill at approximately 500m above sea level. Here a string of small settlements

of varying morphology (*see below*) occur in association with clearance banks and small cairns. This group includes two Scheduled hut circle settlements (RSM 32850 and 32851; NMR no NY 72 SE 23 and 23 respectively) which are divided by the gully of Stow Gill, and a previously recorded hut circle and enclosure to the south (NMR no NY 72 SE 25). These three previously recorded settlements are only part of a more extensive pattern of occupation which has not been fully recognised or recorded before. Three further settlements have been identified to the south of Stow Gill and, together with the known settlements, combine to create a linear group of six discrete settlement groups. All the individual settlements are represented by low, rubble banks, and although of differing morphology, all display a number of similar attributes, including style of wall construction and choice of location. This might suggest that they are all of one period, the morphological differences perhaps reflecting different sizes of individual families or extended family groups, each with its own area of fields or unenclosed land on the limestone terraces. Alternatively, it is possible that the individual morphologies reflect functional differences (this is discussed further below).

As a whole, the group on the east side of the valley occupies two terraces. On the higher of the two, five settlements occur approximately in a line, each separated from the next by gaps of 55m to 125m (252, 589, 635-9, 643, 644-6). On the lower terrace, the settlement is tucked against the scarp that divides the two terraces: this consists of a line of three stone-built roundhouses, c12m apart (652-4; Figure 8). Their diameters range from 4.5m to 9m, but all exhibit the same style of construction: a low, circular rubble bank with no evidence of coursing. None have any evidence of associated enclosures and all have been disturbed to some degree. A nearby structure (451) which at first glance looks like a 'hut circle' is later and associated with the mining close by. Returning to the higher terrace, the southernmost settlement consists of one definite

Figure 8 Linear group of roundhouses formed by stony ring banks (features 652-4)

and two possible, smaller stone-built roundhouses (644-6). The largest (644) is 9.5m in diameter and occupies a slight knoll into which it is cut; an internal hollow 4m diameter might represent an internal division or structure. It is unclear whether the two smaller structures (645-6), both 3m in diameter, are genuinely roundhouses or whether they represent ancillary structures for the larger building. This group of structures has been placed at the edge of a natural bowl in the slope which has been partially enclosed by a stony bank, apparently to form an enclosure or small field. The large roundhouse seems to be stratigraphically later than the enclosing bank, for stones from the bank have been robbed in close proximity to the roundhouse, and then the bank has been remodelled to deflect around the roundhouse and the other two structures. Some 55m to the north is another, large roundhouse (643), 7m in diameter (although this building is markedly oval). This too is raised on a slight natural knoll and has a small, 3m-diameter circular structure apparently appended to it. The next settlement to the north differs from those to its south in that it is a closely grouped cluster of four, possibly five roundhouses (635-8 and 851; Figure 9), ranging in diameter from 6m to 8m, all defined by low rubble banks. Two of the roundhouses appear to be conjoined with a courtyard (Figure 10), which also occupies a small, natural knoll like those to the south. Here, however, unlike those to the south, there are also traces of one, possibly two, small, enclosures at the north, which may be contemporary, since a low clearance bank runs from one of the roundhouses across the terrace. The next settlement in this line (589; Figure 9) is different again from the previous ones, comprising a single roundhouse 4.5m in diameter, which is cut into the slope on the outside of a pear-shaped courtyard or enclosure measuring *c*35m by 23m. There is evidence here for chronological depth, for the courtyard may have been remodelled from the remains of an earlier roundhouse or smaller courtyard. Part of the courtyard bank, in its eventual form, shows evidence of crude coursing of the stonework. This courtyard settlement is similar in form to the one at the east of the large field system at the mouth of the valley (280). This settlement

Figure 9 Extract from the project GIS showing the location of various features, including roundhouses and enclosure banks, on the eastern side of Scordale, close to Stow Gill

Figure 10 Roundhouse (635) formed by a stony ring bank viewed from the east. This is part of a discrete group of three, or possibly four, such structures.

is Scheduled (RSM 33850; NMR no NY 72 SE 23). Relatively modern disturbance has taken place through the construction of a military dug-out and a small, rectangular structure, which might be a shieling, added to the perimeter of the courtyard.

The northernmost settlement of this group (252; RSM 32851; NMR no NY 72 SE 22) lies on a sheltered limestone terrace on the slopes above Stow Gill. It comprises a sub-rectangular courtyard, measuring 21m by 7m, appended to the outside of which is a probable roundhouse, 4m-6m in diameter (not 8m as previously recorded – see NMR no NY 72 SE 22). Although the remains of the courtyard and roundhouse are very obvious, the exact form of the roundhouse is less clear than the examples recorded elsewhere, possibly because a later structure, possibly a small shieling, has been dug into the tumbled rubble: the original building may have been more sub-circular in plan.

Along the limestone terraces on this side of the valley, many of the field clearance banks either terminate at, or follow, minor rock outcrops, scree, or terrace edges, suggesting that the natural features formed parts of the boundaries of fields and other land parcels. In some places, the clearance banks are integrated into the settlement remains and at one place (noted above), there is evidence that one settlement post-dates a bank, suggesting that occupation and cultivation on these terraces may have evolved over time. Some of the clearance banks are substantial features, measuring up to 1.5m wide and 0.5m high (for example, features 648 and 649), whilst others are much less pronounced. However, the boundaries form no obvious pattern, from which either the sizes or the shapes of the parcels could be gauged. Not unsurprisingly, the natural topography and potential of the land for cultivation (whether of crops or pasture) seem to have been the major influences in the choice of areas for clearance of surface stone. For example, a series of apparently disconnected stretches of clearance bank (633, 648-9) extend

between three discrete settlement groups (652-4) on this terrace. The banks run roughly at right angles across successive terraces, but have gaps where the intervening steps are formed by the outcropping limestone; another section of bank runs along the top of one of the steps for a short distance. Similarly, other banks stop at the edge of areas of dense surface stone where no clearance has been attempted, while others terminate at marked changes in slope, or rocky knolls. The sparse scatter of clearance cairns interspersed throughout this field system suggests that there was little surface stone to be cleared in some areas. Taking all this into account, it seems probable that where there was no surface stone to be cleared, no artificial boundaries were created; in other words, that the absence of earthwork traces in some areas does not imply that no farming was taking place. The morphology of the clearance banks and cairns is comparable to many other upland field systems of prehistoric date, including the eastern section of the large field system towards the mouth of Scordale (274). A prehistoric date for one of the more substantial banks (647) is indicated by the fact that at one point it has been robbed to provide stone for one of the best-defined roundhouses on the upper terrace (644). In general, prehistoric fields favour south-facing slopes (as does the large field system towards the mouth of Scordale). However, the settlements and field systems on the east side of Scordale have a south-west aspect, with higher ground to the east. This topography and aspect will have restricted the amount of direct sunshine onto any cultivated ground, particularly in winter. Although it is firmly established that the middle Bronze Age and late Iron Age were warmer and drier than today, it is doubtful whether, even in these relatively clement periods, the fields associated with this group of settlements could have sustained productive arable cultivation and therefore year-round settlement. While it is quite possible that clearance may have been carried out in order to improve the quantity and quality of pasture for livestock, it still seems unlikely that upland pasture of this kind would ever have been used through the winter months, with the same implications for the permanence of the settlements.

Figure 11 Settlement group on the western side of Scordale, above Mason Holes. The clearance banks and edges are shown with green and yellow lines, the roundhouses with yellow dots. 618 is a cairn.

On the opposite side of the valley, at a similar altitude (*c*500m above sea level), two roundhouses (617; 620) *c*6m in diameter and defined by low rubble banks, are located some 55m apart on gently sloping ground just above a limestone terrace (Figure 11). The terrace is naturally poorly drained, although this quality has certainly been exaggerated by the construction of a dam and pond associated with the later mining. The roundhouses lie within a complex of clearance banks and clearance edges (where stone has been tipped or thrown, but not carefully deposited as in the banks) which cover an almost rectangular

area c115m by 35m with its long axis also along the contour; one bank may mark a sub-division of this area. Amongst the banks are a number of small clearance cairns. Although the cleared area appears to occupy more favourable south-east facing slopes, its extent is very restricted by comparison with those on the opposite side of the valley, with no indication that natural features were used as boundaries. It is possible that the cleared area represents a cluster of small plots, or the earliest stage of more thorough clearance, rather than formal fields.

Another small settlement and field system (706-709) is located in a strikingly different topographic setting from the others, on a slightly gentler slope within the steep gradient on the northern side of the deeply-incised valley of the Swindale Beck, close to its confluence with the Hilton Beck. This was recorded prior to the current investigation and is scheduled (RSM 27840; NMR no NY 72 SE 21). Although this settlement seems somewhat isolated, being tucked along the side of a tributary valley of Scordale, it is visible from the larger settlement and field system on the other side of the valley (274). It comprises one probable roundhouse (708), *c*7m in diameter, marked by a low rubble bank, which sits within a network of low lynchets, clearance edges, and banks which seem to define a series of small plots. This field system is of a similar small scale to that on the opposite side of the Scordale (617-20, 622) approximately 1km to the north. The field system seems to cover an area of some 115m by 55m, but its full extent to the west is a little unclear, as a number of what appear to be lynchet-like features extending in this direction may be natural features. It is unlikely to have extended much further north or east due to the severity of the valley slopes. Within this area are three probable burial cairns (437, 439, 710; described further below), one of which (710) may have been partially robbed to build the roundhouse.

Two other settlements (139 and 598) contain structures which differ markedly from those described above, which are represented by either platforms or circular stony banks. Both share a number of distinctive characteristics, which suggests that they may be contemporary with each other, the most striking characteristic being that each comprises a line of three, conjoined circular structures. These can be termed roundhouses, but differ from those encountered elsewhere in that relatively large amounts of stone were evidently used in their construction, with much of the walling showing evidence of coursed, drystone construction. Each settlement is associated with a small field or plot.

The more northerly settlement (139; Figure 12) is located on the east side of the upper reaches of Scordale, where the valley begins to narrow, and sits at the interface between the steep upper slope of the valley side and the gentler lower slope running down to the channel of the Scordale Beck. The three conjoined roundhouses have been slightly cut into the scree at the base of the steep upper slope and are evidently constructed out of this same stone. The northernmost of the three is distinctly sub-rectangular in shape, measuring 3.5m by 3m, and stands up to 4 courses high of drystone walling. Conjoined to its south side is a circular structure, 4.5m in diameter, part of the whose perimeter is formed by boulders. Conjoined to the south of this again is a third structure, sub-circular and 4.5m in diameter, which is less well-defined than the other two. The northern two structures have identifiable entrances facing downslope to the west. The combination of tumbled building stone and natural scree, together with the construction of two military

Figure 12 Three conjoined structures (feature 139), possibly prehistoric roundhouses, viewed from the east

dug-outs which intrude upon the earlier structures, makes further interpretation difficult. However, there is a hint that the northernmost structure - the most sub-rectangular - may post-date its neighbour and that it may also have a small yard or enclosure defined by a low, grass-covered rubble bank appended to its north side. The settlement is set on the upper, eastern edge of a well-defined cultivated area, represented by a mixture of lynchets, clearance cairns and banks; the two are undoubtedly associated with each other.

The more southerly settlement (598; Figure 13) is located on the same high limestone terrace occupied by the long string of prehistoric settlements to the south, lying approximately mid-way between two of them (589, 594). The three small, conjoined roundhouses that make up this example, one with an attached courtyard or enclosure, are similarly remarkably well preserved, with walls, some of which are of coursed drystone construction, standing up to 1m in height. The internal diameters of the buildings seem to be tiny, all under 2.3m, but the large amount of tumbled building stone may mask some of the perimeter, disguising a larger diameter. All have possible entrances facing downslope to the west, whilst the eastern two appear to be linked by a 'corridor' between the entrances. Although the amount of later interference seems to be minimal, it is conceivable that, as with other settlements on this terrace, there may have been some later disturbance, which may have either exposed coursing on the walls, or involved the rebuilding of some elements.

Settlement Morphology and Chronology

The current survey has revealed previously unidentified prehistoric settlements in Scordale and has clarified the nature of those recorded previously. The results not only provide a better understanding of the extent of early settlement in the valley, but also highlight the wide range of settlement types indicated by the slightly differing

Figure 13 Three conjoined structures (feature 598), possibly prehistoric roundhouses, viewed from the south

morphological characteristics. The unenclosed, isolated platforms dispersed throughout the large field system towards the mouth of the valley conspicuously lack the pronounced circular stony banks that represent the wall-lines of the other roundhouse sites. Morphologically, these are closely comparable to platforms proven to have supported timber roundhouses, a number of which elsewhere in northern England and Scotland have been dated by excavation to the mid- to late Bronze Age, with some probably continuing in use into the earlier Iron Age (Burgess 1980; Gates 1982; 1983; Gates and Ainsworth 1979; 1981; Jobey 1980; 1981a and b; 1983; RCAHMS 1967, 70-74; 1978, 81-86). These platforms therefore, are potentially the earliest identifiable remains of settlement in Scordale. As no similar remains were found higher up the valley this could suggest that in the Bronze Age, the settlement concentrated on the more benign slopes and richer, deeper soils favourable to cultivation at the lower end of the valley, on the margins of the fertile lowlands.

The morphology of the roundhouses represented by the platforms differs appreciably from all the other unenclosed roundhouses in the survey area, which are likely to have been constructed with low stone walls, or perhaps stone foundations supporting turf walling, though still probably with a timber roof structure. In itself, this difference in form need not imply a later date of origin; excavation of an unenclosed roundhouse marked by a ring-bank 12m in diameter on Hall's Hill in Northumberland, which proved to comprise a very loosely structured bank of rubble interpreted as a 'damp-proof course' for a surmounting turf wall, produced radiocarbon dates in the late Bronze Age (Gates 2009). In this scenario, at least some of the unenclosed, stone-founded roundhouses could be more-or-less contemporary with those built entirely in timber, and the morphological difference may simply reflect the differing building materials available in the immediate

vicinity of the various settlements. However, some of the unenclosed, stone-founded roundhouses bear close comparison with two unenclosed roundhouses excavated at Baldhowend in Cumbria and dated to the latter centuries of the first millennium BC and the first two centuries of the 1st millennium AD (Hoaen and Loney 2003, 57-58). In broad terms, the examples in Scordale and their associated field systems may well span a similar date range. The fact that some of the stone-founded roundhouses are attached to small courtyards need not necessarily imply that they are of the same date as the superficially similar settlements recorded in large numbers in the Cheviots and Scottish Borders, which are normally regarded as late Iron Age or Romano-British period in date (Jobey 1962; 1964; 1965; RCAHMS 1978, 158-169; Oswald *et al* 2008). Indeed, the morphological characteristics of the settlements at Scordale are very different, with the roundhouses usually either occurring singly or appended to the perimeter of a small courtyard-like enclosure. Although there are some examples of these in the Cheviots and the Borders, the examples in Scordale are much less substantial and more crudely constructed, lacking any of the characteristic evidence of scooping and double-face boulder walling.

Continuity of occupation across the late prehistoric to Roman period transition is often surmised but seldom proven in the Cheviots and the Borders, an important exception being the enclosed stone-built roundhouses at Fawdon Dean, in Northumberland (Frodsham and Waddington 2004, 184-7). On Bollihope Common, County Durham, two stone roundhouses appended to small courtyard enclosures of a similar scale to those at Scordale have recently produced conclusive evidence of continuity in the form of a sequence of timber roundhouses which were replaced by stone roundhouses, containing possible evidence of prehistoric iron and lead smelting on the site (Young and Webster 2006; Rob Young *pers comm*). The Bollihope examples are also located within an area of lead-mining remains and the fact that this settlement falls within the same broad date range as the examples at Baldhowend raises the interesting possibility that the courtyard morphology of some of the structures in Scordale may reflect an industrial function or industrial background (*see below*).

The majority of settlements identified in Scordale comprise earthen platforms or low stony ring banks, suggesting that construction was primarily in organic materials, but in some cases with stone foundations. However, the two settlements which each comprise three conjoined structures (139, 598) exhibit significantly more stone in their makeup, implying higher, stone walls and possibly even stone-slated roofs. Indeed, parts of the walls of one example still stand to 1m in height. Whether this different style of construction indicates that these two settlements are of a different period, or fulfilled a different function, remains open to question. From their circular form, a prehistoric date might be assumed, and both seem to have been associated with fields, indicating that they were to some degree similar in function to the nearby settlements which seem to have been involved in subsistence farming. In other upland regions, examples of conjoined structures and complex variants of roundhouse form, clusters and annexes in close proximity to each other have been assigned to the late prehistoric period, for example on Bodmin Moor (Johnson and Rose 1994). Based on plan-form alone the two examples in Scordale may also be prehistoric and their associations are superficially identical to those settlements that can be more confidently assigned to late prehistory.

However, assuming the the difference in constructional style and materials were more than idiosyncratic choices by the builders, there must be a question as to whether these can be confidently assigned to the same period. This raises three possibilities. First, if they are late prehistoric, then their morphology somehow reflects a different type of occupation or activity within them, possibly related to the exploitation of the surrounding mineral resources. Prehistoric buildings serving industrial functions have been identified elsewhere in the locality of mineral resources. In the uplands of Derbyshire, for example, excavation of one morphologically distinct circular stone building in an area of typical ring bank and platform roundhouses and fields, suggested it to have been intensively used for a specific industrial function, in this case shale working (Beswick and Merrills 1983). As noted above, excavations on Bollihope Common - a similar lead-rich limestone area further east in the North Pennines - have revealed evidence for iron lead smelting in a prehistoric circular building and possible evidence of lead smelting close by (Young and Webster 2006; 2009; Rob Young *pers comm*). However, in this case, the 'roundhouses' were also similar to the some of the other prehistoric settlement forms associated with enclosures identified in Scordale. The second possibility is that these triple structures are of a later period and perhaps represent an unusual form of shieling group, although the presence of enclosures and plots would argue against this (Ramm *et al* 1970, 9). The third possibility is that they were both of later date and of different function; the evidence of possible phasing within both groups might support this. Given the small size of the sample and on the basis of the rapid field survey alone, it would be unwise to confidently support any one of the three possibilities, but it is nevertheless appropriate to speculate that distinct architectural differences may denote a wider range of functions and/or dates than has previously been identified in this area.

Enclosures and Other Features

A small number of isolated enclosures and possible structures which may be prehistoric in date have been identified. All display some of the physical attributes that apply to the majority of other probable prehistoric settlements and enclosures elsewhere in Scordale, including low, rubble banks, erratic plan-form, sheltered locations on the limestone terraces, or are found in association with other monuments of probable prehistoric date. No unambiguous stratigraphic relationship with dateable remains has been observed and the fact that some have been modified or substantially disturbed by later military or mining-related activities further complicates dating.

On the west side of Scordale, one of these enclosures (747) is much smaller than all the others, measuring 7m by 5.5m, and is horsehoe-shaped, using a rock outcrop to form one side. Within it is a circular hollow which might indicate the site of a timber structure such as a roundhouse; however, it could equally be wear resulting from the enclosure's use as a stock pen or something similar. A prehistoric origin is suggested by the proximity of a small field system (748) consisting of cleared patches and clearance edges, and a possible burial cairn likely to be of prehistoric date (742). Some 1.5km further north along this same side of the valley, one of the more pronounced natural terraces hosts an extensive complex of ruined structures (214) which are likely to be a settlement of a much later period (*see below*, Section 5.1.2: 'Mining Settlement'). Two small robbed cairns (212 and 213) which are typical products of prehistoric clearance still survive on the fringe of this complex. These, together with the generally favourable setting offered by the

terrace, probably indicate that some level of prehistoric settlement once existed here, but was eventually destroyed or concealed by the later settlement. At the north end of this terrace is an unusual enclosure (210), which has the appearance of a prehistoric ring cairn, *c*9m in diameter, surrounding a block-like upright stone. The approximately circular enclosure, which lacks any obvious entrance, is partly cut into the slope and is formed by low, coursed, drystone walling, revetted with boulders. This is superficially similar to a number of ring cairns that have been recorded in upland Derbyshire (Barnatt 1990; 1996), some of which also surround low, block-like standing stones. However, two factors argue against this particular example as a prehistoric ritual monument: first, it would be surprisingly well-preserved in the context of the post-medieval settlement; second, the central upright stone appears simply to have tumbled from the rocky slopes above, like many similar ones in the vicinity. It is therefore probably best interpreted as a yard, pen or similar enclosure associated with the later settlement.

The survey has identified two isolated, approximately circular structures (82 and 685) which differ markedly from those more confidently interpreted as prehistoric roundhouses; they may be either small shielings or even military structures. The first (82), although roughly circular and cut into the slope, is built from crudely-placed, large stones and has evidence of a porch or windbreak and a possible paddock-like area adjacent to it. The wall of the other example (685), which lies just outside the survey area, stands to four courses high and has a small enclosure attached to it. Three irregularly-shaped, individual enclosures (221, 400, 414) and parts of a multi-period sheepfold-complex (415), which have similar characteristics to the courtyards associated with the prehistoric settlements noted above, lack any evidence for associated roundhouses. While they may conceivably have prehistoric origins, all show some evidence of use for stock management, possibly associated with later shielings, farmsteads or mining-related settlement. On balance, they are considered likely to have originated at a later date and are therefore covered in more detail below (*see* Section 5.1.2).

Funerary Cairns

Within the survey area, twelve individual cairns stand out, either by nature of their size, structure or location, from the much larger number of cairns likely to have been produced by stone clearance for agriculture, and can thus be interpreted as having a funerary function (251, 256, 265, 267, 276, 278, 283, 431, 439, 618, 710, 742; Figure 14). Although these examples can be recognised through field survey, excavation of 'utilitarian' clearance cairns in upland field systems elsewhere has demonstrated that these too occasionally contain human remains (Jobey 1981b; Barnatt 1994). The explicitly monumental cairns in Scordale range in size from 5m to 7m in diameter and the best preserved stands to a height of 0.8m. Two have been extensively robbed or otherwise damaged in the past (276 and 278). In the main, they are located either within, or on the fringes of, field systems and close to prehistoric settlements. One group of cairns, however, is physically divorced from any settlement or agriculture.

The majority of the funerary cairns appear to have been created by mounding up readily available loose stone, presumably collected from the fields or scree nearby. However, three (251, 283, 431) are distinctly different in that they have been adapted from natural features; two of these (251 and 283) are located on the fringes of settlements/

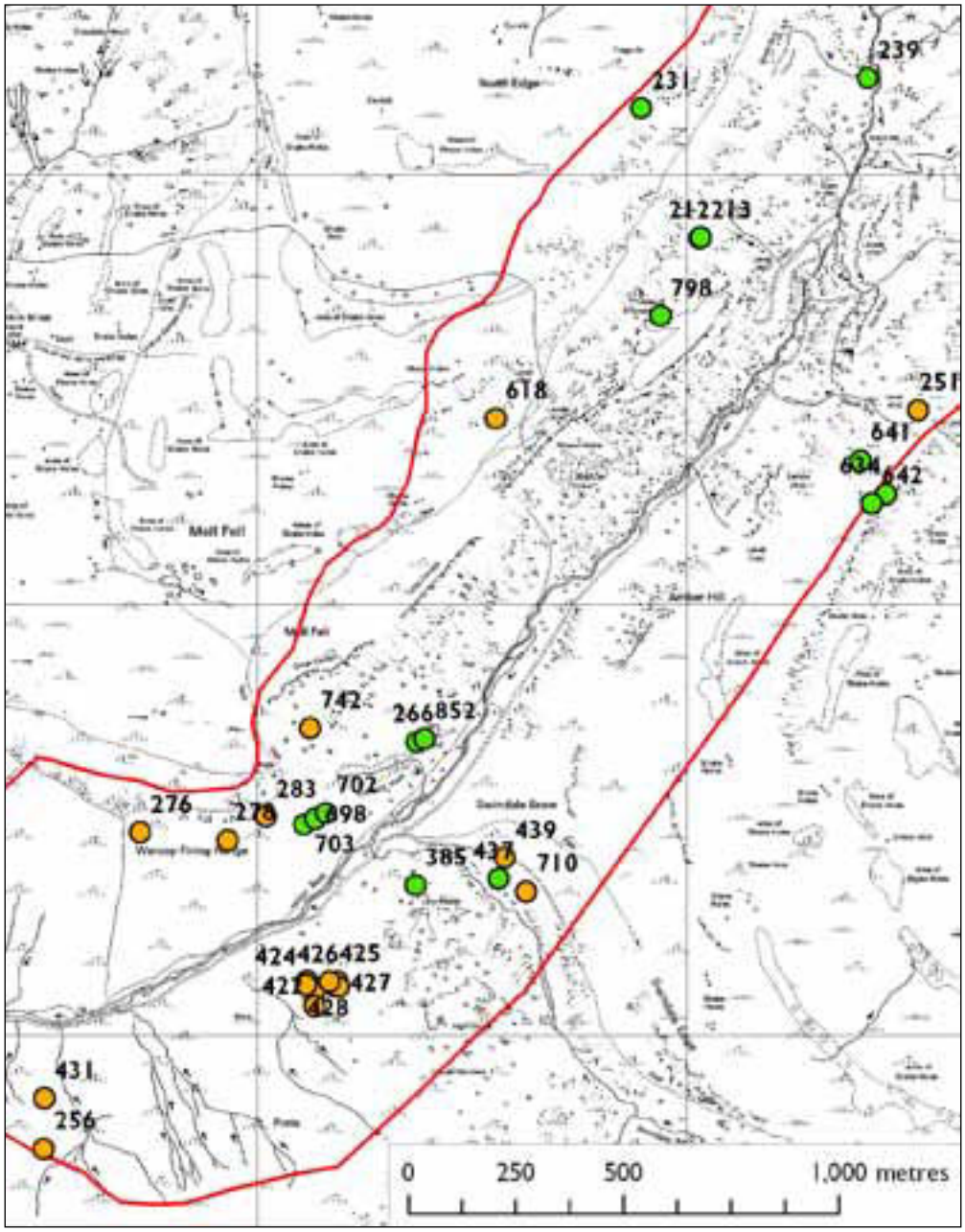

Figure 14 Map showing the location of prehistoric cairns in Scordale. Funerary cairns are shown in orange and more isolated agricultural/unassigned cairns are shown in green.

field systems, while one (431) sits in isolation. Cairn 251 is a pronounced, circular stone mound which lies within, and has been created from, natural scree, and comprises different grades of scree retained, in part, by a kerb of apparently deliberately placed larger boulders. The stone for the mound has been dug from what can be likened to a 'quarry ditch' around its perimeter, rather than gathered from a wider area. The replication of a technique usually employed in the construction of earthen mounds, although in this setting digging would presumably have been a somewhat more arduous task than surface collection, suggests that the construction of an enclosing ditch was in

some way considered symbolically or ritually appropriate. The second cairn of the three (283) is located at the base of a steep scree slope and has had the upslope section of its perimeter defined by digging into the natural slope and scree to define a platform, in a similar way to the 'quarry ditch' around the first cairn (251), with the resulting material piled up to form the mound. The third, more isolated cairn (431) is located on a slight, localised, natural ridge, whose height is emphasised by what appears to be a cairn, although this has been disturbed by the cutting of a post-medieval hollow way which cuts across its base. It is possible that the monument may have acted as a marker for the later trackway. Two other examples of possible cairns appear to have been heavily disturbed in the past, thus leaving doubt about their interpretation. One (439) has been cut into by a hollow way, while the other (278) has been almost entirely robbed during the construction of a building (764) in the same location.

One of the most significant individual discoveries in Scordale is a group of seven funerary cairns (422-8) located on the east side of the Hilton Beck, on a topographically unremarkable shelf of higher ground which overlooks the large settlement and field system (274) on the opposite side of the valley. As no other prehistoric settlement or field system has been identified on the east side of the Beck, either close to or visible from the group of cairns, it seems probable that this cemetery has been deliberately placed so as to be visible from across the valley. The form of the cairns also suggests that a prehistoric, probably Bronze Age, date may be inferred. All seven are low, stony, grass-covered mounds up to 0.4m high, generally flat-topped rather than domed, and all display a level of structural elaboration which suggests that their purpose is funerary. Of the seven, three are rectangular with sides 3.0-3.5m in length and ends between 1.5-2.0m, two are sub-oval, with maximum diameters of 6.0m and 6.5m, one is sub-circular

Figure 15 Rectangular cairn (426) with kerb

with a maximum diameter of 3.0m, and the final one is circular and is 6.0m in diameter. Although a few large stones are evident, most of those visible either through the turf or exposed on the surface appear to be 20-30cm in size, as if stones of a similar size were carefully chosen. In two cases (426 and 427), larger stones appear to have been selected for perimeter kerbs, where these can be seen through the turf (Figure 15). One (428) has been placed against a large, earthfast boulder at its south end. Only one of the cairns (422) shows any sign of disturbance; significantly, perhaps, the disturbance has revealed a large piece of what appears to be quartz embedded in its make-up. Five of the group cluster together, while the circular and sub-circular cairns (424 and 425) are slightly detached from the others, on the edge of a shallow valley to the south, perhaps indicating that there was social differentiation within the cemetery.

5.1.2 Post-Roman, Medieval and Post-Medieval periods

Apart from the enclosed pasture on the fringe of the improved fields around Hilton, Scordale is today predominantly an upland, unenclosed landscape, lying at the edge of a gentler and more intensively used, landscape of farms, hamlets, villages and enclosed pasture fields. The new research suggests that during the post-Roman, medieval and post-medieval periods, grazing has dominated the farming regime in most of Scordale, in a pattern essentially similar to that of today.

The discovery of a range of structures dispersed within the survey area points to a variety of settlement sites, both seasonally and possibly permanently occupied, linked to a largely pastoral agricultural economy on the higher ground. These include a number of post-medieval shielings, small steadings and enclosures, and possible shepherds' cottages. In general, the practice of transhumance - the seasonal migration of shepherds and their herds flocks from winter lowland settlement to summer upland pasture - had been taking place in the northern uplands from at least the 13th century through to possibly as late as the early 17th century. The presence of shielings, usually small stone 'huts' without enclosures, either in isolation or in groups, represents the physical evidence of this activity. Elsewhere, the establishment of small steadings (cottages with associated enclosures) has been interpreted as representing a transition from this transhumance to more prolonged or year round occupation from the early 17th century onwards (Ramm *et al* 1970, 1-8). It is probable, therefore, that the majority of the more substantial steadings identified within the survey area were established after the 17th century and represent possible evidence of year-round settlement (Figure 16). However, some of the smaller steadings are likely to be much earlier in date, as discussed in more detail below. A number of other non-domestic structures, such as pens and enclosures, which form part of the dispersed infrastructure of stock management, have also been identified. Within the survey area, there is no evidence for intensive cultivation after the prehistoric period, nor any attempt at enclosure apart from the enclosed fields towards the mouth of the valley, which essentially marks the eastern fringe of the more intensively farmed 'lowland' landscape. Within this area, which also formed part of a large prehistoric settlement and field system (274), a possible medieval building (764) was identified, suggesting, not surprisingly, that conditions were favourable on the lower slopes for year-round occupation.

Figure 16 Steading (333) on the slopes between Lowfield Hush and Mason Holes

A number of unusual, isolated, shieling-like structures suggest the possibility that small settlements for miners and their families may have been established here during the early post-medieval period, certainly before the large-scale exploitation of the minerals in the valley during the late 18th and 19th centuries (see 'Mining Settlement' and Figure 24, below). Although the industrial aspects of the mining are covered in Section 5.2, these occupation remains are described in this section because they form an important part of the archaeology of settlement in the valley. Though it is not possible at this stage to determine their function conclusively through field survey alone, the possibility that the remains identified are those of remote settlements for miners, possibly permanently or semi-permanently occupied, may be an important discovery for the understanding of the nature of mining settlements in the pre-industrial era.

Shielings

A number of possible shielings have been identified within the survey area. All fall within the range of sizes typical of shielings identified in surveys undertaken in north-east Cumberland and the neighbouring part of Northumberland (Ramm *et al* 1970, 9-43). On the east side of Scordale, alongside the valley of the Swindale Beck are three examples (398, 399, 438), all rectangular in shape and formed by rubble banks with no indications of roofing material, suggesting that they were built with low walls and turf roofs. Two are located along the valley floor close to the Swindale Beck (399; 438), and one on higher ground along the north-west facing slopes of Low Hause (398). All are in sheltered, isolated locations of the type favoured for shielings and none have associated enclosures. The best preserved of the two close to the Beck, feature 399, measures 8m by 3m and is formed by rubble banks, whilst the other example (438) is smaller, measuring

5m by 2m, has been heavily eroded by stream action and is now very amorphous. The third example on this side of Scordale (398) measures 3m by 2.5m and has been partly terraced into the slope. On the opposite side of Scordale, overlooking the confluence of the Hilton and Swindale Becks, is another possible rectangular shieling (281) measuring 3m by 2m. All the examples here are broadly similar in form, and although they exist in relative isolation from each other they loosely cluster close to the confluence of the two streams where running water is likely to have been available even during the summer period. The final example (167) occurs in the upper reaches of the Scordale valley, just to the south of Little Augill, but is different from the other examples in that it is a crudely-formed circular structure, 3m in diameter. A number of other possible shielings have been identified that have been built into, or attached to, earlier, probably prehistoric structures (these are discussed in section 5.1.1). Another example (218), on the higher slopes on the west side of Scordale, may have a small, associated enclosure.

Steadings

On the east side of Hilton Beck, the north-facing slopes below the dramatic escarpment of Roman Fell are very different topographically and geologically from the rest of the survey area. Here, the slopes are gentler, reflecting extensive deposits of sand and boulder-clay, with numerous streams and boggy ground. Nestling in a sheltered hollow here (named 'Potts' on the current OS map, possibly in reference to former well) is a group which seems to comprise three steadings (411, 421, 413) and one enclosure (414). One of the steadings (411) is divorced from the others and lies some 130m to the south-east, higher up the slope at around 390m above sea level. This small settlement comprises a small, irregularly-shaped enclosure measuring 13m by 7m, with two rectangular buildings appended to its outside (Figures 17 and 18). The boundaries of both the enclosure and the buildings are formed by low banks of crudely placed, uncoursed,

Figure 17 Enclosure and appended buildings (411) viewed from the south-east

Figure 18 Closer view of one of the rectangular buildings appended to the enclosure (feature 411)

angular rubble and are generally no more than 0.4m high. The buildings are of a similar size (4.5m by 2m and 5m by 2m), one cut into the natural slope behind, but only one has an obvious entrance visible amongst the rubble. This plan form is reminiscent of the prehistoric settlements with roundhouses appended to the outside of small enclosures (for example 252, 280, 589), except that in this case there is more evidence of stone tumbled from the structures and the buildings have unambiguously rectangular plans. It is not inconceivable that small settlements like this may have early origins, for rectangular structures of the 2nd century AD have been identified in Cumbria, some in association with roundhouses and enclosures (Clare 1982, 46). Although the structures in this group at Scordale are slightly smaller and the immediate landscape is less complex in terms of associated settlements and fields, this group has similarities to an excavated steading (which was also appended to an enclosure) at Simy Folds in Teesdale, some 14km to the north-east. There, an 8th century date was obtained through radiocarbon determination from a hearth within one of the rectangular structures with indications of other activity into the medieval period (Coggins *et al* 1983).

Further down the slope at around 350m above sea level are the two other small steadings noted above, one with two rectangular buildings (412) and the other with one (413), lying within 20m of each other. The buildings of the former (412) are of different sizes, the larger 9m by 2m and the smaller 3m by 2m, and they lie almost side by side, parallel to each other. While the buildings themselves are formed by low rubble banks, they seem to have been set within a rectangular enclosure formed by a sod-cast bank and ditch, placed along the edge of a small stream. The second steading (413) is sub-rectangular, formed by collapsed rubble walling (present in much larger quantities than 412) is sub-rectangular, measuring 6m by 3m with an entrance midway along its east side (Figure 19). The north-east and south-east corners of the building are curved, recalling a similarly- shaped structure (696) on the opposite side of the valley, sited by a spring and

Figure 19 Steading 413

possible field. Although one of the ends of this structure is not evident, all the structures are likely to represent buildings. They display differing amounts of stone in their walls, and the adjacent pair within the sod-cast enclosure may well have been mostly formed of timber or turf as there is too little stone to suggest high walls. A similar rectangular structure, also in an upland context at Crosedale in Cumbria, was originally thought to be a shieling, but excavations proved inconclusive, although they revealed that it was built no earlier than the later 12th century and was abandoned by the mid 14th century (Hair *et al* 1999). Here too, the small amount of tumbled stone indicated that the original stone walls may have been low foundations, possibly surmounted by turf or timber walls. The use of turf has been noted elsewhere in the construction of similar structures (Ramm *et al* 1970, 6).

Some 540m east of building 413 is a roughly egg-shaped enclosure (414), measuring 10m by 8m, formed by a crudely assembled rubble bank with an entrance on the west side. There is a possible quarry ditch on the inside of the western section of bank and the interior is pitted, suggesting that stone has been taken from here to construct the bank. This has similarities to two other isolated enclosures (221, 400) noted elsewhere in Scordale (*see below*, 'Enclosures' section) and may be associated with the nearby building (413).

Despite their proximity to each other, the distinctly different architecture of the three separate steadings may indicate that they are of different periods, although a functional difference between contemporaneous structures cannot be discounted. Although the buildings in the group noted above are clearly rectangular or sub-rectangular in shape, the stony banks that form their perimeters suggest either very crude walling or the use of timber or turf in their construction. They are not obviously shielings, since there are

associated enclosures, and they do not obviously have the more formalised rectangular structure or room divisions often seen with the later farmsteads (Ramm *et al* 1970, 6-8, 44). Without any identifiable stratigraphic relationships, it is impossible to confidently propose any chronological development amongst the different steadings, except by morphological comparison with other settlements in Scordale. One example (411), with what could be two houses appended to the outside of an enclosure, is strikingly similar to prehistoric sites in Scordale. This may, therefore, be the earliest structure in this cluster, and may have evolved at any time between the Roman and early medieval periods. The two lower settlements (412, 413) have an unusual form compared to other examples of shielings and steadings noted in the survey area (*see below*). This may suggest that they too are of an earlier date than the other buildings with rectangular plan-forms, which are mostly thought to be post-medieval in date. In the light of the excavations at Crosedale, this pair may be medieval in date. The lack of any obvious fields and the presence of a single, detached enclosure also suggests that they may be associated with transhumance.

One structure (764), which is located on the gentle south-facing slopes on the west side of Hilton Beck towards the mouth of Scordale, stands out from the other types of rectangular building identified within the survey area; it too. This also may be medieval in date. Orientated roughly east to west along the contour, it is significantly longer than other examples noted, measuring 14m by 4m, oriented roughly east to west along the contour and has an entrance on the north side, but no evidence for internal divisions (Figure 20). At the east end is a small open-ended annexe. It appears to have been built over the remains of a possible prehistoric burial cairn (278) and stone from this cairn may have been re-used in the construction of the low (0.3m high), poorly defined rubble bank which defines it. There is no tumbled stone to suggest that the walling was ever much higher and no obvious evidence for later robbing, so it must be assumed that the walls of

Figure 20 Possible medieval longhouse (764) viewed from the north-west

this building were mainly constructed either from timber or turf. Although both the long sides appear to be bowed - bowed sides are often thought to signify an early medieval or Scandinavian origin - this may be fortuitous, perhaps an echo of the curving perimeter of the underlying cairn. However, the west end does genuinely appear to be slightly curved. The building is located within the area of the extensive prehistoric field system (274), marked by stony field banks and clearance cairns, and some of the banks near the structure appear to have been modified, suggesting that some of the plots may have been re-used in association with the use of the structure. However, no trace of ridge and furrow ploughing or typically medieval field patterns were identified.

Within a North Pennines context, and again on limestone geology, a rectangular structure of similar proportions, but much better defined and with more clearly bowed sides, has been recorded as part of a current survey and excavation project on Bollihope Common, County Durham. This example, which lies close to prehistoric, early 1st millennium AD and early medieval activity, has not been excavated; consequently, its date has not yet been established (Young and Webster, 2006; Rob Young *pers comm*). Its morphology is also broadly similar to structures identified during a field survey of limestone upland at Leck Fell in Cumbria (RCHME 1998), for which an early medieval date has been proposed. Long, thin, rectangular buildings have been also been identified elsewhere in Cumbria, prompting comparison with the settlement at Ribblehead, which exhibits Scandinavian influences (Clare 1982, 46). However, the structure at Scordale is relatively short compared to these other examples and, as noted initially, its apparently bowed sides may reflect its location over an earlier burial cairn, so it would be unwise to postulate a Scandinavian influence on the evidence presently available. Medieval longhouses identified on Bodmin Moor and Dartmoor are also generally similar in size and plan-form, but these typically have double-skinned walling and are orientated at right angles to the slope to allow drainage from a byre at the low end (*see*, for example, Johnson and Rose 1994, 87-89). The proportions and insubstantial walls of building 764 distinguish it from the numerous post-medieval bastles which are located in England's northern uplands (Ramm *et al* 1970, 61-66). Based on its morphology, it may simply be an unusually long post-medieval steading, although the other examples are characterised by relatively large quantities of tumbled stone. The low rubble banks are more typical of those where walls built mainly of turf or timber are envisaged, a characteristic shared by the proposed medieval steadings on the opposite side of the valley. In short, its morphology could be consistent with a date spanning the early medieval to medieval periods.

Two other isolated rectangular buildings, one more complex than the other, are also difficult to date, but their coursed drystone walling suggests a post-medieval date (333 and 594). They have not been shown on OS mapping and are therefore likely to have been much in a collapsed state prior to 1856-60 when their first survey of this area was first completed (Ordnance Survey 1861), suggesting that they are probably of pre-19th century date. One (333) is located on a slight natural shelf to the south of Mason Holes, adjacent to a hollow way (332/770) which runs obliquely across the contour on the west side of Scordale. The building measures 8m by 3.5m and has a south-west facing doorway. Much of the walling still survives, with the north-west gable standing to *c*2m in height, showing that the building had a single storey with a pitched roof. No stone

roofing slates are present, suggesting that the roof was made of turf. It is located in an area bordering Scordale Beck to the east and a curving drystone wall to the north (which separates the grazing land from the southern limit of the mining activity below Mason Holes). There is no evidence of fields, paddocks or cultivation in its vicinity, which may indicate that it was a shepherd's cottage rather than a small steading.

The other isolated building (594), located on the high natural terrace high on the east side of Scordale, south of Stow Gill, is rectangular, measuring 9m by 5m, and of drystone construction, but is more complex. Collapsed stonework, coupled with the later addition of a sheepfold (595) and the digging of a military emplacement (596) into the collapse, makes interpretation of the detail of this structure difficult, but either it is sub-divided internally into two, or possibly three, rooms, or it is the end result of a process of expansion and/or amalgamation, since the north and south ends appear to be on slightly different alignments (Figure 21). The external walls now stand to about 1m high and the amount of tumbled rubble is consistent with it being twice this height originally, suggesting that it had a single storey. Again, the absence of stone roofing slates suggests that the roof was made of turf. Immediately to the east of the building, and probably associated with it, are a series of stony banks which define possible paddocks encompassing a natural hollow. The building is also very close to the area where prehistoric settlement and fields have been identified, as well as later mining activity, so it is possible that prehistoric field boundaries and plots have been re-used when this structure was occupied. In its eventual form, the building was clearly more complex than a shepherd's cottage and is much more likely to have been a small steading. A similar series of structures has been identified on the opposite side of the valley (214); this may be part of a more complex settlement occupied by miners and their families, so steading 594 may be related to mining too (see *below,* 'Mining Settlement' section).

Figure 21 Post-medieval steading (594) viewed from the south

Mining Settlement

A group of six closely-spaced ruined buildings, yards, enclosures and possible field plots, which seem to represent a small, nucleated settlement (214), is located in a very isolated, but well-sheltered position on a level terrace approximately mid-way up the steep west side of the Scordale at *c*500m above sea level, nestling at the base of the steeper, scree-littered slopes above. The morphology of the group, combined with the lack of evidence for any industrial activity within it, would seem to indicate that these buildings were not directly related to industrial processes. However, there are extensive lead-mining areas immediately to the north-east and south-west, which are linked to the settlement by former footpaths. This evidence, together with the conspicuous absence of any industrial impacts upon the settlement remains, suggests some kind of interdependence between the group of buildings and the mining.

The main components of this settlement are the collapsed remains of two, or possibly three, conjoined rectangular buildings and yards in an L-shaped grouping measuring 16m by 8m, generally orientated roughly north-west to south-east (Figure 22). The northernmost building, which has been partly dug into the scree, measures 4m by 2m and has coursed, drystone walls which still stand to a height of 1.5m. At its west end, a doorway has a stone-slab jamb still *in situ*, with a roughly dressed, broken slab, possibly a lintel, lying close by on the ground. The volume of tumbled stonework suggests that the building was of single-storey construction. Appended to the west end of this is a rectangular enclosure or shelter, which has also been partly built into the scree, using the cleared stone to build crude walls, with the south side left open. A smaller yard, also

Figure 22 L-shaped grouping of conjoined rectangular buildings and yards (214), possibly part of a complex, multi-period mining settlement

cleared from the scree, is appended to the western end of this. The second building, which measures 10m by 6m, is at the southern end of the group and has had a crudely made, military emplacement (215) dug into its west side. Although the coursed drystone walls now stand to a height of only 0.5m, the volume of tumbled stonework would suggest they originally stood up to a height of *c*2m, again suggesting a single storey. Linking the two buildings are two small structures represented by collapsed drystone walls, although the large amount of tumbled stonework makes it difficult to determine whether these are yards, extensions of the other buildings, or even a separate building. The two definite buildings are of different widths and are slightly offset from each other, suggesting that they are not components of a single, linear range, but that the complex may have developed organically over a period of time. No roofing material - such as stone slates - was recognised amongst the collapse, suggesting that turf was used.

On this small natural terrace, three other detached, rectangular or sub-rectangular buildings have been either fashioned from the scree or show evidence of drystone wall construction (205, 206, 209), similar to the group described above. Although now collapsed, none display the same volume of tumbled stonework evident in the larger group noted above. The two largest and clearest buildings (206 and 205; Figure 23) measure 5m by 4m and 6m by 4m respectively, while the third (209) is markedly smaller (3m by 2.5m). Two of them (205 and 206) are very similar to each other in that they have walls still standing to 1m in height, identifiable entrances and small annexes. A number of small, free-standing yards or pens, presumably used for livestock or storage, are likely to be associated with the buildings. They too have either been created within, or assembled from, the scree. There are also other less well-defined enclosures, again

Figure 23 Detached, sub-rectangular building (205), possibly a dwelling associated with a complex multi-period mining settlement

possibly for livestock (for example, 488) and the unusual 'ring cairn'-like compound (210), noted above (see *above*, 'Enclosures and other features'). A number of low, stony banks define small plots, whose size is limited by the width of the natural terrace, which are suggestive of either cultivation or improvement for grazing. Intermingled with this settlement are possible traces of prehistoric clearance (see *above*, Section 5.1.1) and it is possible that some of the plot boundaries and other features may have earlier origins. However, the majority could relate solely to small-scale cultivation as an integral part of the subsistence economy of the settlement. A number of military emplacements have been crudely dug into or assembled from the loose stones and structures, disturbing some of the earlier features and further confusing their interpretation.

This concentration of at least six rectangular buildings, together with the yards, pens, enclosures and plots all in close proximity to each other, suggests that this was a relatively large nucleated settlement with an agricultural focus. Whether or not all of the buildings were built and/or occupied at exactly the same time is uncertain, since no relative stratigraphy between individual structures is detectable (apart from within the L-shaped group of buildings). However, there is a general consistency of construction and morphology which suggests that there may be some degree of cohesion to the group as a whole and little evidence of selective robbing of structures, which often takes place when buildings are successively abandoned and replaced nearby. It is possible that the whole group may be of post-medieval date.

The three detached buildings are not as substantial or as complex as the probable steading, but have similarities to shielings, raising questions about their function. Isolated individual shielings are a relatively common feature of unenclosed upland landscapes like Scordale and a few clusters of rectangular and sub-rectangular shielings have been recorded elsewhere in the North-West (Ramm *et al* 1970, 9-43; Bowden 1996, 5), but these tend to be near streams and usually in more benign topographic settings. An isolated nucleated post-medieval settlement like this one, with enclosures and small fields suggesting long-term settlement rather than transhumance, is highly unusual. Scordale's intensively exploited industrial landscape may provide an alternative context for this settlement. There is no evidence for any industrial activity or processing on the northern part of the terrace within the area covered by the settlement and the plots, despite the presence of extensive and intensive mining both to the north, south, and on the slopes below. The only mining-related features lie some distance away at the southern end of the terrace, where there is a complex set of dams (and now dry ponds) constructed to feed hushes on the slope below. In the context of such an intensively exploited landscape, this mutual avoidance must be significant and suggests that the settlement and industrial activity might be contemporary and interdependent. This inference is supported by the existence of a series of paths which traverse the slopes, some linking the terrace with the dams and adjacent mining areas. Ramm *et al* (1970, 1-10) point out that miner's huts were sometimes described as shielings in medieval documents and that distinguishing these based on morphology alone might not be possible. The difficulty in determining the function of shieling-like structures based on their morphology alone is also raised by the excavations of the structures at Crosedale noted above, where analysis of the landscape context of a given building was judged to give a more accurate insight into its function than its morphology alone (Hair *et al* 1999, 154-157). In Scordale, lead

has arguably been a more dominant resource than the rough pasture since at least the 14th century, but the types of settlement that might be associated with it during the medieval and early post-medieval periods have never been identified. It may be that this settlement was occupied by lead-miners and their families working within the valley, and their families, possibly throughout the year and perhaps over a long period of time. If so, it would seem that the inhabitants were mixing mining as a source of income with subsistence farming, largely pastoral but perhaps with some small arable component. The different structures may indicate continuity of occupation from the medieval through into the post-medieval period and, given that the remains were not mapped in the mid-19th century, it seems probable that this settlement was largely abandoned before the onset of the larger-scale industrial exploitation of the late 18th and early 19th centuries (although occupation in some form may have continued within the larger steading).

This may not be the only settlement of this type in Scordale: another steading complex identified on the other side of the valley (594), again close to lead-mining activity, also has a series of plots and yards associated with it, similar to the L-shaped cluster of buildings and yards in the larger nucleated settlement, suggesting something more than a single steading or shepherd's cottage. A number of other isolated shieling-like structures (for example, 401) located close to mining activity may actually be miner's huts (Figure 24).

Enclosures

As well as the enclosure (414) noted in association with the steading group (412 and 413), two other similar enclosures have been identified. The first of these (221) occurs on a gentle, sheltered slope on the west side of Scordale, on a natural terrace above

Figure 24 Possible shieling or miner's hut (feature 401)

the upper reaches of Scordale Beck. It measures 20m by 17m and is approximately oval, defined by a somewhat sinuous low bank, mostly formed of loose stone. The interior contains numerous shallow pits, which appear to be the quarry source for the stone in the perimeter bank, and shows no evidence of having been cultivated. Two collapsed structures, which may be shielings or small animal pens, are appended to its south side and appear to post-date the bank. A military fieldwork has also been constructed on it. The second example (400) is located in the lee of High Hause, a prominent rocky knoll on the east side of the Scordale Beck. Although the knoll is very exposed, the area behind the limestone outcrops is sheltered and this is occupied by an irregularly-shaped enclosure measuring 10m by 9m, defined by a low bank of crudely-placed rubble. The interior has not been cleared of stones and is therefore unlikely to have been used for cultivation. Close by is a possible shieling or miner's shelter (401; Figure 24). The presence of a few shafts, but absence of later lead-mining remains, may suggest this is an area of early mining, with which the enclosure and shieling-like building may have been linked. A possible third example (415) lies on the scree slopes of Low Hause, down the slope to the west of the enclosure described previously. It can only be classified as a possible enclosure, because only the fragmentary remains of a curvilinear bank are identifiable emerging from beneath disturbance produced by repeated rebuilding of overlying walls, sheepfolds and possible shielings (*see below*).

Although shelter seems to be an important characteristic of these enclosures' location, this observation does little in itself to narrow down the range of possible interpretations available. They cannot have enclosed arable plots or 'lazy beds', as all their interiors are either heavily pitted or retain numerous uncleared stones. There is no evidence that the low, stony banks represent collapsed stone walls, implying that they could not have functioned as stock enclosures unless surmounted by hedges, fences or turf walls. However, all have steadings, shielings or similar structures associated with them, in some cases built into their perimeters, which would point to them having a common function related to livestock management. Their morphology, together with evidence that some have been modified, raises the possibility that some may be prehistoric stock pens which have been re-used at a later period for a similar purpose, as commonly occurs in uplands. However, none shows the significant robbing and disturbance that might be expected, and there is no other compelling evidence of any prehistoric settlement in this area east of the Hilton Beck. Therefore, the enclosures are more likely to be entirely creations of later periods, their morphological similarity to prehistoric examples deriving purely from the same pragmatic requirements. The most reliable dating evidence may be provided by the close association of the southernmost example (414) with the small group of rectangular steadings (411, 412, 413) which are likely to be medieval or early post-medieval in date and domestic in function.

Miscellaneous Structures

Five structures of various shapes and sizes do not conform to the major categories of settlement-related features described above. Some examples have been crudely fashioned on the edge of, or within, scree fields, making them difficult to recognise and raising the suspicion that others could have been overlooked due to the rapid nature of the survey. Others (for example, 130 and 131) they have been dug down into the scree, with loose material having been thrown round the edge, yet do not closely resemble

military fieldworks identified elsewhere. All seem to have been constructed in an *ad hoc* manner very different to from the shielings and steadings identified elsewhere. Two other structures have been identified which are not located in the scree: one is an L-shaped length of bank (246) which may mark the corner of a rectangular timber structure, whilst the other is a crudely-fashioned hollow within an area of mining deads(775). All five structures are located close to mining activity but, if industrial in function, seem unlikely to be represent more than lightweight shelters. At High Hause on the east side of Scordale, above Swindale Beck, three isolated structures (402-404), which might be confused either with either isolated shielings or miner's huts, are likely to be disused shooting butts (Figure 25). Although in various stages of collapse, these are distinctly different in build from the shielings or miner's huts identified elsewhere in Scordale, in that they all are small and square distributed roughly in a line at equidistant spacing. One (402) utilises natural boulders on one side, but they are generally of drystone construction with a single entrance.

Sheepfolds

As well as the pattern of shielings, steadings and enclosures probably associated with the use of Scordale for upland pasture, four sheepfolds which are likely to be of a relatively late post-medieval date represent the continued tradition of stock management. It is possible that none of these was associated with any of the settlements identified in the valley, but instead related to use of Scordale by farms in the village of Hilton or further afield. One, now disused, example (415) on the scree slopes of Low Hause, south of Swindale Beck, is a most unusual complex, and may have had earlier origins (Figure

Figure 25 Probable disused shooting butt (402) on High Hause

26). Located on a mostly scree-covered natural terrace and slope, it comprises four, or possibly five, conjoined and overlapping enclosures defined by drystone walls, some surviving to 1m in height whilst others have completely collapsed, and suggesting that it may have grown up from a smaller enclosure (see *above*) and then been gradually abandoned. In its final form, it covers an area of some 80m by 60m. Two walls radiate out to the south-east from the enclosures and end abruptly at a steep natural slope that partly encloses a sheltered natural bowl, thus creating a form of enclosure. Attached to one of the walls is a small, collapsed, rectangular structure, measuring 6m by 2.5m, which may a shieling or small pen. Within the surrounding scree and collapsed stonework there are two, or possibly three, rectangular structures, one of which is typical of a lambing pen. Puzzlingly, however, much of the area enclosed by three of the sheepfolds is so densely covered in scree and large boulders that it would be treacherous for humans or livestock, except perhaps goats, to walk move around within them. Despite its evidently prolonged use and obvious antiquity, it has not been shown on any historic OS mapping, probably due to the difficulty of seeing it amongst the dense scree.

Two other sheepfolds are located on the higher terraces on the east side of Scordale valley, immediately south of Stow Gill. One which measures 6m by 5m (595) has mostly collapsed, and partly overlies (and therefore post-dates) the remains of steading 594. The other (576) is less obvious and may be an adaptation of an earlier structure, but is of a similar size to (595), though somewhat squarer, and shares similar characteristics with the other examples, including a single entrance on its long side.

Figure 26 View from the south of a sheepfold complex (415) of four, or possibly five, conjoined and overlapping enclosures and pens which may have evolved over a long period of time from an original, smaller enclosure with an attached building

The fourth sheepfold (236) is more immediately recognisable as such and is located in the upper reaches of the Scordale valley on its western side. It is depicted and labelled 'Sheepfold' on the 6-inch scale First Edition map (Ordnance Survey 1863) and is therefore likely to be early to mid-19th century in date. It is rectangular, measuring 9m by 6m, and is defined by drystone walls constructed from more deliberately dressed stone than the other sheepfolds, which are now partly collapsed. Its more formal construction of this last example would suggest that it is the most recently constructed of the four.

5.2 Industry

The sheer quantity of archaeological features relating to industry in Scordale bears witness to the centuries of industrial activity here: approximately 616 features (71% of the total identified) were interpreted as relating to industrial process and infrastructure. All the industrial remains were assigned a post-medieval date, although the suspicion that some of the early lead mining remains may be late medieval is discussed below. Although lead mining has clearly been the most extensive and intensive industry in Scordale, extraction of barytes and witherite have also played significant roles. Quarrying, mostly for rough building stone, has evidently been closely allied to mining in some areas, and mining spoil, in the form of small chunks of limestone, has evidently provided a conveniently available mass of raw material for lime burning, possibly both for construction and as an agricultural fertiliser. Farming - the industrial process of food production - has been discussed in Section 5.1, but the possible links between industrial activity and subsistence farming are important in understanding the full picture of the industrial life of the valley.

5.2.1 Lead-mining remains

Note on terminology

Terminology relating to mining remains and techniques can often be problematic, as it is subject to regional variation. Terms used in this report generally conform to the definitions set out by Barnatt and Penny's gazetteer (2004, 104-8). For the purposes of this report, the term 'level' will be used for any tunnel driven near-horizontally into the ground; 'adit' is also widely used, but the former is the common usage in the North Pennines. 'Shaft' will be used for tunnels driven vertically from the surface, whether to access mineral deposits or for ventilation (where a specific function can be distinguished, this will be noted in the text). The preliminary crushing and cleaning of lead ore is often referred to as 'dressing' or 'washing'; the latter term is more common in the North Pennines, but the former (which can also imply the use of water), will be used in this report for the purposes of consistency (in line with Barnatt and Penny 2004, 105)

Overview

Throughout the centuries of lead-mining in Scordale, the processes have remained the same in essence, although various technological advancements have altered the nature and scale of surviving remains. Once the location of a vein was ascertained, the ore was then extracted, possibly stored prior to processing and then passed through various dressing processes to ensure that the lead content was refined to its purest possible

form. The ore was then transported to the smelt mill for smelting and the production of lead pigs, ready for sale. All this was undertaken against an essential background infrastructure of transport and water management, created to ensure sufficient power, water-flows and access were provided to areas which needed them.

Although lead-mining is reportedly first documented in Scordale in the 14th century (Wilson *et al* 1922, 48), and could conceivably have begun as early as the late prehistoric period, no field remains which could conclusively be assigned to the medieval period or earlier were discovered during the course of the present survey. This is not unexpected: the field evidence seems to confirm the generally accepted theory that prior to the 1820s, mining activities were dispersed and small-scale, indicative of a lack of centralised control and a more fragmented industry undertaken piecemeal by individuals or small groups, making it inherently more difficult to recognise. It is likely that early efforts at lead extraction would have focussed on the most easily accessible deposits, particularly those initially visible on the surface. Veins would have been followed until the deposits had been exhausted, or the effort involved in extracting the ore became too great, and then new resources sought. As a result, there would have been a continuity of use of some features and the eventual destruction of others as mining activities were expanded, thus obliterating evidence of earlier exploitation. The evidence recorded in Scordale for early mining comprises a scatter of small-scale extraction sites, often associated with ore-processing (dressing) areas nearby and, as described in Section 5.1.2, in several instances small, individual stone-built shelters or huts, as well as one unusual group of rectangular structures or steadings. These in turn sometimes have associated small-scale agricultural features, possibly indicating combined subsistence and mining activity. The surviving features from these early periods are generally on the periphery of the later activity from which it can be inferred that earlier activity in the more productive areas is likely to have been obliterated by later, more extensive and intensive exploitation, thus skewing the distribution pattern.

A prime example of such potentially early activity is on Low Hause, towards the south-east of the survey area, a part of the valley which is free of the later, intensive exploitation. As well as on the gentler, more hospitable slopes of the southern side of the valley, similar settlement remains which may be associated with mining activities were recorded on some of the natural plateaux in the steeper valley sides and tops. On the surface field evidence alone, it is almost impossible to date these building types precisely, but they may have originated in the later medieval period, with further development into the post-medieval period prior to the arrival of large-scale exploitation. This raises the suspicion that at least some of the mining remains recorded nearby and assigned a post-medieval date might also actually originate in the late medieval period. Some may well relate to the documented 1698 agreement allowing mining rights 'to all the lead mines within the lordship of Hilton and Murton', referred to earlier in Section 4 (CRO(K) 1698). Mining in Mason Holes was also undoubtedly occurring in this early post-medieval period and some vestiges of this activity still survive amongst the later mining features and waste heaps.

By the 1820s, when map evidence can be used for the first time as an indicator of mining activity, there was clearly a developed, centralised system of mining, with its associated

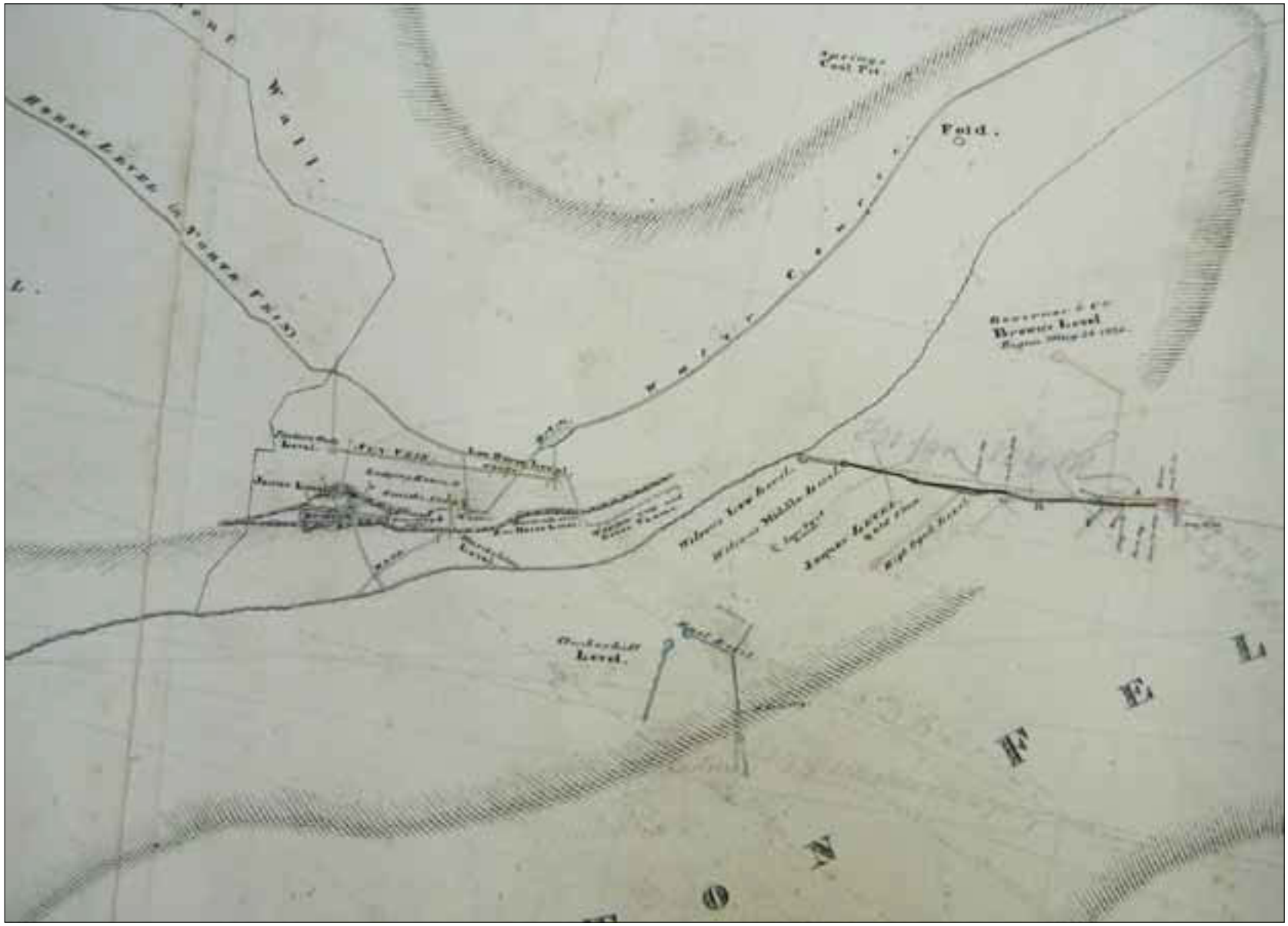

Figure 27 Extract from a plan of the 'mineral ground in the manors of Hilton and Murton', dated 1824.
Reproduced by kind permission of The North of England Institute of Mining and Mechanical Engineers. Ref: LLC/Plans/I/103

infrastructure, in place in Scordale (NEIMME 1824; Figure 27). During this period, the focus of the mining was on the principal productive veins which occur on both sides of Scordale, trending ENE to WSW and generally some way up the valley sides. The depiction on the 1824 plan indicate that mining activity was concentrated on three areas at this date: a vein to the north of Amber Hill, Great Augill and the Mason Holes area. The first of these covered a restricted area on the surface, amounting to approximately three levels. The working to the north of Great Augill took the form of a number of levels in a linear arrangement, following a vein. Most of these levels can be identified with features recorded in the field, or, at least, their location can be inferred from other surviving features, such as spoil heaps and dressing areas. The depiction of the workings around Mason Holes shows at least five named levels, an area of hushing, a 'waggon way', a road, two sets of 'teams', a 'Lodging House', a 'Smith's Shop' and a reservoir. The density of features and infrastructure shown in this area, as well as demonstrating a concentration of activity here around 1824, strongly suggests that Mason Holes was an established mining area by this date. The density of surviving field remains in this area also confirms this assertion and allows most of the features on the map to be identified with the remaining physical evidence. The main mine road, leading from Hilton village to Great Augill, is not shown in its entirety on either the 1824 plan or Hodgson's 1828, smaller-scale map of the county (NEIMME 1824; CRO(K) 1828), demonstrating that its north-eastern section was added after 1828 and confirming that the main focus of activities at this date was in the Mason Holes area.

The intensification and development of fully industrialised lead mining and production which was undertaken by the London Lead Company can be seen in the depictions on the First Edition 25-inch map (Ordnance Survey 1861; Figure 4). When the map was surveyed in the late 1850s, no workings were depicted in the Mason Holes area, indicating a cessation of extraction here. The focus of activities had evidently shifted to the area around the junction of Scordale Beck and Great Augill, where a crushing mill, two further buildings, a probable group of buddles, two reservoirs, a tramway, a mill race and a series of bouse teams, apparently not in existence in the 1820s, are shown. These features are reflected in the surviving field evidence, which also provides further evidence to demonstrate the development of, and alterations to, a number of these features, for example, the series of buddles to the east of Scordale Beck a short distance to the south of its confluence with Great Augill. One of the principal features shown on the earlier maps and still in use in the late 1850s was High Shop, a building on the high slopes of the north-west side of the valley, opposite Stow Gill, which can be equated with a 'Lodging House' on the 1824 map. This structure still survives, with evidence of a number of phases of expansion and alteration visible in the remaining fabric of the building. Other levels are also shown on the map at this date, away from the main focal area, two in the vicinity of High Shop and another to the north of Great Augill, referred to as an 'Old Lead Mine'. These levels, although isolated from the principal working area, appear to be aligned on the mineral vein which crosses the valley. One of the most remote levels in Scordale, adjacent to Little Augill, is described on this First Edition OS map as an 'Old Lead Mine', indicating that it was no longer being exploited by the late 1850s, having probably come into existence in 1824, as evidenced by the earlier plan This level can be located using surviving field evidence; the map allows an approximate period of usage to be assigned to the feature. The infrastructure in place at this date included the

main mine road, which is shown on the map leading from Hilton village to the principal working area, a tramway within the principal working area and head and tail races, serving the crushing mill. Whilst the map captures these features at a single point in time, the field evidence, which survives for all the aforementioned elements of infrastructure, demonstrates their development over time.

The intervening period between the survey of the First Edition 25-inch map (1856-60) and the revision of the Second Edition 6-inch map (1897) (Ordnance Survey 1861; 1899b) saw the departure of the London Lead Company from Scordale (in 1876), resulting in the short-term cessation of lead mining and production. Documents relating to the 1895 sale of the lead mines demonstrate that there had been a period of considerable investment and construction, instigated by the Scordale Lead Mines Syndicate, which ultimately failed (CRO(K) 1895). These changes can be traced on the Second Edition 6-inch map (Ordnance Survey 1899b), which shows seven structures around the principal area, at the confluence of Great Augill and Scordale Beck, a further structure alongside Stow Gill and two structures adjacent to Scordale Beck to the south-west. The active levels depicted are broadly the same as the previous edition of the map, suggesting that the principal mineral vein crossing the site was still productive and was still being exploited. Further alterations to the mining structures and infrastructure, not depicted on this edition of the map, can be traced through the surviving field evidence.

Although records show that mining was resumed in 1896 by the Scordale Mining Company, there are no further references to lead ore output, indicating that this operation had ceased; the primary output of these operations post-1896 was barytes (Carruthers *et al* 1916, 31; Dunham 1948, 138). Some of the lead-workings were re-used to extract barytes and some waste-heaps were re-worked in this process, examples of which are discussed below in the barytes-mining section (Section 5.2.2).

The following text will consider the field evidence for the processes undertaken in the acquisition of lead ore and its refinement in approximate order, incorporating details of infrastructure where relevant.

Water Management

A key component of the infrastructure supporting lead mining was the management of water, which was utilised for prospecting, powering a range of equipment by means of waterwheels, and for washing and processing the ore. Furthermore, unwanted water had to be drained away. The centrality of water to the lead-production process is reflected in the large number of surviving features relating to water management in Scordale; just over 200 features (approximately 23% of the total) were classified as having a 'Water Management' function. The latter two functions depended on a sustained, regular flow of water and the former required the collection of a body of water to be released as and when it was required. The water management associated with hushing is discussed in more detail in the 'Hushing' section below.

In terms of the chronology of water management, there are few field remains in this category which can confidently be assigned to the early post-medieval period. However, map evidence helps to clarify features which date to the 19th century and later. By the

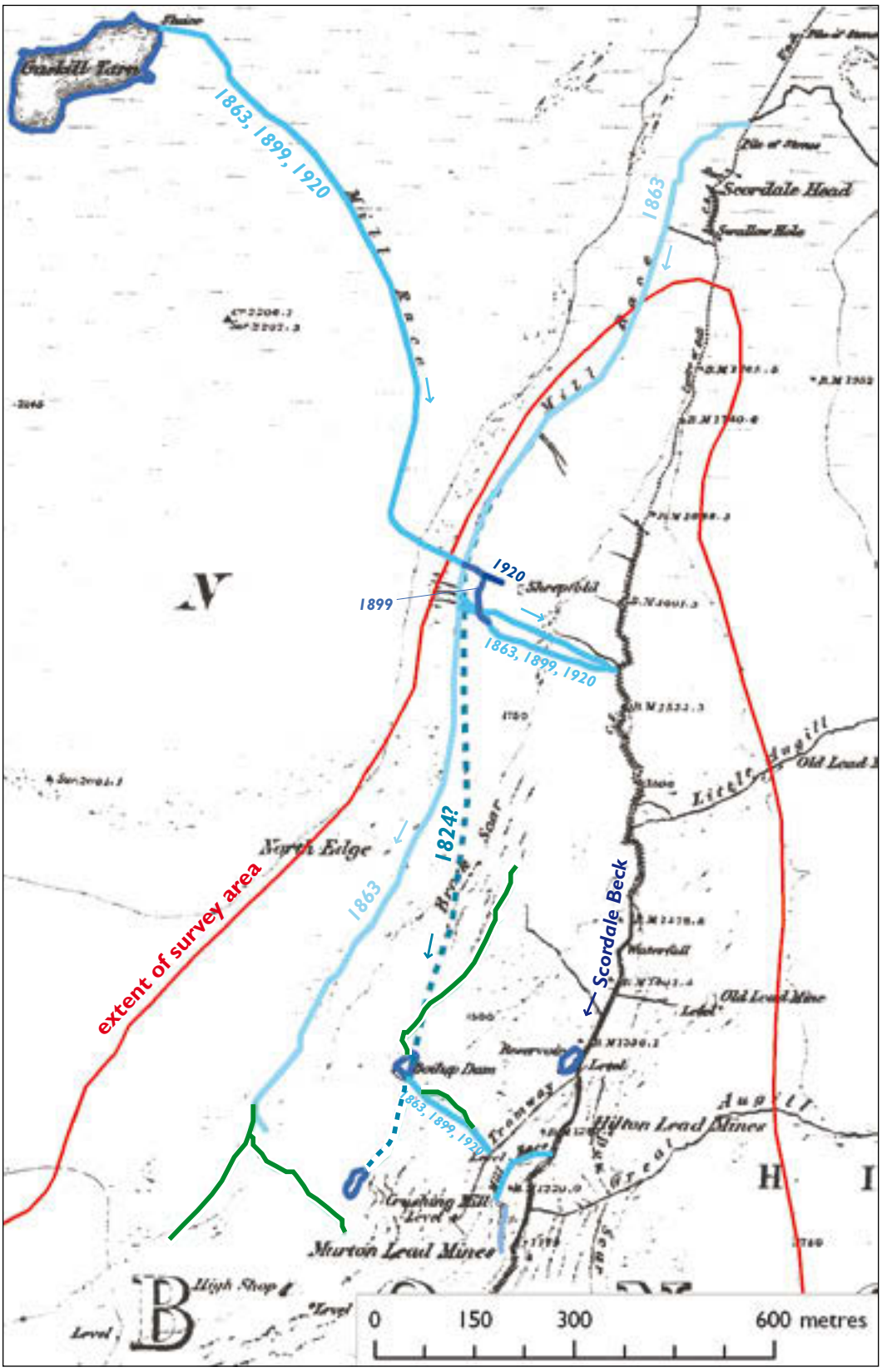

Figure 28 Map showing leats mentioned in the 'Water Management' and 'Water Collection' sections, annotated with the dates of maps that they appear on and direction of flow. Previously unmapped sections of water course recorded during the present field survey are shown in green.

Reproduced from the 1863 Ordnance Survey map.

1820s, a substantial leat (marked as 'Water Course' on the 1824 map; see Figures 27 and 28) had been created to the west of Scordale Beck to tap into the water source at Scordale Head (NEIMME 1824). This fed into a dammed reservoir, from which channels or leats dispersed water to the Mason Holes area. Further, smaller-scale water management, such as channels feeding individual dressing floors, was doubtless being undertaken at this date, but depicting such features would have been beyond the scope of a map of this scale. By the 1860s another long leat had been created to tap into Gaskill Tarn, a natural body of water situated at around 670m above sea level, approximately 1km west of Scordale Head. The First Edition 6-inch map shows this leat as a 'Mill Race' with a 'Sluice' at the eastern end of the tarn, as well as depicting what appears to be the northern section of the leat shown on the 1824 map (also labelled as a 'Mill Race') (Ordnance Survey 1863). In addition, a mill race is shown leading to the crushing mill opposite Great Augill, with two reservoirs to the north of this area. Subsequent map editions show broadly the same water management features, with the main difference being between the depiction of the long leats; only the channel leading from Gaskill Tarn is shown, joining a series of potentially natural run-off channels north of Little Augill and rejoining Scordale Beck (Ordnance Survey 1899b; 1920). The broad pattern demonstrated by the map evidence is that for the first part of the 19th century, water was carried some distance along a leat to the upper slopes of the western side of the valley, particularly in the vicinity of Mason Holes, the inference being that this was the easiest method to ensure a sustained supply of water to mining locations high up the valley side. Subsequently, Gaskill Tarn was tapped to provide a similarly reliable source. The development of the working area by the confluence of Great Augill and Scordale Beck in the mid-19th century saw a shift in the location at which water was required and the construction of Boilup Dam and a reservoir adjacent to the beck appears to have fulfilled this need. The leat leading from Gaskill Tarn was still in existence in the 1860s, but it is not clear if it was still in active use for the mining process, or if so, where it was carrying water to. However, by the end of the 19th century, it had been abandoned as a method of supplying water to the mining and processing activities.

Timber launders commonly augmented the system of leats and channels dug into the ground, but these were not always shown on maps and are now barely traceable on the ground; only occasional stone bases which would have supported elevated timber launders survive.

The vast majority of man-made water management features occur on the north-west side of Scordale. Whilst this may be indicative of the availability of natural water sources and the topography (the north-west side of the valley, whilst equally as steep as the south-east side, has more level areas and plateaux, making it more accessible and conducive to being exploited and engineered), it may also reflect the intensity of mining activity focused on the north-west side of the valley, relating to the more productive and lucrative geological character of that area.

Even from this brief summary, it is clear that water was collected from a wide area and brought to the processing areas as required. Often, this water was used for one process, possibly used for other functions, but was ultimately deposited back into Scordale Beck after use. This would potentially have introduced a greater volume of water to the Beck

than might otherwise have occurred naturally. It is this movement of water through the landscape and the artificial manipulation of water flows which has impacted on the flow of, and sediment distribution within, the lower reaches of Scordale Beck.

Water Collection

The collection of water from the wider area has been discussed above, namely the creation of a leat from Gaskill Tarn and an earlier leat from near Scordale Head. The northern section of the latter feature lies outwith the extent of the present survey, but further south it was traced on the ground as part of leat 229. The 1824 map evidence suggests that the leat descended the slopes of the valley towards a reservoir, which in form and position is a close match for reservoir 300. The remains of two sections of leat, 216 and 864, which are approximately aligned with each other, appear to represent the remains of this earlier leat, with the latter section feeding into reservoir 300. The features are very faint and fragmentary on the ground and are now separated by reservoir 115 (Boilup Dam), but they approximate to the mapped location of the leat. The position of reservoir 300 would have allowed water to be collected and stored for use in the Mason Holes area, which was the focus of activity on the western side of the valley in the early 19th century. The absence of reservoir 300 from the First Edition 25-inch map and subsequent editions is an indication that by the late 1850s, it was no longer a functioning feature (Ordnance Survey 1861; 1899b; 1920).

The leat leading from Gaskill Tarn originates some distance outside the survey area, but its mapped course on the First Edition 25- and 6-inch maps shows it turning a right angle, descending the slope and joining the leat which originated at Scordale Head, represented by the earthwork of leat 229 at that point (*see* Figure 28). Leat 229 continues to the south-west as an earthwork for approximately 1km, with the field evidence suggesting that the leat extended further than the First Edition 25-inch map shows (Ordnance Survey 1861). The destination of the leat is not clear, but it may have been heading towards an area of activity around level 540, to the north of Mason Holes, and then potentially continuing along leat 566 into reservoir 543, which was the main source of water for much of the hushing at the south-west end of Mason Holes. However, this latter part of the route is supposition as there is no firm field evidence to confirm the hypothesis. The First Edition 25-inch map depicts leat 229 turning downslope some 200m short of the end of the earthwork feature recorded during the present survey (Ordnance Survey 1861). The downslope channel, shown on the map for around 35m, was recorded as leat 796 and the field evidence demonstrates that this actually continued further downslope towards the large group of shaft mounds to the north-east of High Shop. This latter segment of the leat post-dates leat 229, as at the junction of the two features, the continuation of leat 229 to the south-west has been blocked by stones and the upcast bank defining the south-east side of the leat has been dug through to allow water to flow into 796. Therefore the map depiction appears to reflect the latest course of the leat, with the lower part of leat 796 not shown, because it was no longer flowing, i.e. the diversion of leat 229 into leat 796 was no longer functional by the 1860s.

On the eastern side of the valley, above Amber Hill, there is an example of a long leat (457) bringing water from outside the present survey area to supply a former reservoir (456). It was traced as an earthwork for 136m within the survey area, but continues to

the south east. In addition, there is a series of three conjoined ponds (444, 445 and 446) on this side of the valley which appear to have been fed by groundwater from within the limestone and from a spring above as there is no evidence of leats leading to them. Natural ground seepage also appears to have fed leat 655, which carried water from a higher limestone terrace into a former pond (447).

Water utilised in the area of activity to the north of Great Augill was collected from a natural stream course, which was tapped by a narrow leat (242). The leat can be traced intermittently for around 200m leading to the reservoir 245 to the south, which it was clearly dug to feed. From here, the water was used for hushing and dressing.

In addition to these substantial man-made leats, there is evidence that natural run-off channels were utilised to enhance the collection of water. There are examples of natural channels descending the valley side and feeding into channel 566 and subsequently into reservoir 543 at the south-west end of Mason Holes. Similarly, to the north-west of Lowfield Hush, there are a number of natural run-off channels, some of which have been artificially straightened (752 and 753), which collected water from the slopes above and fed it, via a collector leat (738), into the series of reservoirs at the western end of Lowfield Hush.

There is also evidence that Scordale Beck was tapped to provide a water supply, for example, leats 119 and 120 feeding from the beck into reservoir 116 and leat 69, a mill race, taking water from the beck, both discussed below. However, Scordale Beck was not a widely used water source, potentially reflecting the rapidly fluctuating water level and unpredictable flow pattern in the beck.

Water Storage

Having observed Scordale Beck during the course of the present survey, it is clear that its level fluctuates greatly, often in a short space of time, indicating that reservoirs would have been necessary to provide a reliable, easily controlled and sustained source of water. Of the features recorded during the present survey, 37 were identified as reservoirs or ponds, ranging from relatively small features of just over 22m^2 to one reservoir which would have had an area of around 1323m^2. There appears to have been no 'standard' shape, with the form of the reservoir often dictated by the natural topography. The majority of the ponds and reservoirs were recorded on the western/north-western side of the valley, with eight examples identified on the eastern/south-eastern side (Figure 29). Most of the reservoirs recorded appear to have been created as part of the hushing process, in order to retain a body of water for the purpose of clearing overburden and exposing mineral veins (see 'Hushing' section, below). A few examples of ponds and reservoirs created to supply the ore dressing process were recorded, generally found in association with dressing floors.

One of the reservoirs which can be assigned to a relatively early date is a large reservoir (300; Figure 30) located c175m to the north-east of, and on a similar level to, High Shop. It is approximately 50m in length and is created by an earthen and stone dam (781) of substantial construction which stands to a maximum of c1m high. Water for the reservoir would have been supplied via leats 864/216, potentially parts of the same

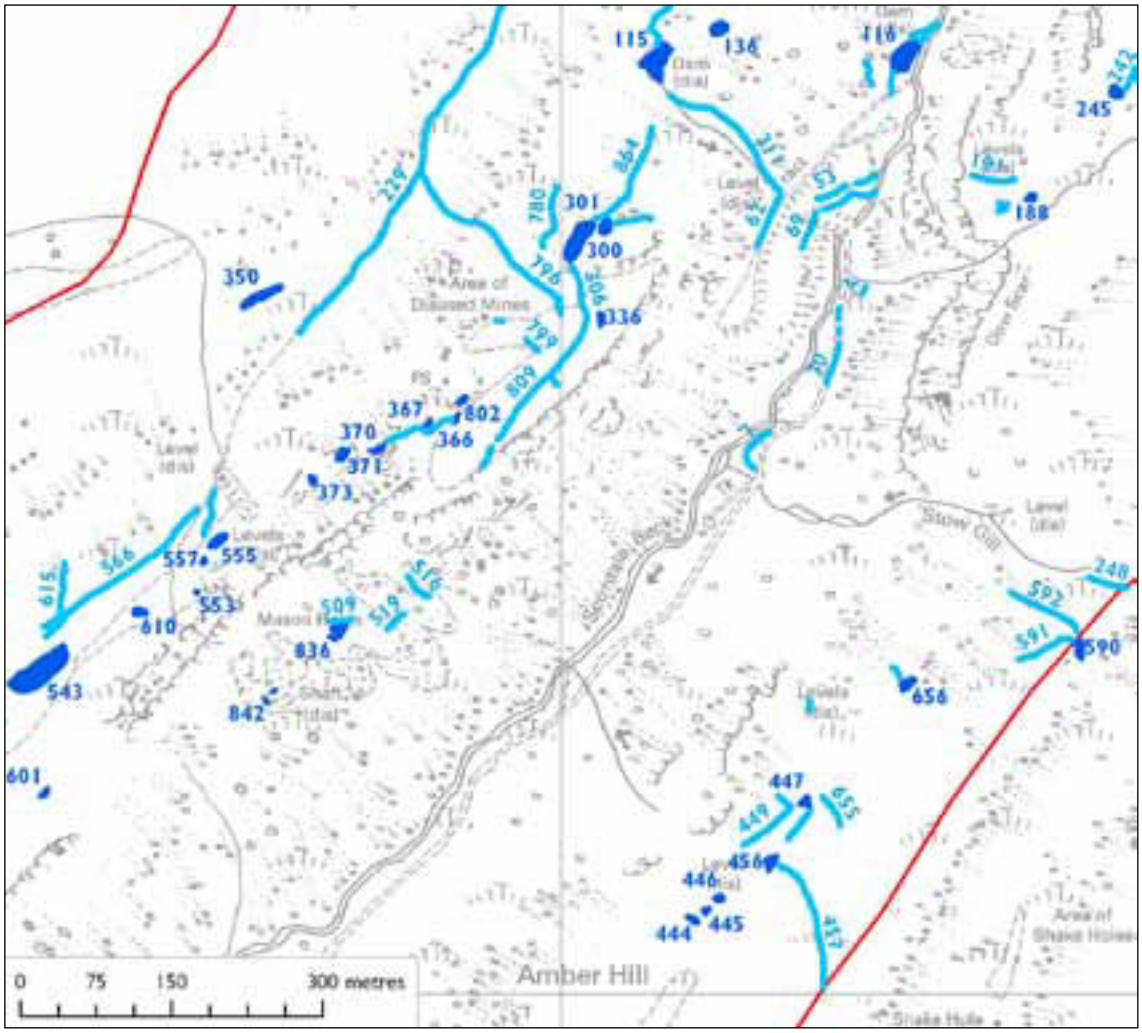

Figure 29 Map showing the principal reservoirs and leats mentioned in the 'Water management' section. There are further reservoirs in the vicinity of Lowfield Hush c1km to the south-west.

feature, discussed above, which probably originated towards Scordale Head. There is a leat (306) leading away from the southern end of the reservoir towards the area around High Shop; this emanates from beneath a section of stone-built dam, suggesting that the water is managed underground via a culvert or pipe. There is a repaired breach in the dam at its north-eastern end, which leads into an adjoining, smaller reservoir (301). The latter has two clear breaches in its dam (787); a narrow spade-dug leat (788) leads away from the more northerly breach, potentially carrying water to the processing areas downslope to the east and another breach directs water into an area of hushing to the south (302). There is evidence of repaired breaches in the dam, suggesting multiple usage of the feature. A reservoir is depicted on the 1824 plan which is broadly analogous with the shape of 300 and is located in approximately the right position (NEIMME 1824). However, there is no reservoir shown in this location on subsequent map editions, suggesting that it had become redundant by the 1860s. The dating of this depiction would associate it closely with the workings around High Shop, potentially providing

Figure 30 View of reservoir 300 from the slopes above, to the north-west. Although it no longer holds any depth of water, the interior of the reservoir is still very boggy.

a power source, but it also appears to have been used as a water source for hushing the area below it (302). These uses appear to have been concurrent, as the 1824 plan depicts three levels below the reservoir, which broadly correspond with three levels/ open face workings (782, 783 and 784) recorded within the hush. The adjacent reservoir (301) is not depicted on any of the mapping, but field evidence suggests that it is most likely to post-date 300. The main evidence for this is that the leat leading from it (788) carries water to the edge of the rock outcrop where it cascades onto the steep slopes below, with the potential to have been managed via timber launders and chutes onto the dressing areas below, to the east, which were operational in the later 19th century.

A short distance to the north and upslope of reservoir 300 is a further possible reservoir (305). There is a stretch of dam (779) associated with the reservoir, but it is not as well-engineered as other examples in Scordale. Water seems to naturally collect in this area and it may have been enhanced to provide a more reliable water source. A leat (780) leading from the southern end of the reservoir carries water downslope to reservoir 300. There are no breaches visible in dam 779, thus suggesting that the purpose of reservoir 305 was solely to supply water to reservoir 300 below, achieved by managing the naturally occurring water in this area.

The other principal water storage features with a relatively early date on the western side of the valley are a series of ten reservoirs above Mason Holes (see Figure 29). These appear to have been fed via a combination of natural groundwater seepage, springs and leats. The largest of these is reservoir 543, at the south-western end of the group, which measures almost 67m by 22m; the actual area of the reservoir is around 1323 m^2 and with a dam of up to 1m high, the potential capacity could have been 291 000 gallons (1 323 000 litres). The reservoir has been created by the construction of a dam (559) which

displays evidence of three major, deliberate breaches along its length. Water for the reservoir appears to have been gathered from a series of collector channels (for example, 615) on the hillside above the reservoir, which fed into a leat (566), which in turn fed into the north-western side of the reservoir. The leat (566) leading to the reservoir (543) originates in the vicinity of level 540, to the north-east, and the water feeding into the leat probably came from this area, possibly draining out of the level itself. These features are most likely to date to the 18th century, when a considerable amount of hushing was being undertaken (Cranstone 1992, 44), and the early part of the 19th century, when some reservoirs are crudely depicted on the 1824 plan along the top edge of Mason Holes (NEIMME 1824).

Boilup Dam, a reservoir (115) created by an earthen and stone dam (855), was recorded as an earthwork on the course of leat 216. Its depiction on the First Edition 25-inch map would suggest it dates to the late 1850s, if not earlier (Ordnance Survey 1861). The source of water filling this reservoir is not clear, although leat 216 would undoubtedly have channelled water into the reservoir. The leat can be traced for almost 380m to the north-east, falling with the shallow gradient towards the reservoir. In addition, the plateau that the reservoir is situated on is relatively boggy and appears to collect water naturally.

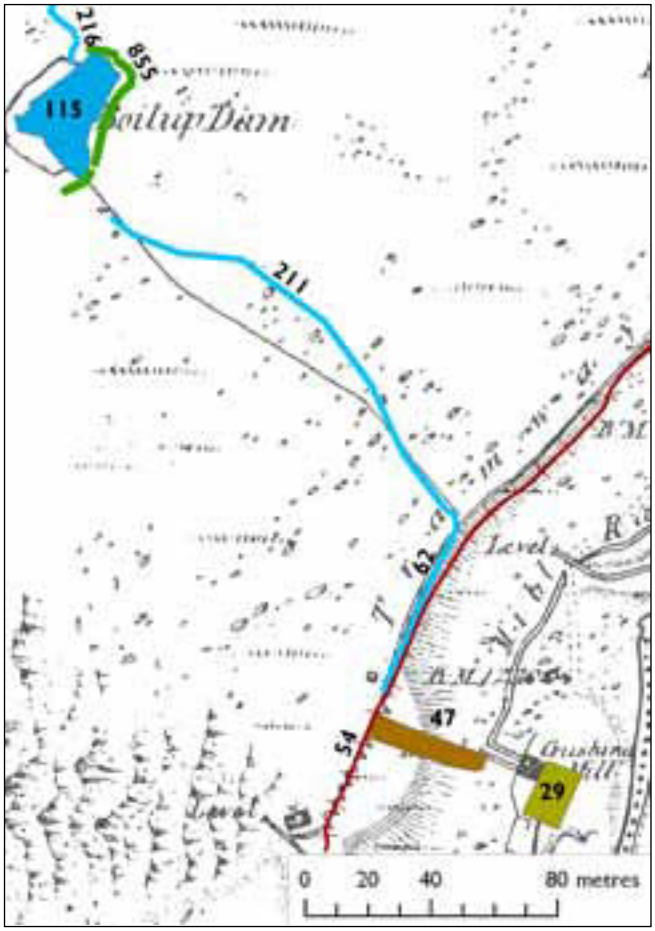

Figure 31 Extract from the GIS showing features connected with 'Boilup Dam', against a background of the First Edition 25-inch OS map.

Reproduced from the 1861 Ordnance Survey map

A channel (211) leading from the south-eastern corner of the reservoir, where there is evidence of a well constructed stone channel, potentially housing a sluice gate to control water-flow, seems to have been used to carry water down to the principal processing area on the slopes below; it feeds into a covered leat (62) on the level of the principal tramway (54), the water then flows to the south-west and is delivered to chute 47, above crushing mill 29.

Reservoir 116 is also shown on the First Edition 25-inch map, some 250m to the east (Ordnance Survey 1861). This was fed by two short sections of leat (119 and 120) which took water off Scordale Beck. At its south-western corner is an embanked channel (862), deliberately cut through the dam, which would have carried water away from the reservoir. The field evidence indicates that the channel was cut into the cutting (863) for tramway 54, thus post-dating it. There are faint remains of a possible

channel to the south of the cutting which suggest that it continued beyond. It is possible that the water supply was carried on a launder over the top of the tramway, which would have enabled both features to be used concurrently. Both reservoirs 115 and 116 were of sufficient capacity and suitably positioned to supply water primarily for power, possibly utilising timber launders, to the processing area around the confluence of Great Augill and Scordale Beck, which was developing in the mid-19th century

There is a reservoir (350), measuring approximately 50m by 8m, upslope to the north-west of the end of leat 229. The function of this reservoir is not clear, as it does not seem to be clearly linked with any parts of the extractive process. A breach in the dam (870) and a channel in the slope below might indicate a hushing function, but there are no associated workings with the hush channel; either this channel revealed no mineral deposits or it was never intended as a hush channel.

On the eastern side of Scordale Beck there are significantly fewer examples of water being stored and those that were recorded were generally smaller than those features on the opposite side of the valley. No reservoirs or ponds are depicted on this side of the valley on the historic editions of the Ordnance Survey mapping. However, there are earthwork remains of at least six former ponds or reservoirs in the vicinity of the Amber Hill mining area and at least a further two to the north of Great Augill. Of these features, those located near Amber Hill were almost certainly created to allow hushing of the hillslope below and most are of a relatively modest size, measuring around 10m across, with the exception being reservoir 656, which measured c18m across. These features are further discussed in the 'Hushing' section below. One of the reservoirs to the north of Great Augill (245; Figure 32) appears to have similarly been used as part of the hushing process. However, nearby, the reservoir behind dam 188 would have stored water used in the dressing process, supplying it to dressing floors 186 and 189 a short distance to the west. A dam (192) further to the north-west would probably also have retained a small pond, but its function is less clear, as it appears to have been fed by a leat (193) from a dressing floor (190) above it to the east, suggesting that water was discharged from the dressing process into the pond behind the dam. From here the water was released to the west via leat 191, apparently over the edge of the rock face, possibly an attempt at hushing.

Figure 32 Extract from the GIS showing features to the north of Great Augill. The linear features shown in orange are hush channels.

Reproduced from the 1861 Ordnance Survey map

Evidence also suggests that at one time, water was stored within the large linear hush channel (178) to the north of Great Augill, potentially supplying the dressing floors alongside it (186, 189 and 190). A section of earthen and stone dam (184) was recorded across channel 179, which would have enabled the retention of a small body of water behind it. This small pond/reservoir appears to have supplied dressing floor 186 and possibly fed into the reservoir behind dam 188. Dam 184 clearly post-dates the creation of hush channel 178, thus indicating that the dressing floors in the vicinity were utilised for processing the ore retrieved from the veins exposed by the hush channel.

A single example of a reservoir created to store water for domestic used was recorded, adjacent to the rear wall of High Shop. The remains of a pond (802) and dam (801), now dry and partially infilled with rubble from the collapse of High Shop and partially overlain by the structure, were observed. While it is clear that the dam could not have functioned in retaining the pond in its original form after High Shop was constructed, it is possible that some element of the water catchment may have been retained to supply water to this building. One channel which leads from this pond may be channelling water to the building either by pipe or conduit.

Water Movement

Water was dispersed around the site via a network of leats and channels (*see* Figure 29); approximately 60 examples (*c*7% of the total features) were recorded during the course of the present survey. Some leats had the function of water collection, as discussed above, but others were created to move water between reservoirs and areas where it was required for power, dressing or hushing. Generally these leats survive as earthworks, some in poor condition due to subsequent use as paths, often little more than a spade-dug channel, following the contour. In places where sections of leat do not survive as earthworks, it is possible that the water was carried in a timber launder; however, no surviving remains of *in situ* timber launders were recorded during the present survey.

Gravity-fed transferral of water between reservoirs using a series of shallow spade-dug leats was recorded amongst the series of reservoirs directly to the south-west of High Shop. Leats 368 and 369 connect reservoirs 367, 366 and 370, enabling water to be moved along the series of features. It seems likely that this is a chronological indicator, demonstrating that 370 (the highest of the reservoirs) was in use first, and when it was no longer required, or when water was required further to the east to expose mineral veins in that area, then a leat was used to carry water from 370 into 367, thus supplying a new reservoir with a different scope. The same process appears to have been used to supply reservoir 366. It is possible that these reservoirs were used either concurrently or sequentially. However, it is clear that they were utilising the same water source and the water was being regulated and transported by a system of interconnecting leats.

There are also examples of water being moved between reservoirs on the eastern side of the valley in the Amber Hill area, such as leat 450, which carries water between the reservoirs retained by dams 456 and 447. In this case, the inference to be drawn is that dam 456 is the earlier feature, as this is the topographically higher feature, enabling water to flow downslope into the reservoir behind dam 447 on a gentle gradient. A further leat (449) leading from dam 447 indicates that water was subsequently carried from the

reservoir across a gentle gradient, before being discharged into hush channel 452. The course of leat 449 cuts across hush channel 453, demonstrating that the leat was of a later date. The evidence suggests that once the reservoirs had been utilised for initial hushing, creating the short hush channels directly descending the steep valley side, a less powerful, more manageable source of water was required, which was achieved by constructing the longer leats, traversing the slope and descending at a much gentler angle across the contour. This later movement of water in this area may have been to enable further cleaning of exposed veins within the hush channels or washing extracted rock and ore *in situ*.

As well as utilising purpose-built leats to move water around the site, there are also examples of enhanced natural channels being used with the gradient to deliver water to areas where it was needed. One such channel is feature 211, which descends the valley side from reservoir 115 (Boilup Dam) leading into a covered leat (62) alongside the principal tramway (54), carrying water to the principal processing area (chute 47 and dressing mill 29; *see* Figure 31). Channel 211 appears to have originated as a natural run-off channel, or possible an overflow from reservoir 115, but latterly seems to have been used to move water down the valley side.

Evidence of water being moved between processing areas and used for a number of purposes was recorded within the survey area. Towards the north-eastern end of the large surviving level surface within Mason Holes are the remains of two water channels (519 and 509) and a culvert (504), which appear to be carrying water from reservoir (835), to a dressing floor (501) and on to a further processing structure (502), before discharging it into an adjacent hush channel (518). Similar re-use of water was observed to the north of Great Augill, where channels (185 and 191/193) were constructed to supply water to reservoirs as well as provide water to dressing floors. Channel 185 seems to have fed water from the small reservoir behind dam 184 (discussed above) to dressing floor 186, and possibly 189, while channel 193, to the north, carried water away from dressing floor 190 into a pond behind dam 192 and then from the pond in channel 191. This latter sequence is unusual, as it appears that waste water from the dressing process was being collected behind dam 192. However, the route of channel 191 from dam 192 to the edge of the rock outcrop, indicates the possibility that it was used for hushing, in which case, contamination of the water from the dressing process would not be significant.

Water Power

The use of water for the purpose of providing power can be seen in the vicinity of the extant mill remains in Scordale. The surviving remains of the crushing mills (27, 29 and 81) which were recorded on the valley floor all housed waterwheels which transferred power to the machinery within them. A mill in the vicinity of Lowfield Hush (629), potentially of an early date, may also have housed a waterwheel, but the surviving evidence is not as clear and its position is not certain.

Although a 'crushing mill' was shown in the vicinity of High Shop on the 1824 map of the site, it was not possible to verify its location on the ground, therefore it is impossible to tell if this crushing mill had a waterwheel. Given the early 19th century date of this

crushing mill it is quite possible that the rollers or crushing stone was powered by hand or by animal (Burt 1982, 21). However, circumstantial evidence indicates that water might have been managed in this vicinity. The location of the mill would potentially have been to the south of reservoir 811, accessed via path 857, and a gully (807) leading downslope from the reservoir suggests that water was being carried in a southerly direction by this feature. The archaeological remains have been eroded in this area and the incomplete nature of what survives makes it difficult to make confident assertions about water management in this area and whether or not it was being used for power. The early cartographic evidence for this area does not show any evidence of water management associated with the crushing mill either (NEIMME 1824).

The earliest of the surviving crushing mills is mill 29, located opposite the confluence of Great Augill and the Scordale Beck. Cartographic evidence demonstrates that this mill was in existence in the early 1860s, in a form which was expanded over the subsequent decades (Ordnance Survey 1861). The depiction of the mill shows a 'Mill Race' being taken off the Scordale Beck, passing under a track and tramway, then following the contour before turning a right angle towards the mill building. The course of the mill race can still be traced on the ground, the feature recorded as leat 69 representing most of the course of the mapped feature. Evidence of how and where the leat was culverted under the main track no longer survives. To the west of the main track, the leat is visible running along the base of retaining wall 44. The section of the mill race between the end of the surviving section and the mill (29) was almost certainly carried on a timber launder, powering an overshot wheel. This is corroborated by photographic evidence from the late 19th century (Figure 33). This is one of the few places where water was

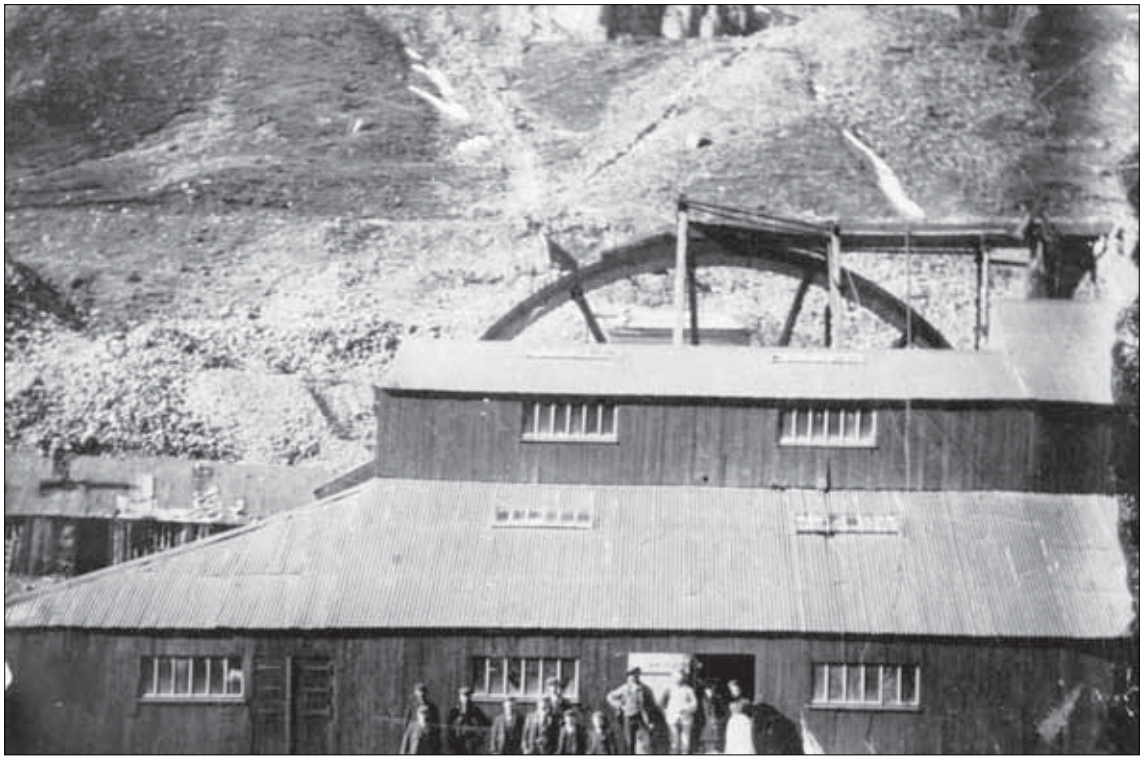

Figure 33 Late 19th-century photograph of the principal crushing mill (feature 29), illustrating the overshot waterwheel powering the mill.
Reproduced by kind permission of Beamish Museum Ltd Photographic Archive. Ref.: 16314

taken off Scordale Beck for a specific purpose and it is unclear how the water would have been managed to allow a steady and sustained flow, particularly as this part of the beck has been witnessed to have an erratic, precipitation-dependent flow pattern. There may have been a sluice at the conjunction with the beck, but there is no evidence of such a structure now surviving. The First Edition 25-inch map depiction suggests that there was a tail race carrying water away from the mill and discharging it back into Scordale Beck. However, no evidence of this tail race was found on the ground, potentially as this area has suffered the most significant erosion and dumping of waste material from the mill and extractive activity in the vicinity.

The mill further to the south-east (27), which was probably constructed in the 1890s, is shown on the Second and Third Edition 6-inch maps (Ordnance Survey 1899b; 1920), without any obvious source of water power. However, historic photographs show that an elevated timber launder ran, on supporting trestles, from the floor-level of mill 29 to the south before turning a right angle and crossing the beck, delivering water to the waterwheel in mill 27 (Figure 34). Traces of two of the stone buttresses which supported the trestles carrying the timber launder (17 and 28) were recorded during the course of the present survey. It would appear that water was discharged directly back into the beck having been used to power the waterwheel, possibly through the outshot of the mill

Figure 34 Late 19th-century photograph of the processing area at the confluence of Scordale Beck and Great Augill. Mill 27 is in the foreground. The timber launders visible in the photograph transported water around the site, supplying both overshot waterwheels.
Reproduced by kind permission of Beamish Museum Ltd Photographic Archive. Ref.: 16316

building (27), within which it may have been recycled to power machinery. Alongside the eastern edge of the mill building, a capped leat (70) was recorded, consisting of a narrow channel covered with stone slabs. There is no clear evidence that this leat provided water directly to the mill, particularly as it is a lower level than the structure; it is more likely that it was used to carry water away from the structure, although explicit evidence for this was not found.

The second mill dating to the 1890s (81; similarly only depicted on the Second and Third Edition 6-inch maps) is located *c*320m to the south-west of mill 27. The map depictions suggest that the mill was powered by a water source carried from the nearby dressing floors (83), possibly in an artificially created or enhanced channel. There is also the suggestion of a tail-race exiting the mill at its western corner and discharging into Scordale Beck. The archaeological field remains confirm this arrangement, with a channel (871) traceable between the dressing floors and mill 81; the channel approaches the mill's eastern corner before turning a right angle and flowing into Scordale Beck. This latter part of the channel may have been a later extension or an overflow channel, to carry water away from the mill building directly into the beck. This would suggest that there was some kind of sluice arrangement at this corner of the mill to control the water flow, but tumbled building-stone has obscured the area and there was no surviving field evidence to corroborate this. A faint linear depression to the south-west of the mill represents the course of the tail-race. The level at which channel 871 approaches the mill structure would suggest that the waterwheel in this mill was undershot, but there is little surviving evidence of how the water powering this wheel was regulated.

Water for Dressing

Water was central to a number of operations on lead-mining sites, including dressing, classification, concentration, jigging and buddling. There are examples of small, crude features which relate to dressing, and are likely to be relatively early, and examples of more formal structures, including the mill buildings themselves where dressing would have taken place.

At the north-east end of the mine road (32), a pair of hollows (64) was recorded, probably washing pits. They take the form of a small, circular, stone-filled hollow with an earthen bank separating it from a sub-rectangular hollow below. The latter is stone-edged with a small stone dam and an opening below a large stone on its downslope side, possibly a sluice. Fine white chipping waste was observed below the dam. A dressing floor (63) a short distance to the north-west, was probably used in conjunction with the pits. It is not clear where the processed material would have originated, especially given the small-scale of the features. The possibility is that they relate to an early phase of the site's use or a small-scale trial to ascertain the proportion and quality of mineral deposits. Water for these features may have been supplied from reservoir 116 to the north, via one of the channels recorded in the area, but precise details of the water supply have been lost.

Within Mason Holes are two examples of pairs of ponds or reservoirs (841-2 and 835-6; Figure 35). The relative size of these features suggests that they are more likely to have been used for supplying water for dressing, or providing a water-source for washing

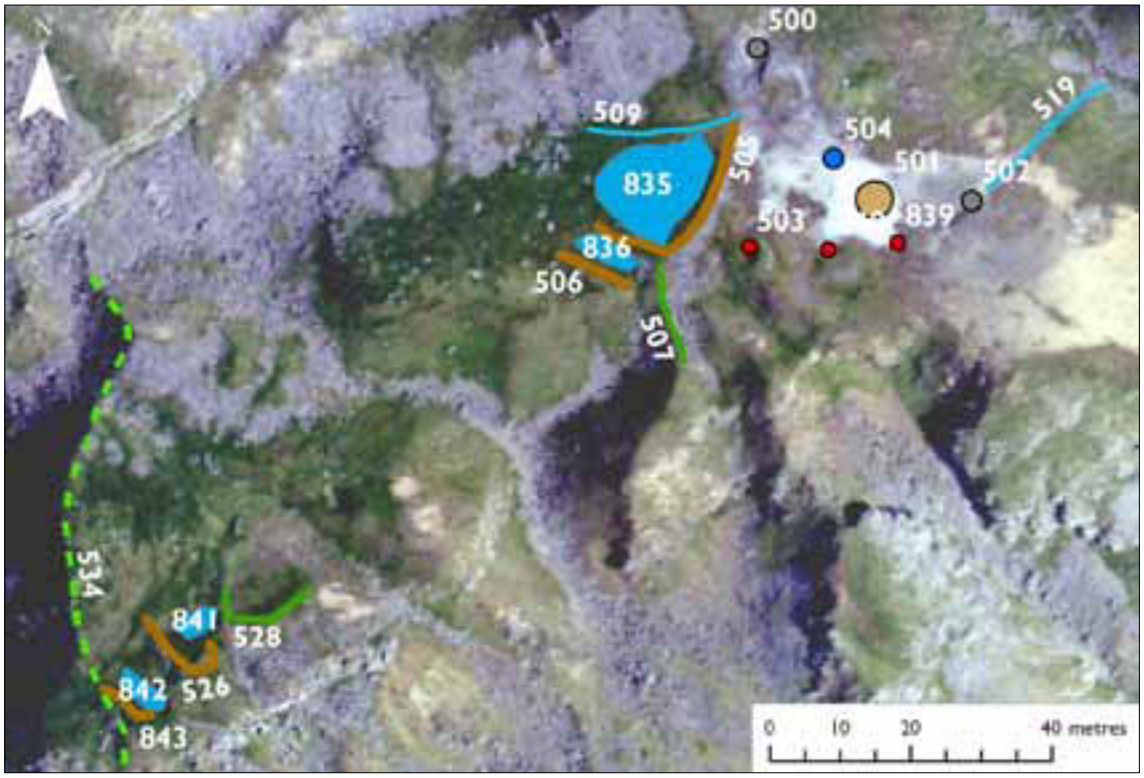

Figure 35 Extract from the GIS, with the orthophotograph as a background, showing the features relating to dressing within Mason Holes

floors, rather than for hushing or as a power source. The more westerly pair (841 & 842) are smaller, and they may have been part of a series of three ponds, as the very degraded remains of a dam (528) were recorded to the west. This would strongly suggest that water was being managed here for the purpose of dressing, particularly as the ponds are on three different levels, indicating a gravity-driven process. Chronologically, the pond group appears to post-date hush 534, as the most easterly pond and dam (842 and 843) overlap the edge of the hush. There are similarities between this pair of features and the pits recorded close to the tramway, discussed above. The reservoir group to the east has been created to manage water in association with dressing features to the east (501, 502, 504). The smaller pond (836) pre-dates the much larger pond (835), as the dam forming the latter overlies the former. A leat (509) to the north of reservoir 835 functioned in association with this group, potentially bringing water into the reservoir and carrying it away to the washing area nearby, possibly on a timber launder. Whilst these features on the level area within Mason Holes may appear to represent features on an earlier land surface which has subsequently been worked away by the intensive hushing, the basic chronology observed between pond/dam 842/843 and hush 534 demonstrates that these water management features were created after the hush was in existence, thus utilising the scarce flat ground available within Mason Holes at that time.

One of the most ephemeral remains on the valley floor is the dressing floor (83) to the north-east of mill 81. However, cartographic evidence indicates that this dates to a relatively late period of activity on the site, only appearing on the Second Edition 6-inch map (as a series of three rectangular, unroofed features), which was published in 1899 (Ordnance Survey 1899b; Figure 36). Its position at river level would have left

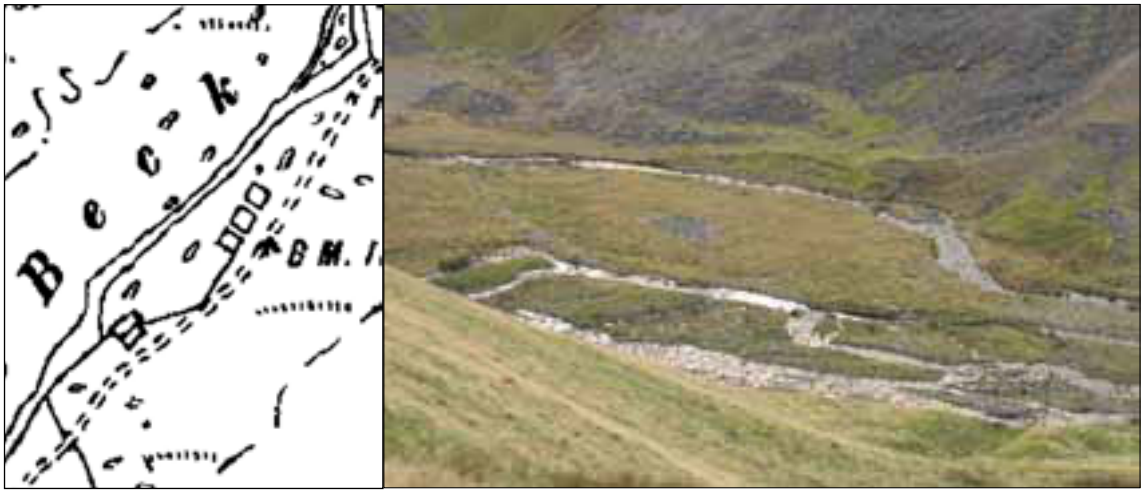

Figure 36 Extract from the Second Edition 6-inch map of 1899 (left) showing the dressing floor comprising of three rectangular features with mill 81 a short distance to the south-west. The photograph (right) shows a view of the area from the slopes to the north-east; the angular course of Scordale beck in the foreground highlights the position of the dressing floor.
Reproduced from the 1899 Ordnance Survey map

the dressing floor susceptible to fluctuating river levels and changes in flow speed, but it would have been reliant on a source of water to operate. The field evidence suggests that water was supplied via a covered leat (1) to the north-east, which may have continued in a timber launder towards the dressing floor. There would presumably have been some management of this water flow through the dressing floor, but the only potential surviving evidence of this is an apparently *in situ* timber plank (inscribed with 'XIIII'; Figure 75), which may have acted as a part of a sluice or shuttering system, allowing the river flow to be managed or diverted as required. The earthwork evidence suggests that the dressing floor consisted of shallow rectilinear features, stepped down the gradient, suggesting a sequential process, possibly a series of settling tanks, consistent with the map depiction. The most south-westerly of the 'tanks' is shown with a linear feature emanating from its southern corner; apparently carrying water away from the dressing floor towards mill 81, potentially to recycle it as a power source for the mill's waterwheel. In the absence of further surviving evidence, the precise methods operated on the dressing floor are unclear.

Machinery housed within the crushing mills would undoubtedly have required water as an integral part of their operation. Whilst there is no surviving physical evidence of these machines, documents indicate that there were at least two 30-inch crushing mills, four jiggers, two classifiers and four buddles on site in Scordale at the tail-end of the 19th century (CRO(K) 1895). Without evidence of the location and position of these machines, it is difficult to be certain of how the water was specifically utilised. However, a steady stream of water would have been needed, particularly for jiggers and trunk buddles. In and around the mills, water for the operation of dressing machinery would presumably have been taken off the launder and leat systems carrying water to the waterwheels

Mining The Ore

Within the survey area, 191 features relating to mineral extraction were recorded (c22% of the total features), varying from quite crude, small-scale extraction to the well-constructed entrances to large networks of underground levels and reflecting a number of different techniques and periods of activity. The vast majority of extraction was undertaken in the area between Mason Holes and Little Augill, on both sides of the valley. Other concentrations of extractive activity can be found around Lowfield Hush and, to a lesser degree, around Low Hause, but there is barely any evidence for further extraction in other parts of the survey area. These concentrations of activity are clearly a reflection of the geological composition of the valley, indicative of the location of the productive ore veins, and reflect the ease of access which has dictated the extractive methodology. Some of the levels and mines which were still extant at the time of making the various maps and plans of the site are depicted and labelled, making it easier to assign a date to these features. However, there are many which are not on the maps, suggesting that they are from periods prior to the mapping of the area, i.e. the start of the 19th century and earlier.

The principal mining techniques discussed in the following section include: shaft mining - the process of accessing subterranean mineral ore via a vertical shaft; hushing - the release of water stored in a reservoir or pond to clear soil and overburden from mineral veins in rock a short distance below ground surface; level - a horizontal tunnel or passage driven in to access subterranean workings (also referred to as an 'adit' when accessing a mine from the ground surface, although this term is not used in the present report to avoid confusion); open face working - small-scale working of a mineral vein exposed in a crag or small outcrop; opencut - an opening mined downwards from the surface that follows the line of a vein, of variable width and depth; drift - a linear, finger-like cut into hillslope which may appear like a level but has a worked face at its end; bench working - level or near level rock surface from where a horizontal vein (or flat) has been worked from the surface.

Prospecting

It was crucial to establish the location and extent of mineral deposits. Whilst those visible in outcropping rock are an indicator of the presence of a workable vein, further exploration below the surface would often have been necessary to ascertain the extent and quality of further deposits. There are features in the landscape at Scordale which appear to be trial shafts or prospecting pits; these generally take the form of hollows in the ground with a very small amount of spoil, if any, associated with them. It is difficult to confidently ascribe this function to features, as the lack of associated spoil may reflect a particularly pure vein, thus generating minimal deads, or it may indicate a shaft which has been backfilled using the deads removed from it, thus removing the diagnostic waste material associated with a productive shaft. However, there are some features which, given their form and geographic location, appear to have been formed during this process of prospecting.

There are a number of shafts which survive around the periphery of Lowfield Hush (322, 328, 329, 330, 692 and 693), all of which only have a small amount of associated spoil,

indicating that there was unlikely to have been a great quantity of material removed from them. The fact that they are located around the edge of a large opencut mine, suggests that they are trial shafts, sunk with the purpose of proving the extent of the mineral deposits. The fact that the shafts were apparently not further exploited would suggest that they were not suitably productive and did not reveal any extensive mineral deposits. Alternatively, the shafts may have been sunk at a later date, after the main extraction in Lowfield Hush had ceased, by new companies or miners, trying to ascertain if there was a profitable quantity or quality of mineral deposit still to be won in this area.

A group of hollows (194-198; Figure 37) to the north of Great Augill and Dow Scar have the appearance of prospecting shafts and are in a location where such features might expect to be found. The hollows all have a small spoil bank to the west. They are located between two productive areas of flats, accessed by Middle Level and Dow Scar High Level (Dunham 1948, 136), suggesting that the shafts may have been sunk to ascertain if the flats were extending further to the north or south. The map indicates that they would indeed have fallen outwith the extent of the mineral flats, thus demonstrating that there were not sufficiently economically viable mineral deposits in this area. Potential evidence that these shafts did yield mineral ore are the dressing floors a short distance away (186, 189, 190). However, there are also a number of open face workings in the vicinity which are more likely to have supplied these dressing floors.

A small section of opencut working (92), recorded to the south-west of Amber Hill, demonstrates that this technique was also occasionally used in an exploratory capacity. The field evidence consists of a 30m long terrace on the steep slopes containing an exposed face, which may have been worked, where there is an area of numerous

Figure 37 One of the prospecting shafts (196) to the north of Great Augill. The small amount of spoil can be seen on the downslope side of the feature.

limestone blocks, small outcrops and frost-fractured debris on the slopes below. Although most of these exposures appear to be natural, there are some delves that appear to be artificial and these are interpreted as exploratory diggings. The absence of any other extractive activity on these slopes, the closest being over 250m to the north-east, clearly shows that there were no profitable minerals to be won in this area.

Survival of prospecting features is, by its very nature, likely to be varied, as successful prospecting would lead to an expansion of the feature, and potentially obliteration, in order to exploit the discovered vein.

Shaft Mining

Approximately 61 examples of shafts or shaft mounds were recorded throughout Scordale, equating to around 32% of the total features ascribed an extractive function. These shafts occur both individually and in groups. The groupings of shafts tend to indicate the exploitation or proving of a vein or flat, whilst the more isolated features may indicate trial prospecting or ventilation shafts. Groups of shafts were recorded around Lowfield Hush, in the vicinity of Great Augill, to the north-east of High Shop and on the level area within Mason Holes. Only two features displayed evidence of potential winching or winding mechanisms associated with them and no *in situ* mechanisms were recorded. Whilst some shafts may indicate the entrance to a bell pit, it is impossible to confirm this type of feature without ascertaining the profile of the underground void, a task beyond the scope of the current project, thus all features are referred to as shafts.

A pair of shafts (586 and 587) was recorded on a level terrace to the south of Great Augill. The former (586) is a very good example of a mine entrance covered by a drystone-built beehive-like structure (Figure 38), although this does not appear to be the type of capping structure often seen elsewhere, sealing off the shaft. The freestanding entrance, constructed of drystone slabs gathered from the surface stone nearby, stands to a height of 1.6m and is 0.5m wide. It is accessed by a narrow, stone-lined surface-passage at the south which leads on to a ramp cleared into the scree; the latter has had a surface laid on it using the scree slabs with some crushed-stone infill. A ramp leads from this onto the miner's path below. The mine entrance has been cut into one of the natural terraces and hummocks which are littered with slab-like boulder-field stones. Immediately to the north is a rectangular building (621). The whole has the appearance of a mine entrance and an associated structure, but there is no evidence

Figure 38 Entrance to shaft capped with drystone beehive-like structure. It is not possible to be certain of the date of this feature, but it is likely to be relatively early.

of waste or dressing in the vicinity. Approximately 40m to the south of this shaft is what appears to be another shaft (587), visible as a hollowing surrounded by scree, which has, in places, been stacked around the edge of the hollow. There appears to be a cleared gap at the south-west to allow access. There is a smaller hollowing immediately to the south of 587, which might also be an infilled shaft. The appearance and scale of these shafts immediately suggest a relatively early date, as they are not analogous with the large-scale commercial extraction seen elsewhere in Scordale. The fact that this part of the valley has not seen extensive mineral extraction also suggests that these were small-scale attempts at extraction. It is possible that the features in this area date to the 17th or 18th centuries, but this is a tenuous suggestion in the absence of any firm dating evidence.

A group of four shallow shafts (382, 384, 387 and 388) were recorded on Low Hause, close to settlement group 415. The field evidence suggests that these features may be the result of shallow mining. The location of the features in an area was not commercially exploited in the 19th century and their form, indicative of early small-scale attempts to locate minerals, suggests that they may be of a relatively early date, potentially even late medieval. However, it is also possible that the features were created in the process of acquiring stone for the construction of nearby settlement and enclosures.

A group of ten shafts (307-15 and 340) survive on a plateau to the north-east of Mason Holes. The general form of these is a circular depression with an upcast bank of spoil on the downslope side. The exception in this group is 315, which has a semi-circular niche lined with four courses of masonry and a stone base at its south-western end (Figure 39). This may possibly have been a base for a piece of machinery, such as a winch. The 1824 map shows 'Shafts' in this area, located along 'Sun Vein', which seems to be depicted as the course of a vein which was not being 'wrought' (i.e. worked), although the colours on the map key are difficult to differentiate. However, according to a 1945 geological map of the mines, the shafts are situated on, or close to, Murton Fell North Vein (Dunham and Dines 1945, 140). The relative absence of large quantities of waste suggests that these shafts were not productive on any significant scale, or that possibly the spoil from

Figure 39 Shaft 315 viewed from the north, with the stone-lined niche just visible at the left of the feature (left). Detail of the stone-lined niche within shaft 315 (right).

one shaft was used to backfill the previously-dug one, although there is no specific evidence of this. There are two examples of dressing waste associated with this group of shafts (794 and 797), but neither of these is particularly large, both approximately 5m in diameter. Dressing waste area 794 is relatively lead- and barytes-rich, which would suggest that it was an early hand-dressing floor, as such wastefulness of lead would not have occurred in later periods. It is possible that these shafts were driven in to prove the vein and its productivity, which could explain the small amounts of dressing occurring in this area. The various pieces of evidence would suggest that this group of shafts are of an early date, i.e. pre-19th century. It is unlikely that these shafts were ventilation shafts given the irregular positioning of the features and the spoil and dressing waste associated with them.

On the level ground within Mason Holes are six shafts (503, 522, 525, 527, 839 and 840). These clearly post-date the opencut mining which has largely created the overall gauge in the valley side and the level area within it, but they are not the latest features in this area. Some have been partially infilled with dressing waste (840, 839), indicating that the dressing activity is of a later date, whilst others are cut by later features (525 cut by hush channel 524 and 527 overlain by dam 526). The shafts in this area appear to have been driven in to ascertain the extent of the mineral deposits, possibly to explore whether the lowest extent of the flats found here had been reached.

To the south-east of High Shop on the north-west side of the valley, are a series of at least three shafts (365, 352 and 810) which appear to have been worked, as they all have substantial sized spoil heaps on their downslope sides. The spoil from shaft 365 appears to contain some hand-dressed material along with some finer tailings, suggesting that some dressing was occurring here. These shafts are all positioned approximately on the north-western edge of a flat located to the north-east of Mason Holes. Although much of this flat appears to have been worked underground, via Hardshins and Murton Horse Levels, these three shafts may have accessed part of the mineral deposit from the surface.

Some shafts display examples of significant spoil heaps encircling them and, where these are flat-topped, it may be inferred that they were used for a horse to circle the shaft, powering a winch to bring material up from the shaft below. There is a particularly good, well-preserved example of such a shaft mound at Scordale, close to the edge of Lowfield Hush (331; Figure 40). The feature consists of a flat-topped spoil mound encircling the shaft, which suggests that a horse may have walked around the top of the shaft, powering winding gear to bring mined ore from the shaft up to the surface. This may be connected to the workings accessed by level 632, which would have been directly below.

There is another example of a shaft mound (241), situated just over 200m north of Great Augill and to the east of Jacques Level. The mound measures approximately 10m across and 2.5m high. The quantity of material forming the spoil bank would suggest that the shaft had been excavated to some depth. Its position potentially indicates that it was exploiting the same vein which was being worked from Jacques Level.

Figure 40 Shaft 331, situated to the north-east of Lowfield Hush; an example of a shaft surrounded by a flat-topped spoil heap

Hushing

In its broadest sense, the process of hushing involves the use of a flow of water, either natural or artificial, to clear overburden and soil to expose mineral veins a short distance below the ground surface. Contemporary accounts of hushing recount a dramatic process, with a head of water formed behind a dam, which was then released so that 'the flood of water, rushing down with all its fury, tears up the earth and stones with immense devastation and lays bare new surfaces to view' (Mitchell 1842, 9). More recently, the lack of investigation into, and understanding of, this often large-scale process has been highlighted and an attempt made to categorise types of hush and their distribution (Cranstone 1989). This study highlights the fact that although hushes are often referred to as a generic group, they may have served different purposes. Elsewhere it has been suggested have been put forward that the dams were not of sufficient size to retain a body of water large enough to cause such devastation as described in the 19th-century descriptions and that hush channels were quite modest in size, but expanded by the excavation of revealed veins (Forbes *et al* 2003, 45).

There are a number of features in the Scordale landscape which can confidently be interpreted as evidence of hushing. The two principal types of feature, as discussed in this section, are hushes and hush channels. The latter is the residual un-mined channel created by the course of released water, potentially a 'prospecting hush' under Cranstone's classification, whilst the former is the often extensive void, created from a hush channel and subsequently enlarged by the following and extraction of exposed mineral veins, broadly analogous with an 'exploitation hush' or a 'hushed open pit' (Cranstone 1989, 46-7).

There is clear evidence in a number of places in Scordale that the release of a head of water was used to expose rock-faces and mineral veins, sometimes by repeated releases of water, which can be seen to have had a scouring effect, in varying degrees of scale, on the valley sides. Undoubtedly some of these hush channels were then enlarged through the working of the exposed vein, giving the illusion of very deep, wide channels, but in other places, water action has been responsible for sizeable scars in the valley side. The very steep gradient of the sides of Scordale would have enhanced the effect of the releases of water, with even a relatively small amount of water able to build up significant velocity by the time it reached the foot of the slope. Any loosened rock or overburden would relatively easily have been shifted by this action. In addition, the soils on the valley sides are very thin and would easily be washed away in the hushing process. During fieldwork for the present survey, at times of heavy, sustained rainfall, torrents of water were witnessed coming down the hillside, generally through natural water channels, but still indicating the potential of water to gather momentum whilst descending the steep slopes. Whilst some hushing appears to have been a case of releasing a flow of water down a single channel, there are other examples of the water being managed in a more complex manner, with further channels and diversions constructed in exhausted hush channels to carry water to alternative areas of extraction. The surviving evidence frequently represents the later, or even, final stages of hushing, as evidence of earlier activity has either been mined or washed away.

The most extensive surviving evidence of the hushing process in Scordale can be found in the vicinity of Mason Holes (Figure 41). A series of ten reservoirs, of varying sizes, are situated along the ground above the north-western edge of Mason Holes. Some of these are linked by leats, but most appear to have operated independently. The water from reservoir 543, the largest of the group, is directed into two principal hush channels (560 and 561); these have been subject to a number of diversions and re-routings which have created a number of larger hush channels which would have cleared the overburden from much of the Mason Holes area. Although it is difficult to assign a chronology to these channels, due to their complexity and the rapid nature of the survey, it would appear that reservoir 543 and its associated channels are possibly the latest phase of hushing activity in this area. The evidence for this is most pronounced at the south-west end of Mason Holes, where some of the hush channels are truncated by the worked-back rock-face, but are visible again further down the slope below the intensively worked area. However, hush 533, at the south-west end of Mason Holes continues as a single feature down the slope. This would suggest that the working of the mineral veins was not as extensive as elsewhere in this area, as the rock-face was not worked back as far, thus leaving the hush channel intact as a single feature. However, it may also indicate that the mineral veins were less productive at this end of Mason Holes, thus not warranting such intensive exploitation. In support of the chronological argument though, there is further evidence of phasing within the hushing process where hush 608 is cut by hush channel 560, indicating the later date of the latter. The latter is reinforced by an earthen bank where it crosses this earlier hush, thus enabling the water to be carried further to the north-east. This north-easterly course of 560 is also demonstrable as one of the latest directions of hushing, as there are channels (563 and 565) which were originally fed by water from reservoir 543, but have subsequently been blocked to allow water to flow along channel 560.

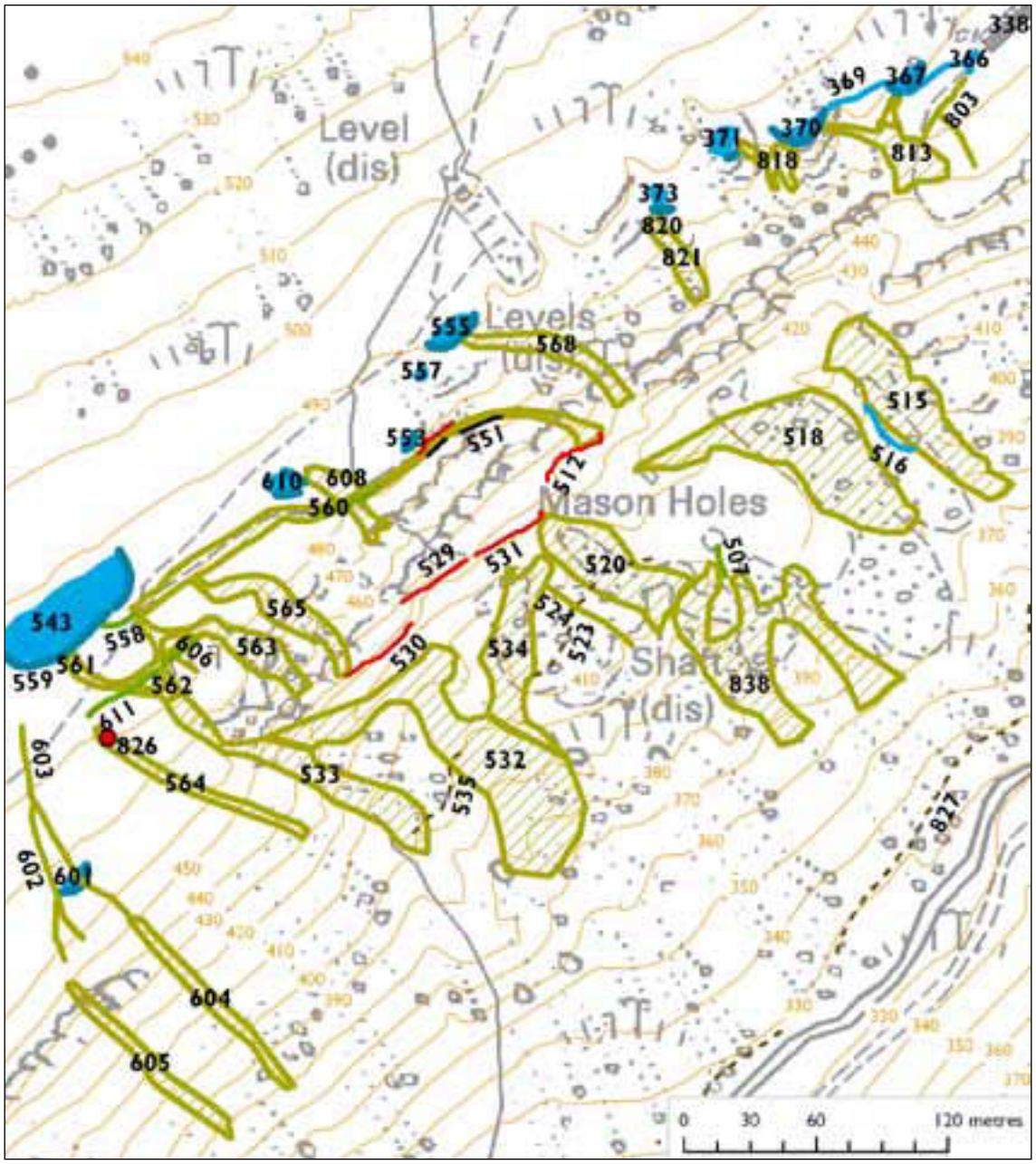

Figure 41 Map showing the hushes (outlined and shaded in olive green) and hush-related features in the vicinity of Mason Holes. The contours (in metres) are shown in orange.

About two-thirds of the way along hush channel 560, there is evidence of extraction, presumably where a vein was uncovered by the hushing process. Two stretches of well-constructed revetment wall (549 and 551; Figure 42) line the downslope side of the hush channel and there is evidence of open face working (823) on the exposed rock-face (to the north-west). A small pond (553) to the west of this appears to have been used for small-scale hushing of this specific worked face as there is evidence of a breach in the dam (552) containing the pond. The fact that the working area in front of the rock-face appears to be defined and consolidated by revetment walling would suggest that this face

Figure 42 Revetment wall (549) lining and revetting the downslope side of hush channel 560

was worked once the hushing channel had gone out of use, thus, this may be one of the later stages of extraction in this area.

Further to the north-east are two more reservoirs (555 and 373) with associated hush channels (568 and 821), which appear to have operated as self-contained features. Both of these hush channels are truncated by the worked-back rock-face.

There are the extensive remains of hush channels further down the slopes below the main working area of Mason Holes (515, 518, 522, 532 and 534). These are likely to be the lower parts of hush channels which originated further up the slope, having been split into two features by the subsequent working back of the exposed rock-face. The lower channels may also be larger due to further hushing to clear overburden from the working area, thus enlarging the original channels. In addition, as the water released from the dams at the top of the slopes gathered velocity, it would have created a greater scar in the hillside, thus creating more substantial hush fans (deposits of hushed overburden) lower down the slope.

There are further hush channels to the south-west of the field wall which effectively defines the south-western end of Mason Holes, but these are much narrower than those further to the north-east. These channels (564, 602, 603, 604 and 605) were presumably fed from reservoir 543, although there are no surviving channels explicitly linking them. An additional supply of water was created for channel 604 by the construction of a dam (600) and reservoir (601). The only evidence of workings within these channels is a small amount of open face working (826) at the north-western end of channel 564.

The evidence indicates that this hushing was speculative, to establish if there were any productive veins in this area; the lack of evidence of any workings suggests that there were not. Alternatively these may have acted as overflow channels from reservoir 543, but the deliberate construction of dam 600 to form a reservoir makes this unlikely.

Another example of large-scale hushing in Scordale is visible at Lowfield Hush (320; Figure 43), which is a large gouge into the valley side towards the south-west of the survey area. The name is something of a misnomer, as the feature itself is not purely a hush, but has been created by repeated hushing and then extraction of the revealed mineral deposits, using open face mining techniques, effectively developing into a linear, opencut mine. Hodgson's plan of Westmorland, which dates to 1828, depicts 'Low Field Mine' in this location, indicating that there was extraction here from a relatively early date and that the name of 'hush' was adopted relatively late, potentially after extractive activity had ceased here. The principal remains pertaining to the hushing and water management around Lowfield Hush are a series of dams (688, 689, 691, 699), creating reservoirs (271, 690, 289), and channels leading from the reservoirs to the hush (316, 317, 318, 319, 695). Water appears to have been collected at the head of the hush from the higher ground above using a series of enhanced natural run-offs, collector-channels and leats (694, 738, 749, 750, 752 and 753). The remaining features suggest that there was a chronology to the water management activity, with some features only partially surviving, with their other sections having been eroded by the hushing, illustrated by dam 699. Evidence of a sequence of use can also be seen in the channels feeding into the hush, for example 316, 317 and 319, all of which have evidence of diversion and blocking to carry water on a different course. A long channel (321) leading downslope, away from the hush, may have acted as an overflow channel, taking excess water away from the hush edge and depositing it at the foot of the slope, thus allowing it to enter Scordale Beck below. On the natural plateau above the northern side of Lowfield Hush

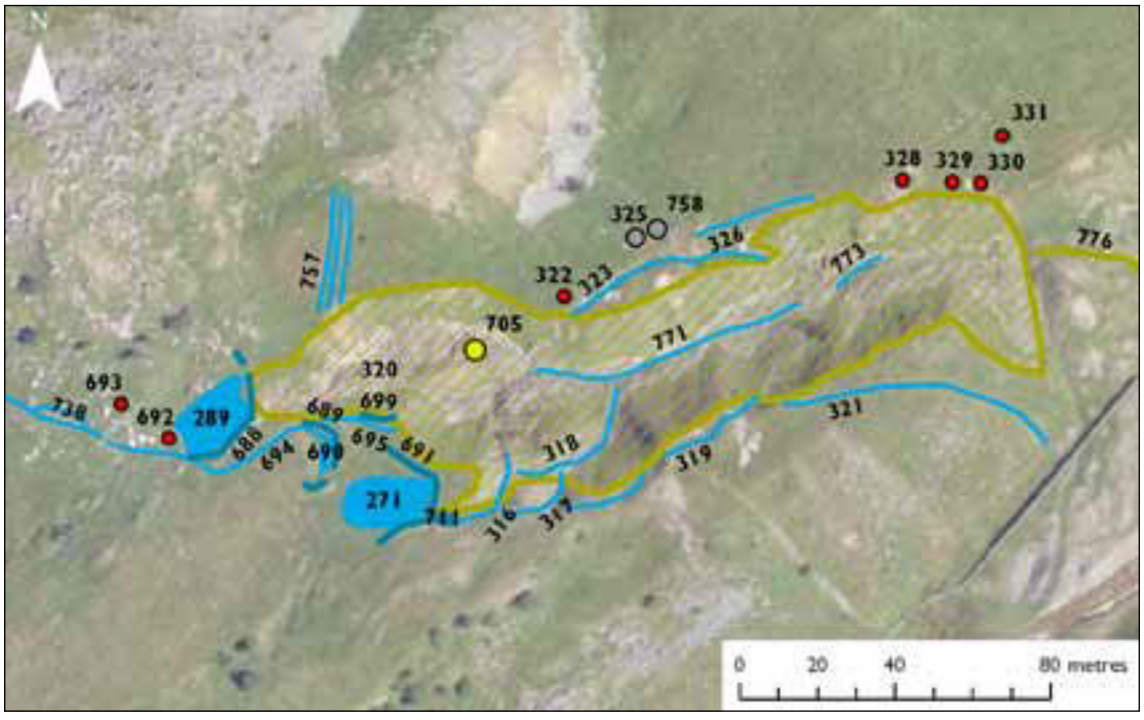

Figure 43 Extract from the GIS showing features around Lowfield Hush mentioned in the text

are a number of shafts and shaft mounds (322, 328, 329, 330 and 331) which potentially indicate attempts to locate mineral deposits, or an extension of those already discovered in Lowfield Hush.

The very nature of hushing means that other remains of the process may well have been eroded by the later hushing. On the north side of Lowfield Hush, there are the remains of further channels (323, 326) which appear to have been truncated and have no obvious point of origin. Therefore, there may have been a reservoir supplying water to channel 323 which has been superseded and destroyed or it may have been fed from one of the reservoirs to the northern end of the hush (271, 289 or 690), but the working back of the hush has destroyed any linking channels. It does seem likely that the rear (western end) of the hush was being worked back, as there is evidence of an exhausted mineral vein in at least one place within the hush (705).

The other large area of hushing in Scordale is on Amber Hill, to the south-west of Stow Gill and on the opposite side of the valley to Mason Holes. Similar techniques were used here as in Mason Holes, but on a smaller scale. A number of dams were constructed (444, 445, 446, 447 and 456) to create small bodies of water, which was then released to expose and clear the mineral veins below. The more south-westerly of the dams (444, 445 and 446) form a group of three conjoined ponds which occupy a natural cove in the limestone at the crest of the steep valley side above the opencut lead mines at Amber Hill (470-473). These ponds were probably fed by groundwater from the within the limestone and from a spring above as there is no evidence of leats leading to them. There is no obvious evidence of phasing, and they are stepped down in level from north-east to south-west. All three feed into the same hush channel (484) and they may all be contemporary or constructed within a short time frame to overcome the problems that would be associated with trying to create one large dam within the topographic constraints of this natural cove. Further down the steep slope, hush channel 484 becomes channel 479, a much broader and more substantial channel; this may have originally been a run-off gully enhanced by the hushing process.

To the north-east, located on a level terrace in the limestone just below the valley crest, are the former ponds created by dams 447 and 456. The latter is now dry and there is evidence of an outflow to the north-west. The pond appears to have been supplied with water via a leat (457), which can be traced for some distance to the south-east. It is possible to trace a further leat running between the two former ponds, suggesting that there was a movement of water between the two, indicating that they were contemporary. The more north-easterly dam and pond (447) shows evidence of two outflows, feeding into leats 448 and 449, which the subsequently feed hush channels 452, 480 and 481, the latter two being much larger, more substantial hush channels further downslope. There are a number of sites where evidence of open face working has been recorded in and alongside these hush channels (467, 468, 469 and 712).

A further reservoir (656) formed by a dam (658) survives to the north-east, to the south of Stow Gill. The only substantial hush channel associated with this reservoir/dam appears to be feature 659. This appears to have originally been a natural run-off channel on the steep slope, but artificially widened at the top to feed off pond 656. There are

no obvious workings in the gully on the slope and no exposed ore-bearing rocks were observed. This may therefore have been a non-productive trial. To the south-west of this hush channel, another, much straighter and narrower channel (723) was recorded. This appears to be a natural gully, possibly carrying outflow from reservoir 656. There are other such similar natural gullies along the slope.

Also on the eastern side of Scordale Beck, to the north of, and almost parallel to, Great Augill in the vicinity of Hilton Lead Mines, is a striking example of a narrow, deep linear hush channel (179; Figure 44), a good example of an exploitation hush (Cranstone 1992, 46). The channel, created by releasing water from a reservoir (245) at the top of the natural slope, has exposed a vein in the natural valley side, along which there is evidence of open face working (for example, 182 and 114). The remains of a crescent-shaped earth and stone dam (865) *c*2.5m wide, which now only survives to a height of 0.8m, indicates the extent of the former reservoir. The reservoir was fed by leat 242, which can be traced intermittently for almost 200m to the north-east, where it originates at a natural water course. At least one breach in the dam is visible, and it is from this point that the water being released was controlled. Leading out from this breach is a hush channel (179), which continues south-west to the edge of the natural rock outcrop and then drops down the sheer rock face. At least two other channels were created from the same reservoir, channel 178, which was created by blocking channel 179 to divert it to the mining area to the west of the reservoir, thus post-dating 179, and channel 487 which runs north-west from the reservoir into the mining area to the west. The latter channel appears to have been truncated by the working back of the rock-face of the mining area below, although the form of the channel can just about be seen in the surviving rock-face. Hush channel 179 can be seen up to the edge of Dow Scar, the sheer rock-face, at which point the entrance to a level (109) can be seen. This suggests that the initial creation of the hush channel pre-dates the level, as it would not have been practical to have worked the level whilst the hush channel was in use. Similarly, there is a complex of features (6, 8, 10, 11) on the slope below Dow Scar which are related to the early twentieth-century barytes workings on the site (see 'Barytes Mining' section), and these must also post-date the active creation of the hush, as they are located in the path of any run-off from the hush channel or reservoir above. It appears that the lower section of the hush channel was subsequently modified to house a chute to deliver material to the complex below.

Figure 44 View along hush channel 179, from the north-east

The process of hushing, whether for exposing the vein or for washing debris away from worked areas, created a large amount of debris which was carried down to the valley floor. As a result there are

significant deposits of material, 'hush fans', close to the edge of the beck below some of the hushing episodes along the valley. One of the most substantial of these is hush fan 828, below hushes 515 and 518 which lead downslope from Mason Holes, and appears to have been built up over a number of hushing episodes, but which represents a huge amount of shifted material. This accumulation has been created by the washing down of debris and waste from the working areas above. A significant amount of the material has been removed by large-scale quarrying operations, probably undertaken by the MoD. Track 837 appears to climb the side of this hush fan, indicating that it was of later date, but the hush fan does seem to obfuscate the eastern end of track 381, suggesting it post-dates this track, although there is a possible re-creation of this end of the track alongside the hush fan, hinting at a later re-use of this routeway.

The wide variety of evidence relating to hushing in Scordale clearly indicates its importance as a method of making the valley sides workable and of exposing the mineral veins and flats. The sheer size of the scars left by the hushes demonstrates that this was undertaken on a large scale. The hushing appears to be concentrated on some of the steeper slopes in the valley, i.e. around Mason Holes, Amber Hill and Dow Scar, suggesting that the use of this method may be related to the topography. Hushing is generally believed to have been carried out in the earlier periods of mining activity and the evidence at Scordale seems to reflect the fact that there was no hushing being undertaken by the end of the 19th century, as the workings were confined to the area around the confluence of Scordale Beck and Great Augill by this date.

Levels

There are a number of entrances to underground levels still surviving within the landscape of Scordale, not all of which are depicted on the mapping of the site. In total, the locations of 42 levels were recorded, ranging from well-constructed, arched entrances to locations based on conjectural evidence. A few of these survive in good condition, some have been deliberately blocked and some have been obscured by landslips and later mine-workings.

One of the best preserved level entrances in the survey area is located high on the slopes on the eastern side of the valley. The entrance is a well-constructed arch of roughly-dressed stone at the mouth of an arched tunnel, which leads back to a rectangular passageway into the hillside (145). The entrance arch has been blocked with coursed stonework - this would probably have been done at the closure of the working, although it may be a more recent MoD addition. The blocking wall has been partially dismantled - possibly as a result of the present day explorations of mine enthusiasts. Water can be heard flowing along the level and it exits slightly further down the hill. The level is located a short distance from the ore bins (144) and the remains of a small structure (146), likely to have been associated with mining activity, are situated adjacent to the level entrance. There is a stone-revetted platform (147) just in front of the level entrance. There is graffiti on one of the stones forming the arch of the entrance level which appears to read 'G Pinkney' (Figure 46). Together these features form a self-contained extraction and preliminary processing area, which correspond with the position of Jacques Level, as depicted on early maps of the area.

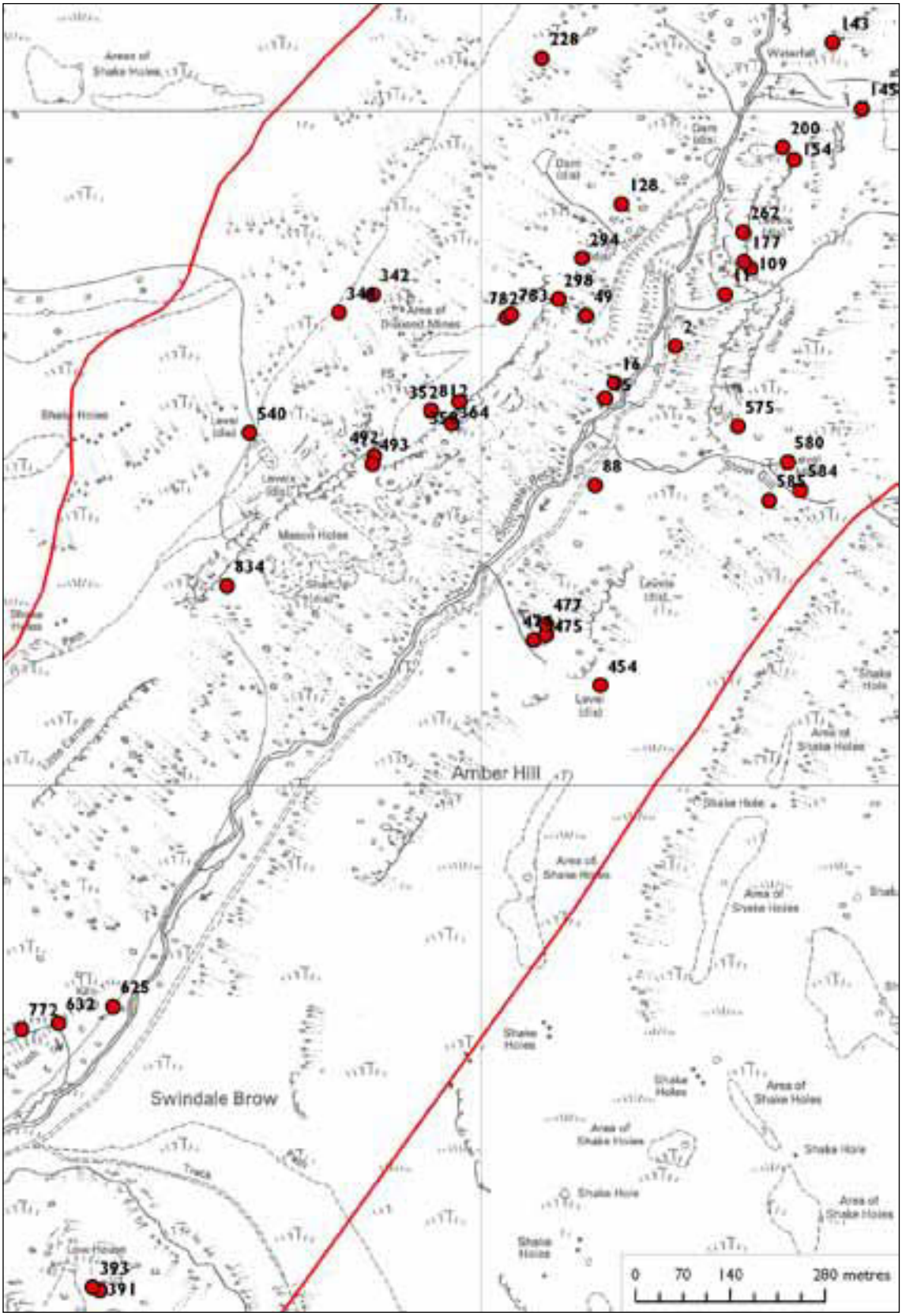

Figure 45 Map showing the location of mining levels recorded during the course of the present survey

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Figure 46 Graffiti, reading 'G Pinkney', on a stone in the arched entrance to Jacques Level (145)

An example of a level entrance (49) which has deliberately been blocked, by the military using explosives, lies close to the principal processing area on the west side of the valley at the south-west end of the tramway (54). There is only a small opening now visible, with a large pile of stone in front of it (Figure 47). The position of this level corresponds with Hardside Low Level on Dunham's geological map (Dunham 1948, 136) and 'Hardside alias Low Horse Level' on the 1824 map.

Further examples of level entrances survive on the eastern side of Scordale Beck, just to the north of Great Augill, in the area formerly known as 'Hilton Lead Mine' ('Murton Lead Mine' was to the west of the beck). The entrance to level 262 is well-constructed and would have been person-height. It is now blocked by an iron gate, to stop public access - not only for health and safety reasons, but also because the level entrance has been populated by bats and now acts as a bat roost. Evidence can be seen of tunnels cut into the rock heading into the hillside. It would appear that this level gave access to the flats worked via Middle Level. The position of Middle Level on Dunham's map (ibid 1948, 136) does not directly accord with the feature recorded on the ground, but this may be

Figure 47 The entrance to Hardside Low Level (49), deliberately blocked

due to the rectification of the map. Closer to Great Augill at the foot of a rock-face on the curve of the natural topography as it turns into a natural declivity (occupied by Great Augill), is level 109. This survives as just a small opening, blocked by iron bars, which have the appearance of tram rails. It may originally have been larger, but relatively recent consolidation appears to have encroached on part of the entranceway. This too is now a bat roost and entry is once again forbidden. The position of this level corresponds with Dow Scar High Level, and it is located at the south-western end of an area of flats which extended around 150m to the north-east. Also recorded nearby were an example of open face working (114) and a possible blocked level entrance (177), both of which appear to have been positioned to exploit the south-western end of the flats.

As well as examples of well-constructed, obvious level entrances, there are also a number of level entrances which are no longer visible on the ground, but can be located using conjectural evidence. One example of this is a possible level (200) on the eastern side of Scordale Beck, *c*200m north of Great Augill. Whilst there are no remains of a level entrance visible on the ground surface, there is a huge, flat-topped spoil heap (156) on the valley side (Figure 48), suggesting that waste was transported along the top of the heap and dumped. The barrow run or wagon-way along the top of the spoil heap leads to a small landslip on the hillside, which is the projected position of level 200. To further strengthen the interpretation of this as a level, there is a level entrance marked in approximately this location on Dunham's map (Dunham 1948, 136), accessing the flats and underground workings between Wilson's and Jacques Levels, and, on the 1824 plan of the site, 'Wilsons Middle Level' is depicted in approximately this location. It is also possible that this was one of the lead levels which was re-opened for barytes extraction in the late 1890s.

Figure 48 View from the probable entrance to level 200, looking south-west along the flat-topped spoil heap (156) associated with the level

Similarly, there is evidence of a former level (540) adjacent to a field wall to the north-west of Mason Holes. The key indicator in this case is the existence of an extremely large spoil heap (537), which survives in two parts as it is bisected by path 339, to the south-east. Further evidence of the level is the way in which the stone field wall has been disrupted and two stretches of walling, presumably flanking the tramway leading into the level, have been built into the gap. The gap which would have housed the tramway has been subsequently filled in with drystone walling, as evidenced by the straight joins on either side of this section (Figure 49). Behind this walling, the linear depression of the former tramway continues a short distance towards the hillside before being obscured by a landslip, which would also be obscuring the level entrance. The level appears to have been active until the early twentieth century, as it is depicted as 'Level' on the First Edition 25-inch map and the Second Edition 6-inch map, but as 'Old Mine Level' on the Third Edition 6-inch map (Ordnance Survey 1861; 1899b; 1920). It is possible that this level may be 'Pasture Gate Level' as depicted on the 1824 plan, but problems rectifying the early map means that this is more of a speculative match.

Extant remains indicate that there was a level driven into the slope at the eastern end of Lowfield Hush. Although the level entrance is no longer visible, its position is indicated by a stone-revetted passageway (632) leading to the point in the slope where soil slippage appears to have obscured the entrance. This passageway could have accommodated a tramway, to allow the removal of material from the underground workings. It would also have acted as a method of draining the level; at the time of the survey water was observed flowing along this passageway, eventually making its way in to the Scordale Beck below. It is possible that shafts 328-330 were sunk to prove the vein exploited by level 632. A further level (625), adjacent to a field wall approximately 100m from Lowfield Hush, is similarly obscured by a landslip from the hillslope above. The position of level

Figure 49 Entrance to level 540. The straight joins in the drystone wall (indicated by the arrows) show where the gap allowing access to the level has subsequently been blocked.

625 is further evidenced by an in-filled gap in the drystone field wall and a level area to the south-east. A short distance from this, a finger dump (628) indicates the potential location of a further level; there is no evidence of the level entrance and it must be assumed that natural slumping above the level entrance has obscured any remaining evidence.

The most northerly example of this, or indeed any, type of extractive activity is level 202, which is situated adjacent to the course of Little Augill. The level entrance itself is no longer visible, but parts of a stone-lined channel still survive, along which water still flows, presumably draining from the level. At the eastern end of this channel are two vertical slots, possibly used for a sluice gate to manage the water coming from the level. To the south-west of the level is a large tear-drop shaped spoil heap (203), along the top of which is a linear feature, interpreted as a barrow run (684). These features clearly functioned as a group and represent a single phase of working. The size of the spoil heap suggests a substantial amount of spoil was removed from the level; part of the north-west edge of the spoil heap has collapsed due to erosion by the flow of Little Augill. There is little other mining activity in the vicinity of these features and they appear to have formed a self-contained unit. There is no clear evidence of processing in this area, although there is evidence of a dam (204) across Scordale Beck and possible structural remains a short distance to the south of the confluence of Little Augill and the beck, approximately 200m downslope from the level. This level almost certainly corresponds with Browns Level, as depicted on the 1824 plan of the site. Annotation on the map records that it was 'Begun May 24 1824' by the 'Governor & Co.', i.e. the London Lead Company.

The distribution pattern of levels within the valley is fairly well spread, and dictated by the occurrence of mineral ores. While many can be identified with named levels on maps, there are others which can not. These unrecorded levels may indicate the location of relatively early mining activities, potentially from the mid-18th century when levels became more prevalent (Gill 2004, 52), or may indicate unproductive areas which were not fully exploited. However, given the expense of driving a level into the valley side, it seems unlikely that these undertakings were not carried through.

Open Face Mining

The technique of open face mining is perhaps one of the simplest to be employed in mineral extraction; at its most basic level it entails working a mineral vein exposed in a rock outcrop or crag. The simplicity of the technique means that it can potentially be seen as an indicator of relatively early activity, particularly where little work was needed to expose the outcropping vein in the rock face. In general open face working tends to be small-scale, although it may be used in multiple locations within a much larger scale open working. In Scordale, twenty-three occurrences of this technique were recorded, ranging from relatively small examples to others covering up to 150m of rock face. The majority of examples were clustered within Mason Holes and on Amber Hill, with other outliers to the north of Great Augill and around Lowfield Hush.

One of the most prominent areas of extractive activity is the massive open mine on the north-west side of the valley, known as Mason Holes. This gouge into the valley side has

been created by successive centuries of extraction and contains a number of examples of open face extraction, although there are suggestions that some of the initial working of Mason Holes was undertaken underground. Within the rear face of Mason Holes is clear evidence that the rock-face has been worked back systematically (for example, open face working features 495, 512, 529). Often this open face working is found in conjunction with hushes, where it is employed as a technique to work the mineral veins uncovered in the hushing process; this is demonstrated by features 823-5 around hushes 560, 563 and 565 in Mason Holes. Open face workings within hushes could be considered as opencut mining, but the distinction is not clear cut. Another series of open face workings (829-31) were recorded in hush 515 on a south-east to north-west alignment, where exposed limestone buttresses containing lead ore had been worked, indicating the orientation of the mineral vein. Features 512 and 529 are examples of larger areas of open face workings, created as the main rock-face at the rear of Mason Holes was worked back; respectively, they cover around 35m and 37m of the rock-face. One specific example of open face working was recorded on a very large *ex situ* block of limestone which had been brought down from the exposed rock-face above, probably by blasting (833). It contained many inclusions of lead and quartz (Figure 50) and evidence of chippings below it suggest that it had been partially worked. The amount of lead still evident in the rock suggests that working on it may have been abandoned and that this was one of the last phases of activity in Mason Holes. There was also evidence of dressing waste in the immediate area. As well as these examples of open face working, there are also examples of recesses in the rock-face within Mason Holes (512 and 529), which may be interpreted as the end of an underground galleries, now exposed following removal or working-back of the rock-face.

Across the valley from Mason Holes, in the vicinity of Amber Hill, there are similar examples of worked rock-faces, some of which are classified as opencuts and are discussed below. The principal open face working feature is an outcrop of limestone which has been worked intermittently for a distance of some 150m (712). The limits of the mining activity associated with this feature are evidenced by the cuts into the slope where the overburden has been removed onto the slopes below to expose the mineral. There is barytes within the waste on the slopes below the open face workings suggesting that this was not the primary mineral being mined, which most likely to be lead. Nearby are the remains of a rectangular building (716), measuring 3.4m by 2m. It is possible that this is a tool-shop or miner's shelter, potentially associated with the workings.

Figure 50 Photograph showing lead inclusions within a large block of limestone (833) which appears to have been partially worked

Further examples of open face working were recorded to the north-west of the principal processing area, opposite Great Augill. Feature 296 is an example of a limestone buttress which has been worked for mineral content, in this case, presumably lead. Nearby features (291 and 292) suggest that preliminary dressing was undertaken in the vicinity of the worked buttress, with material being transported to the processing area below via a timber chute (295). The location of this working and its association with the principal processing area suggest that it dates to the mid-19th century, post-dating the 1824 plan, which shows no evidence of lead mining or processing this far north.

Around 80m to the south-west of this, within hush 302, another example of open face working was observed (784). This is close to levels 782 and 783, which can be potentially identified on the 1824 plan, suggesting that this phase of open face working dates to the early 19th century. It is conceivable that the open face working was one of the earlier activities, obtaining the most easily available, visible lead ore first, before further deposits were sought using underground mining.

Feature 740, to the north-west of Lowfield Hush, located amongst exposed limestone boulders and scree, has the form of a 4m diameter platform with an exposed limestone face which appears to have been worked for lead. This relatively isolated outlier would seem to represent a small-scale extraction of a small amount of mineral, as there is no evidence of further extensive extractive activity in the vicinity, with the exception of shaft 284, a shallow feature which may have been exploratory.

Although it is difficult to date phases of open face working with confidence, by observing their relationship to nearby features, it is possible in some cases to begin to build a broad chronology. However, within Mason Holes, for example, where the workings are so extensive, there may be numerous phases of open face extraction which have subsequently been obliterated by later workings, taking the rock-face further back. It would appear that open face working has been used at most periods of activity in Scordale.

Opencut

Opencut workings are created where the line of a vein has been mined downwards vertically from the surface or in an outcrop, creating an open working of variable width and depth (Barnatt and Penny 2004, 106). Fourteen examples of opencut workings were recorded in Scordale during the present survey. As mentioned above, some features recorded as open face workings within hushes could arguably be classed as opencut mining, however, they do appear to be discrete episodes, whereas the examples outlined below are more clearly recognisable as opencut workings.

A large plateau in the eastern side of the valley, on a north-south alignment, to the north of Great Augill can be interpreted as an opencut working (872), although it perhaps does not strictly adhere to the above definition, given that it has not been mined down from the surface as such. However, it is similar in form to Mason Holes, but smaller in scale, measuring some 190m along its long axis. The plateau appears to have been formed by systematic working back of the rock-face, although it may have originated in part as a natural geological feature; similar natural plateaux are visible on the opposite side of

the valley. There is a large amount of tumbled debris, mainly medium-large deads at the foot of the rock-face indicating overburden removed to access mineral veins. It was not possible to examine the rock-face in detail during the course of the present survey, so any evidence of mining surviving there was not recorded. There are some hushes associated with the mining in this area (152, 178 and 487) and a spoil heap (176), all of which are at the southern end of the opencut, suggesting that mining activity was more intense at that end of the area. This area of mining does not appear on any mapping of the valley, which may suggest that it was pre-19th century. In addition, the techniques employed and the association with hushes point to an earlier date, although it is difficult to be more specific. A structure at the southern end of the opencut (151) may be a former mine shop, potentially identifiable with the 'Old Shop' marked in approximately this location on the 1824 map of the site, again suggesting a pre-19th century date for mining in this area. The structure is discussed further in the 'Living and Working' section below.

A series of three occurrences of opencut working (26, 114 and 182) was observed within the incised hush channel (179) running parallel to, and to the north of, Great Augill. The hushing activity has clearly exposed mineral veins and these have subsequently been worked out. In opencut 182, some slight traces of galena can be observed in the exposed faces although the most obvious residual mineral appears to be barytes. It seems likely that the opencut workings here may have been seeking galena in the first instance, the veins of which were exhausted, but was then subsequently re-worked for barytes. The group of structures and transport features below can be firmly associated with the later stages of mineral exploitation on the site, the early years of the twentieth century, when barytes was the focus of activity.

Further to the south, towards Amber Hill, there are more examples of opencut working, again observed in close relation to hushing activity. Two groups of opencut workings (467-9 and 470-3) were recorded, all in the immediate vicinity of hushes 479 and 480. All of these displayed similar characteristics, namely numerous chippings and deads below the opencut working and a vein containing predominantly quartz and calcite crystals with some barium, but with no obvious traces of *in situ* lead ore. There are no other extractive features in the immediate vicinity of these opencut workings, but they are on a similar geological alignment to the more extensive mineral workings to the north-east. The fact that the hushes only appear to have revealed these rather small-scale mineral veins suggests that hushing was undertaken here to remove overburden and assess potential mineral deposits, but that large-scale deposits accessible from the surface were not found here. Given that the opencut working seems to relate to barytes extraction, it could be that the opencut post-dates the hushes by some considerable time. If the generally-held assumption that hushing is relatively early (i.e. early 19th century and earlier) is applied and the documented evidence demonstrates that barytes was mainly sought in the early years of the twentieth century, then there would have been a considerable gap between the exposure of the mineral and its subsequent extraction.

Drift

In a generic sense 'drift mining' can refer to underground mining, specifically horizontal, or near-horizontal levels driven into hillsides to obtain minerals. However, the term 'drift mining' in Scordale is used to describe linear, finger-like cuts into a hillslope which often

appear like a level entrance, but invariably have a worked face at the end, effectively open slots into the hillside to exploit minerals a short distance below the surface. This technique was not particularly common in Scordale, with only nine examples of this type of mining recorded within the survey area.

Eight of the recorded examples of drift mining (666, 668, 670, 676-9 and 681; Figure 51) are located on the northern part of Amber Hill, all located on a north-east - south-west alignment, all close to each other within the same area, presumably attempting to access the same mineral vein. The drift mines vary in size, with the three larger examples measuring some 20m in length and between 2m and 8m in width. These drift mines were accessed via paths 570, 680 or 667. The association of 677-9 and 681 with path 680 indicates that these features are all contemporary and, therefore, the fact that the path is truncated by the open cast mining nearby (712), demonstrates that the latter post-dates the other features. Some of the drift mines have very little waste associated with them, but drift 677 has loose spreads of pea-sized quartz chippings on the slopes below, suggesting that dressing has taken place close-by and that waste from this process has been dumped on the slopes randomly without dumps being formed. The other drift mine with evidence of waste and dressed material nearby is 676, downslope from which is an area of concentrated pea-sized, quartz chippings which appear to overlie miner's path 667. There is no vegetation covering this cluster, suggesting that it is likely to be lead-rich. Its form suggests that it is not a dump from processing elsewhere and that hand-dressing may have taken place here. As this activity seems small in scale, it may pre-date the industrialisation of the 19th century. The relationship between the path and the waste may not be as clear as the ground remains suggest as there appears to be erosion

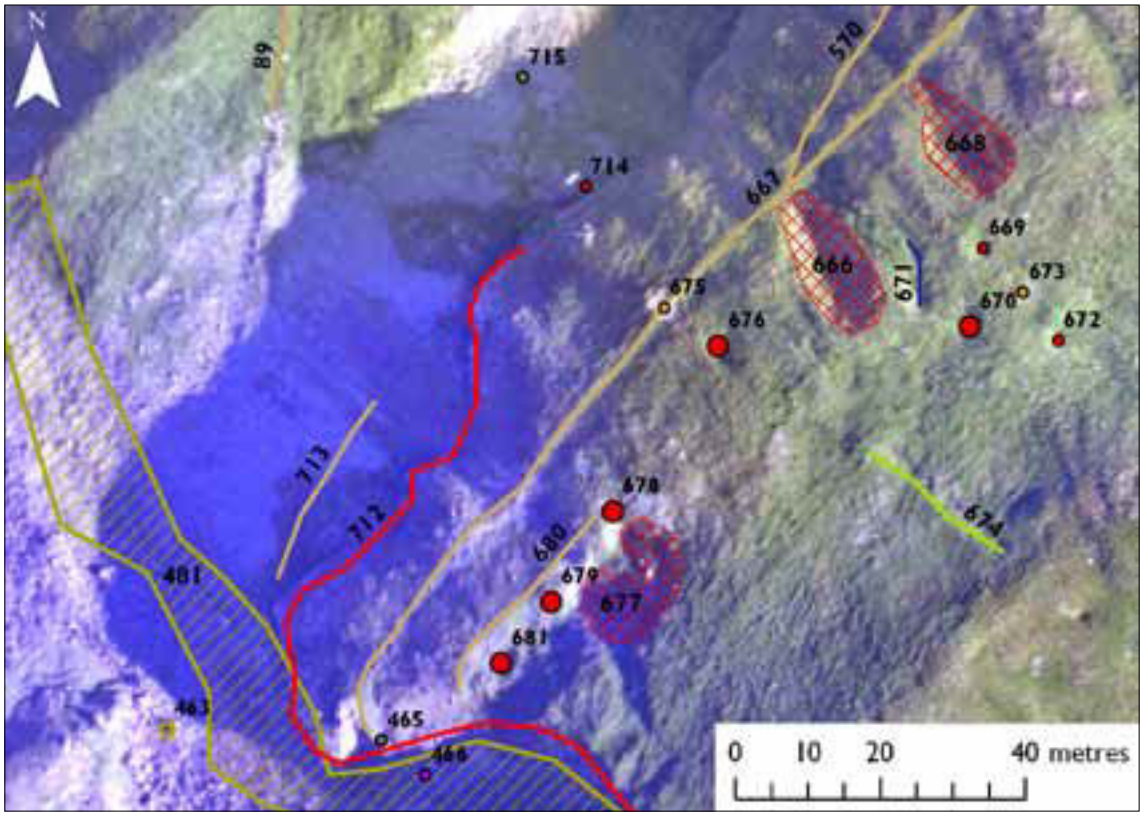

Figure 51 Extract from the GIS showing the principal mining features located on Amber Hill

on the path at this point, probably caused by the lack of cohesion caused by the absence of vegetation growth over the waste.

A further example of a drift mine (717), linear in form, was recorded approximately 50m downslope from the workings described above. However, this feature is overlain by the remains of a rectangular building (716), measuring 3.4m by 2m. It is possible that this is a tool-shop or miner's shelter, potentially associated with the large open face workings nearby (712), which adds further weight to the suggestion that the drift mining pre-dated the open face working.

The clustering of drift mines in this area strongly suggests that the adoption of the technique was dictated by the topography and geology occurring here. These are some of the steeper slopes in the valley, which would potentially have required modification of working practices to ensure extraction could be undertaken safely and relatively easily. The use of drift mining would also suggest that the mineral deposits being sought were not located particularly deep underground, thus allowing the less labour-intensive, and cheaper, surface extraction to be employed. The scale of the drift mines and the relationships with the paths on the valley side would suggest that these are unlikely to relate to the 19th century industrialisation of extraction in Scordale. It can also be demonstrated that the drift mines are post-dated by expansive open workings on these slopes.

Bench Working

Bench working can generally be described as a level, or near level, rock surface from where a horizontal vein (or flat) has been worked from the surface which appears as a terrace or 'bench' on a hillslope. Only three examples of bench working were observed in Scordale.

To the west of Lowfield Hush, two areas of bench working (735 and 736) were recorded. The features differ slightly, in that 735 is a slight terrace into the natural slope measuring approximately 12m by 7m, whilst 736 is more of a sinuous, linear hollow measuring approximately 33m by 3m. However, they both represent an area where limestone has been worked, presumably for lead. The former has an associated bank and some low spoil mounds on its periphery. A leat (737) leading towards the features may have supplied water to bench working 736, although this relationship is not clear.

The only other recorded example of bench working (226) is located on the western side of the valley towards the northern end of the survey area. This manifests itself as an apparent artificial widening of a natural bench, which cuts into the face of an exposed limestone buttress. Deads on the slope nearby suggest that there has been some extraction here, but no exposed vein is visible. A shaft with an associated spoil bank (224) has been sunk into the bench, but it may only have been an exploratory shaft, as there is only a small amount of associated spoil. There is also a structure (225) nearby, possibly a shelter associated with this mining activity.

Ore Processing

Over the centuries, many different processing techniques have been employed in the lead and mineral extraction in Scordale. These range from the crude hand-dressing operations, such as spalling (the manual breaking of rock using hammers), to the highly mechanised classification processes of the 19th century. This section will review the process from the removal of material from the mines, through the refining processes to smelting and transportation between the stages.

Ore Storage

Once removed from the mines, the rock containing lead ore, or 'bouse', was often stored close to the level in a series of bins, sometimes known as 'bouse teams'. The latter term was predominantly used where mining was undertaken in partnerships, so that the ore could be dressed and paid for separately (Raistrick and Roberts 1990, 5). Other examples may simply be referred to as ore bins or ore stores; the latter terms are used here.

Whilst many examples of ore stores are substantial, stone-built structures, there are instances of much more informal storage of ore, sometimes little more than piles of stones in the vicinity of levels and dressing floors. These features are often difficult to identify in a naturally stony environment, but may represent early, small-scale mining activity. One such example of surface traces of ore storage (63) was recorded close to the tramway cutting (863), a short distance north-east of the principal processing area. The feature simply consists of an area of crudely sorted material, mainly palm-sized chunks. The composition of the material suggests that it was waiting to undergo further dressing, suggesting that this was an area of ore storage prior to the next stage of the process. Some patches of exposed stone were also recorded to the east of level 632 at the end of Lowfield Hush, which may also represent relatively early ore piles. However, it is also possible that these are exposures of sub-surface natural rock.

Possibly one of the earliest surviving ore storage structures is to be found in the vicinity of Lowfield Hush. It seems likely that Lowfield was being worked at the end of the 18th century into the early 19th century; its absence from the 1824 plan of the site seems to corroborate the dating. The small complex of processing buildings around level 625 include a structure (624) built into the field wall, consisting of two compartments. The more southerly of these would appear to be a possible ore store associated with mining activity here. The compartment is a simply-built, rectilinear, open-fronted structure, incorporating the field wall as its rear wall. This could potentially have provided an area for ore storage, although it is somewhat small.

Some examples of ore storage within the survey area display a very poor level of survival. There is a series of six ore bins in two groups of three (354-6 and 359-61) on the north-western side of the valley, to the south-east of High Shop, but all that can be seen of the bins are occasional fragments of slightly curving, loosely constructed dry-stone walls, as there has been surface slippage from above, which has covered most of the bins. Some of the bins have interlinked walls, as seen on the better preserved examples, and some appear to have a substantial amount of stone in them, which may either be deads or

Figure 52 Stanchions (378) on the slopes below, and to the south-east of, High Shop

bouse. In between the two groups of bins is evidence of a possible level (359) which may have been the source of bouse for these bins. A path (357) runs along the front of the ore bins, allowing access to bouse stored in them. It is possible that bouse was dressed in an area to the south-west of these stores, where there is a level area, with evidence of a structure (353), charred areas and an iron artefact (808). The location of this series of ore bins can be fairly confidently identified with one of the series of 'teams' depicted on the 1824 map (NEIMME 1824), thus giving them a *terminus ante quem* of 1824.

Evidence of more ore bins is visible further down the slope between the series of six, described above, and pair 380, described below. Again, these are mostly covered by slipped material from the slope above, but fragments of walling are visible to indicate that there were at least two ore bins here (379). They appear to be smaller than the series of bins higher up the slope and there is bouse or deads within the bins. Material from these ore bins may have been transported to the valley floor via a chute, or possibly even a water balance, which was potentially located to the north-east, although there is only circumstantial evidence of this, namely a pair of stanchions high up the slope (378) and a spread of material in a vertical line down the slope below (Figure 52). Although apparently not depicted separately on the 1824 map (NEIMME 1824), it seems likely that these ore bins were in use at this period, possibly used in tandem with the series of bins to the north (354-6 and 359-361).

Figure 53 Extract from the First Edition 25-inch map showing the depiction of ore bins (the wavy line) between two sections of tramway
Reproduced from the 1861 Ordnance Survey map

The other series of 'Teams' depicted on the 1824 map of the mines is located below tramway 54 to the north-east of level 49, in the area of Murton Lead Mines. There are approximately nine bins depicted. These are also shown on the First Edition 25-inch map (Ordnance Survey 1861; Figure 53), but not on any later editions of the mapping. No evidence of ore bins in this location survives on the

Figure 54 The series of ore bins to the north of Jacques Level. The ore bin with the large boulder incorporated into its rear wall can be seen in the foreground.

ground, possibly as a result of the intensive activity in this area at the end of the 19th century and the start of the 20th century.

A series of six interlinking, stone-built ore bins (144; Figure 54) are situated on the high slopes of Scordale, adjacent to the entrance to Jacques Level (145). The individual ore bins are almost semi-circular on plan, open at the front with high retaining walls, constructed of roughly dressed limestone blocks, built into the slope at the rear. The three southern bins are the best preserved of the group, with the rear walls surviving to a height of 2m in places. It is interesting to note that one of the better preserved bins has a large boulder incorporated into its rear wall, with metal bolts to secure it. Collapse from above has obscured some of the bins and stone, possibly from the construction of the bins or remnants of bouse, has fallen onto the slopes below. The bins were accessed by a path running along in front of them, to the west, which was consolidated by a retaining wall (148) on the downslope side. A further revetment wall (149) runs parallel to this wall, some 7m to the west, which would have formed a solid platform below the ore bins, possibly enabling some preliminary dressing of the ore to be undertaken. A patch of white tailings just below wall 149 add further weight to this interpretation. It is not clear how the bouse was transported away from this area, but it is possible that there was a series of wooden chutes descending the slopes, of which there is now no trace. There are fragments of paths in the vicinity of the ore bins, but landslips and erosion on the very steep slopes have obscured the full routes of these paths. These ore bins are depicted on the First Edition 25-inch map (Ordnance Survey 1861), as part of a complex labelled as 'Old Lead Mine', suggesting that they were out of use at this date; they are not depicted on subsequent editions of OS mapping. The veins in this area appear to have been worked in the years around 1829, according to the annotations on the 1824 map (NEIMME 1824), which would suggest a similar date for Jacques Level and its associated structures.

A pair of ore bins (380), the best preserved examples seen in the survey area, are located on the steep slopes on the north-west side of the valley, opposite the Amber Hill workings (Figure 55). The ore bins are well-built using a drystone construction with roughly-dressed stone blocks; they are interlinking, sharing a central wall. The bins are roughly semi-circular on plan, open at the front with the rear wall built back into the slope behind. This rear wall survives to a maximum of approximately 3.3m. These appear to stand in isolation, as there are no other ore bins which can be linked to this series. It is unclear where the bouse which went into these ore bins came from, as there is no surviving evidence of a level or path to a level in the vicinity, although this is below part of the valley side which has seen a great deal of slippage of surface material, disturbed by mining-related activity above, which has potentially destroyed or obscured a number of features. It is possible that bouse was fed into these bins via a system of chutes, but no evidence of such a system survives. A well-constructed path (381) leads from the ore bins across the slope of the valley, down towards the beck; this is the route along which bouse would have been taken away from the bins for further processing, potentially at mill 81 on the valley floor. These ore bins do not appear to be depicted on the historic mapping of the site, but there is a feature on the 1824 plan, showing an open-fronted, rectangular structure at the end of a 'road', which may be tentatively identified with the ore bins.

A further well-preserved ore bin, or possibly a pair of ore bins, survives on the north-western side of the valley, to the north-west of Mason Holes adjacent to field wall 547. The ore bin is a semi-circular, open structure cut into the south-western side of the north-western part of spoil heap 537. Well-constructed, curving dry-stone walls, standing to over 2m high in places, revet the cut into the spoil heap. Slumping from above has

Figure 55 A well-preserved pair of ore bins (380) on the lower slopes to the north-east of Mason Holes

obscured any possible central dividing wall, making it difficult to be certain if it was originally one or two bins. Pieces of bouse seem to remain at the edges of the structure. This ore bin would have housed bouse removed from level 540, which would probably have been tipped into the bin from above, as there is evidence of a tramway running along the top of spoil-heap 537 from the level. A footpath (541) is cut into the spoil-heap to give access to the top of the ore bin from the main track (339). The spoil-heap is depicted on the First Edition 25-inch map (Ordnance Survey 1861) but apparently not at its full extent, indicating that the level was active subsequent to this date. Although the ore bins are not shown specifically on this mapped depiction, there is a more pronounced slope shown where they are located, suggesting their existence.

A potentially late ore store appears to be represented by the heavily-eroded, fragmentary remains of a structure (78), a short distance to the south of mill 29 (Figure 56). Most of the building has collapsed into the beck below, making it impossible to ascertain its extent, but an L-shaped section of walling survives, potentially representing the western corner and the north-west wall of a structure. It was thought that the building might have been used to store processed mineral (Giecco 2008, 19), as there was a fine, silty deposit observed in the corner. However, environmental sample residues taken from this structure were inconclusive in terms of assigning a function to the building, but found no evidence of mineral storage (Paynter 2009, 10). Photographic evidence from the turn of the century, which depicts a group of workers and a traction engine in front of the crushing mill, would suggest that there was a loading bay close to the southern corner of the crushing mill (Figure 57). A further photograph, possibly from *c*1895, shows a large, stone-built section of walling with a right-angled return, sloping

Figure 56 Remains of possible ore store (78), adjacent to Scordale Beck. All that survives of the structure is the rear wall and part of one of the side walls - the rest has been lost to erosion.

downwards, possibly with a chute leading into it, close to the location shown in the other photograph (see Figure 34). Given its position, it is possible that feature 78 represents the last fragments of this structure. If so, this may have been a rectilinear plan ore store, from which ore was taken and transported off site, potentially dating to the late 19th century; a square building located in this approximate location is also shown on the Second and Third Edition 6-inch maps (Ordnance Survey 1899b; 1920).

Transport

Tramways And Barrow-runs

The movement of ore around the site, from mined source to ore storage to processing to off-site smelting, was achieved in a number of ways. Ore stores and dressing floors were often located near the mines to ensure that as little effort as possible was expended in transporting non-profitable material around the site. At the earliest stages bouse would have been barrowed out of levels, often using the flat tops of spoil heaps outside the level entrance to facilitate this process, or carried out in baskets. Wooden rails were used in the 18th century to allow horse-drawn wagons or tubs to be used; these were superseded by iron rails, introduced in the first quarter of the 19th century (Raistrick and Roberts 1990, 2). In some cases, evidence of tramways coming out of mine levels still survives, in other places, it is merely the form of the associated spoil heaps which indicate that material was routinely removed from the level and tipped, creating finger dumps. Chutes were often used to transport ore between stages of processing, particularly where the topography was not conducive to carrying material. There is also

Figure 57 Late 19th-century photograph of the principal crushing mill (29). The walling to the far left of the photograph may represent the original form and position of structure 78.
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a network of paths, tracks and roads criss-crossing Scordale to enable the movement of people and mined material, ultimately allowing access to and from the site. The human movement around the site is covered in the 'Navigating the Landscape' section below, whilst this section focuses on the movement of ore around the site.

The transport of bouse out of levels and into ore stores, and deads onto waste heaps, was undertaken using barrows and tramways, the latter being the later technique. A potentially early example of the use of barrows to remove material from levels can be seen outside level 202 (Brown's Level), where a barrow-run (684) is visible along the top of a substantial spoil heap (203). This level is known to have been started in 1829 (NEIMME 1824). There is no evidence that there was a tramway here and, given the relative isolation of the level, it is unlikely that it would have been economical to transport the requisite materials to construct a tramway in such a location. The form of the spoil heap outside the level, a linear, tear-drop shape, suggests that material was being barrowed out of the level and tipped, gradually expanding the dump. The same process appears to have occurred around Jacques Level (145) as well, where there is a considerable amount of spoil outside the level entrance, but again, no evidence of a tramway. The flat area outside the level would have been suitable for a barrow to take the spoil to a suitable dumping place. It is possible that the revetting walls (148 and 149) to the north-west of Jacques Level were constructed to provide a suitable surface for a barrow-run.

The entrance to level 632, which was driven into the side of Lowfield Hush at its eastern end, is no longer visible, but its position is indicated by a stone-lined passageway. The walls of the passageway are of drystone construction and clearly define a corridor of a consistent c1.5m width. The deliberate construction of the passageway and the maintenance of the access suggest that it housed a tramway, although no evidence of rails was observed during the course of the present survey. Linear dumps of material radiating from the end of the passageway are indicative of a tramway, where material was dumped at the end of the tramway and then sections were realigned to allow a new linear dump to be started. The potential date for this level is the early 1800s, so if there was a tramway here, it may have had wooden rails.

The First Edition 25-inch map shows a two-branched tramway coming out of level 49 (Ordnance Survey 1861). The layout of the tramway indicates that the south-eastern branch of the tramway was used for depositing spoil; it is depicted running along the spine of a large spoil heap, which is still in evidence today, although there are now no physical remains of the tramway itself. The eastern branch of the tramway was used to transport ore into a series of bouse teams depicted a short distance to the north-east (*see* Figure 53). The bouse teams are no longer visible on the ground, possibly covered over by waste material from subsequent decades of mining activity. This section of tramway can be relatively confidently be identified with a 'Waggon way' with associated bouse teams shown on the 1824 plan of the site, leading north from level 49, which appears to have no specific destination. The origin of this tramway is thus relatively early.

The First Edition 25-inch map also shows a more substantial section of tramway (54), which originates at level 66, leading to the other side of the former bouse teams

(Ordnance Survey 1861). The tramway exited level 66, crossed the Scordale Beck on a bridge, adjacent to a footbridge, continuing to the south-west over an embankment before reaching the bouse teams. It would appear that ore was being removed from level 66 and also being deposited in to the bouse teams. This route still exists today as a levelled route terraced into the valley side. Map evidence demonstrates that the route of the tramway was altered over the following decades. By 1899, the tramway is only shown between levels 61 and 66, but on a different alignment; the north-east end of the tramway bypasses the cutting (863), and instead follows the former line of the footpath (65) (Ordnance Survey 1899b). It seems that the tramway would also have had to cross the beck using the former footbridge, as this is on the alignment of the altered route. The reason for this diversion is not clear. The switch to barytes and witherite extraction around 1896 may account for some of the changes reflected in the mapping.

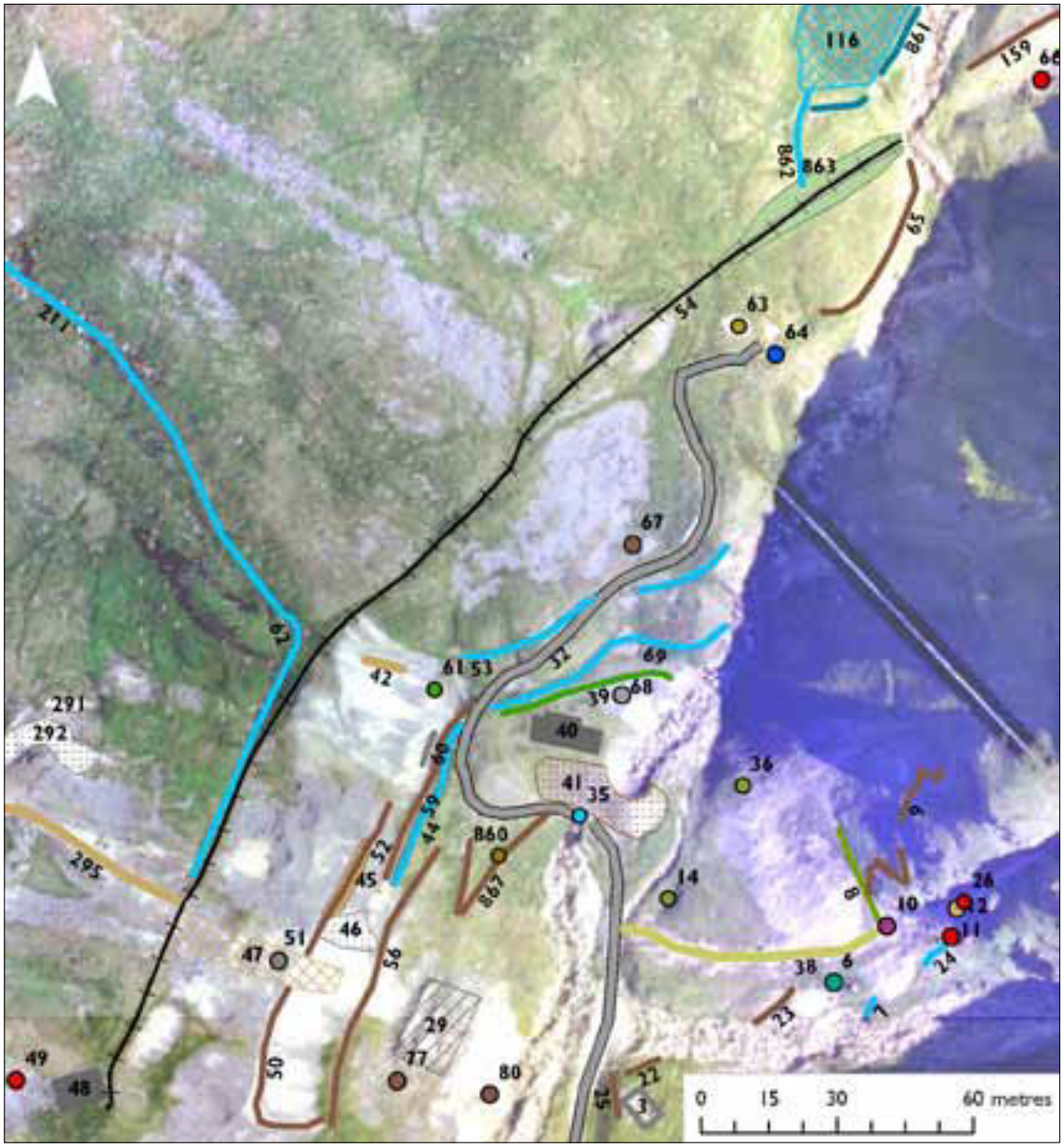

Figure 58 Extract from the GIS showing the principal tramway and other features around the principal processing area. Great Augill joins Scordale Beck in the lower right-hand corner of the image.

Other later examples of tramways leading out of levels can be seen on the First Edition 25-inch map of the site, indicating that they were functional around 1860 (Ordnance Survey 1861). Short lengths of tramway can be seen emanating from level 61 and another level, to the west of crushing mill 29, which can no longer be identified. The tramway from the level by the crushing mill appears to be heading straight into the mill building, suggesting that the material from the mine was being deposited directly into the mill for processing. The tramway from level 61 can still be traced in the form of a bank of compacted waste stone (39). This appears to have been used for the deposition of waste material, substantial dumps of which can still be seen on the beck side. Some ore may have been deposited alongside the tramway for dressing, as there is evidence for dressing adjacent to the feature on dressing floor 68. The tramway from level 61 appears to have been re-used in the barytes mining era, as it connected to the barytes extraction site on the opposite side of the beck; this is discussed further below in Section 5.2.2.

Although not depicted on any maps, it seems likely that there was a tramway leading out of level 540, tentatively identified as Pasture Gate Level, to the north-west of Mason Holes. To the south-east of the level is a very large spoil heap (537) which has a level top and has clearly been created by tipping from wagons on top of the spoil heap. The interesting feature of the spoil heap is that it is cut in two by a path (339) and there is a well-constructed stone feature (538) incorporated into the more south-easterly part of the spoil heap adjacent to the path, apparently a retaining wall (Figure 58). As well as acting as a retaining wall, it seems that this wall may also have served to support a tramway running from the level across the top of both parts of the spoil heap. This may have been used in conjunction with wooden trestles, but would have provided a solid support to enable the tracks to bridge the substantial gap between the two parts of the spoil heap. Evidence from the First and Second Edition 25- and 6-inch maps suggest that the splitting of the spoil heap occurred between 1860 and the 1890s, as the spoil heap is a single feature on the former, suggesting that the tramway was still in use in the latter half of the 19th century (Ordnance Survey 1861; 1899b).

Clear evidence of a tramway can be seen at level 88, *c*70m south-west of the confluence of Stow Gill and Scordale Beck, where a tram rail and sleeper (687) were seen eroding out of the side of the beck. While level 88 is not depicted on any of the map editions, it is possible that it operated during the latter part of the 19th century. The nearby dressing floors (83), shown on the Second Edition 6-inch map of 1899, indicate that ore was being processed here, and the vicinity of the level would suggest that material was being transported directly out of the level and straight on to the dressing floor.

Some artefactual evidence of the tramways in Scordale was recorded during the course of the survey. A number of iron rails (for example, 491, 687, 860 and 868), mainly *ex situ*, were recorded at various locations in the valley. A discarded tram wagon (856) embedded in the north-western bank of Scordale Beck (Figure 60) was also recorded, a short distance from a level entrance (15) and in an area of extensive waste material deposition.

Figure 59 View of the 'split' spoil heap (537) to the north-west of Mason Holes. The stone retaining wall (538) can be seen in the centre of the photograph.

Figure 60 A discarded tram wagon embedded in the north-western bank of Scordale Beck, some 150m to the south-west of the principal processing area

Chutes

Once bouse had been extracted, and, in some cases, undergone preliminary dressing, it often had to be moved some distance for the next stages of processing. This tended to be more prevalent in the later, larger-scale undertakings, as it became more common to have a mill serving a group of mines, rather than earlier workings, where dressing floors were located as close to the level as possible to minimise wasted effort transporting bulky material. There are a number of examples of chutes in Scordale, employed to move bouse or dressed ore from the high slopes into the processing areas and on to the main transport network. Some of these may be relatively early, as the steep topography does not always allow sufficient space for dressing floors in the immediate vicinity of the mines. Some chutes appear to have initially functioned using gravity, although later examples, such as those in the principal processing area above mill 29, appear to have used a form of mechanical power.

A potentially early example of a chute (12) used for moving ore around the site was recorded on the eastern side of the valley, just to the north of Great Augill. The chute is formed of a revetment of crudely dressed stones below an opencut between limestone buttresses. It seems limited to a length of approximately 15m, above which it either ends or is masked by loose stone in the opencut and at the bottom of which it has partially collapsed. This chute may have been constructed to carry material from the mining within the opencut above (114, 182 and 183) down to the valley bottom for processing, or possibly from levels 109, 177 and 262 along Dow Scar. The spread of material on the slopes below (38; see Figure 58) may indicate the route of a continuation of this chute which has subsequently been lost with the barytes extraction and processing on these slopes at the end of the 19th century.

Figure 61 View down the route of chute 295; surviving timbers can be seen in the foreground. The remains of mill 29 can be seen at the end of the chute.

On the slopes high above mill 29, there are surviving timber fragments which were once part of a timber chute (295; Figure 61) which ran down the slope, delivering material into wagons on tramway (54) below or to a further chute (47) which led to mill 29. Some of these timbers are potentially still *in situ*. Mixed waste material, with a high proportion of fine white chippings, scattered around the line of the chute indicates where material was spilled from the chute as it was transported down the slope. Below the tramway (54), the area of chute 47 contains a number of surviving artefacts, such as a number of loose timbers and upright metal fixing bolts and re-used tram rails, likely to be the fixings for a chute or chutes. There are three stone-built walls descending the slope from the tramway

(54), which appear to be the bases for chutes or supports for hoppers. The walls are crudely fashioned, with no mortar. A stone pillar with an angled concrete cap (51) was recorded below the stone wall in the middle of feature 47. This may possibly be part of a mechanism for moving dressed ore up and down the slope, suggesting that the . The good level of survival suggests a relatively late date, in addition to which the chutes can still be seen as intact structures in the photographs of the site which date to the late 1890s. There is also a building visible on the level of the tramway in this photograph (see Figure 34); fragmentary remains of stone walling, recorded in the middle of feature 47, are almost certainly part of this structure. It is likely that a stage of processing occurred in this building, but the evidence is insufficient to identify precisely what. Photographic evidence shows that a wooden chute came out of the building feeding material directing into a loading bay or storage structure just below mill 29, whilst another chute appears to have delivered material into mill 29. This suggests that two grades of ore, or possibly even two different minerals, were being processed here. The likelihood is that this network of chutes dates to the latter stages of lead-mining in Scordale. They may additionally have been re-used for barytes processing.

Further to the north-east on the slope below tramway 54, an area of laid stone (42) was recorded. The stone had been laid in a 'herring-bone' type pattern in amongst the deads on the slope. This appears to have acted as a base for a chute, or possibly even the chute itself. A platform below this chute, close to level 61, may have been where the material was off-loaded. The location of chute 42 also roughly corresponds with the point at which the tramway is shown to end on the Second Edition 6-inch map (Ordnance Survey 1899b), suggesting that at this date, material was being transported along the tramway before being off-loaded into chute 42 and transported to the lower slopes for dressing.

A pair of stone stanchions (378; Figure 52) on the steep slopes below High Shop may represent the head of a chute carrying material down the slope to be worked on the valley floor below, possibly on platform 846. There is dressing waste around the platform, which possibly represents residue which has fallen from the chute or scattered during an unloading/loading process, or may even indicate that dressing was undertaken here. It is also possible that the stone stanchions (378) represents an obscured level entrance, but no further evidence to corroborate this was observed. A lengthy, close inspection of the feature was not possibly due to the treacherous terrain and loose material underfoot. However, a linear scatter of fine brown tailings on the slope below the stanchions may indicate the line of material spilling from the possible chute. There is a remote possibility that there may have been some form of water balance here transporting ore to the valley floor, rather than a chute. However, this is merely a tentative suggestion based on circumstantial evidence, but closer inspection of the area and calculation of gradients may help to ascertain if this is a possibility. Water balances were in use at Coldberry and at Lady's Rake Mine (operated by the London Lead Company) in the North Pennines (Forbes *et al* 2003, 43 & 61), but these were primarily applied to haul men and/or ore up the mine shafts and appear to have been used on slopes with shallower gradients. A lack of structural remains at Scordale, as witnessed at the other sites (Railton 2009, 27-8), might also indicate that a water balance is unlikely to have operated here.

There is a chute (90) which can be seen as an earthwork between Amber Hill and Stow Gill. Cartographic evidence demonstrates that this chute was constructed between 1899

and 1920 (Ordnance Survey 1899b; 1920), giving a firm indication that it was connected with the barytes mining and processing in Scordale, as a result, this feature is discussed further below.

Transportation of Refined Products

Once the ore had been extracted and dressed, the refined product needed to be taken off-site for smelting and onward transport. In the earlier periods of mining, prior to the 19th century when the workings were relatively small-scale, it is likely that the network of paths which exists along the valley were sufficient for this purpose. As the mining operations expanded and the volume of material removed increased, more substantial routeways would have been needed and proper metalled tracks were built.

The main route along Scordale is the principal mine road (32; Figure 62), which links the mine workings to the village of Hilton, where the smelting mill was located. This road presently stretches through approximately 75% of the survey area; along much of its length the route has been well-maintained and survives as a metalled road. Early map evidence indicates that at least part of mine road 32 was in existence by the 1820s. Whilst the 1824 plan of the site does not show the mine road on the south-east side of Scordale Beck, there is a stretch of road depicted on the north-west side of the beck, the inference being that the road crossed the river, either via ford or bridge at this point. This seems to approximately correspond with the earthwork remains of track 381, a well-constructed feature, with heavy drystone revetment in places. Although the main mine road is not shown on the 1824 plan, Hodgson's map of 1828 shows the road leading up the valley from Hilton village, on the southern/eastern side of the beck, and it is depicted crossing the beck at a location which can be approximated to the inferred crossing point on the 1824 plan. Both plans show a 'Crushing Mill' at the end of the mine road, clearly demonstrating the purpose of the road in the transportation of the processed ore out of the valley. Other active mines are shown further up the valley on these 1820s plans, which suggests that the mined and processed ore from these was transported via a series of lesser tracks and paths, not substantial enough for cartographic depiction.

Today, the mine road (32) continues up to the principal mining and processing area around mill 29; this extension occurred between the late 1820s and 1859, when the First Edition 25-inch map was surveyed, which depicts the road to its full extent (Ordnance Survey 1861). There is no representation of the routes on the north-western side of the beck, shown in the 1820s, on the First Edition 25-inch map. For example, track 381 (as described above) is not illustrated, indicating that the routes on the north-west side of the beck were redundant by this date. The focus, and need for transport, by this date had clearly shifted to the area further up the valley around the confluence of Great Augill and Scordale Beck. The First Edition 25-inch map (Ordnance Survey 1861) simply shows the track crossing the river at this point, presumably fording it, as no bridge of crossing structure is depicted. The crossing point at this date was over 550m north-east of the earlier crossing point, a short distance north of Great Augill. The upper section of the mine road on the western side of the beck, as shown on the First Edition 25-inch map (Ordnance Survey 1861; *see* Figure 58), still survives, in places as an earthwork and in places as a rough track. This section of the track is shown running from the footbridge or road-bridge to level 66, over the mill race close to level 61 and towards crushing mill

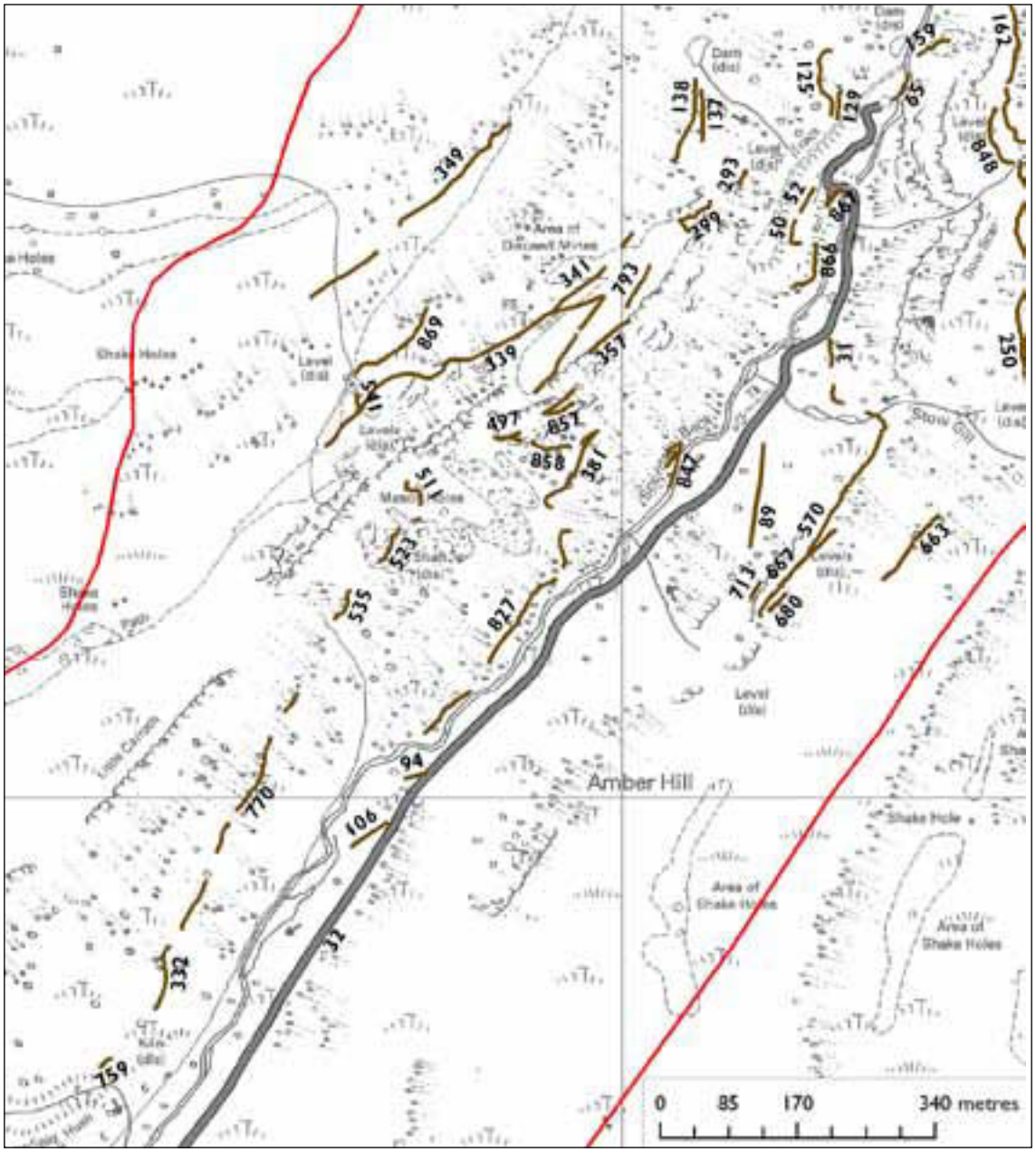

Figure 62 Map showing the main routeways in the central part of the survey area.

29, before it takes a sharp turn and traverses back across the slope to the crossing point over the beck. This latter section can still be traced as an earthwork (867), becoming redundant at some point before 1899, as it is not depicted on the Second Edition 6-inch map. The fact that this section of the track only survives as an earthwork also indicates that it fell out of use and was not maintained. Earthwork path 65 represents the remains of the northernmost section of the mine road from this date.

At some point between 1859 and 1899, the map evidence shows that part of the beck was covered over, partly to allow the road to cross the river and potentially to provide a

larger, flat working area (Ordnance Survey 1861; 1899b). The beck was culverted under this area, part of which survives today (35; Figure 63). The current culvert measures 20m in length, whereas 50m of the beck was covered according to the Second and Third Edition 6-inch maps (Ordnance Survey 1899b; 1920), indicating the potential extent of subsequent erosion. The 1899 map does not show the road crossing the beck at all, but the 1920 map shows it crossing the beck, rounding a corner and heading to structure 40, the surviving route of the main track today (Ordnance Survey 1899b; 1920). This would suggest that access to the area to the north-east of the beck in this area became less formalised during the latter stages of working in Scordale, indicating a shift of focus away from the area towards level 66. Photographic evidence demonstrates that traction engines were being used on site (Figure 57), probably for the transportation of ore to the smelting mill, which would have necessitated the substantial construction of the mine road and good maintenance.

In a number of places, mine road 32 crosses tributaries of the Scordale Beck, which are running down the valley side. This is most often achieved by using a culvert, for example, where the road crosses a stream to the south-west of Stow Gill (33; Figure 64). The culvert is created by a stone-built archway over the stream. The style of the archway suggests that it dates from at least the 19th century, if not earlier.

Track 381, as mentioned above, crosses the steep slope below the north-eastern end of Mason Holes, and appear to correspond with the 'Road' shown on the 1824 plan of the site. Its present route appears to be between a pair of ore bins (380) and the valley floor, with possible continuations of the track traversing the slope above (858). Much of

Figure 63 The culvert (35) carrying the main mine road (32) over Scordale Beck. The large mass of material on top of the culvert is a spoil heap (41).

Figure 64 Culvert (33) carrying the mine road (32) across Stow Gill. Water flow off the road and from Stow Gill is causing erosion to this feature, visible to the left of the arch in this photograph

the lower part of the track has been disturbed by modern activity in this area, where large amounts of material appear to have been bulldozed. It seems that track 381 would have continued its descent of the valley slope to the edge of the beck and then have forded the river; there are wheel ruts across some of the 'islands' within the beck at this point and although these are of recent date, they may indicate an original crossing point. Fragmentary branches of a track (847) were recorded close to Scordale Beck at the foot of the very steep slope below High Shop. These may have been the continuation of track 381, however, they lead to a platform (846), defined by an area largely free of deads with a scattering of barytes waste.

The other main routeway on the north-west side of the valley is a well-constructed track (827; see Figure 62), which is roughly 2m wide with stone revetment on its downslope side. It is clearly associated with the mining areas on the slopes above and parts of its route may have changed or been abandoned over time as mining progressed. It climbs up the hush fan (828) which it post-dates and has deads stacked along its eastern edge, presumably contemporary with its use and from which a number of barrow runs are evident, whilst at the north it is blocked and overlain by deads from a later phase of dumping. At the south-western end it has been truncated by valley-side collapse. At the west it has been maintained free of deads and debris and one section has been cleared through earlier deposited deads. Its route to the south-west, although now truncated by river-side erosion, clearly crossed Scordale Beck and climbed up the opposite slope where its route is marked by the stone revetment (94) onto the principal mine road (32). There is no ford depicted at this location on the First Edition 25-inch map, potentially indicating that this route had gone out of use prior to 1860 (Ordnance Survey 1861). There is a possibility that this track may have connected with track 381, but any explicit

evidence has been lost in the removal of material from hush fan 828 in relatively recent years. It seems quite likely that this may have been a precursor to road 32, allowing access to the Mason Holes area from Hilton. The width and maintenance of the route suggest its importance, potentially for transporting ore off site.

There are some well-constructed paths and tracks (50, 56, 59 and 866) within the principal processing area. These appear to represent routes between various parts of the processing area. The volume of material dumped in this area means that it is likely that these are late features, as they would have been obliterated by waste material if they were early. In which case, given the mechanised and developed methods known to be used to move bouse and ore around the site during the latter phases of activity (such as chutes, tramways and timber launders), it seems most likely that these were routes for the workers to move around the processing area.

At the eastern end of the survey area, a group of braided hollow ways (270) either side of Scordale Beck indicate a well-used corridor of movement. This appears to have been principally associated with movement of material between limekilns; the routes pass above limekiln 269 and map evidence show that a path continued to a further limekiln outside the survey area. However, the First Edition 25-inch map also shows that the continuation of the route leads to the rear of Hilton Smelt Mill (Ordnance Survey 1861). This may potentially have been a route along which refined lead ore was taken to the smelt mill, particularly from the north-western side of the valley, and potentially from areas of relatively early mining activity.

Mills

Four mill sites associated with lead-mining in Scordale were identified from the field evidence; a further site, based on cartographic evidence, can also be postulated. Mills on lead-mining sites may have been stamping mills, crushing mills or dressing mills, all of which performed a part in the ore refining process, breaking the bouse and purifying the raw product. Stamping mills were introduced to England in the late 16th century, but tended to be used in an auxiliary capacity on lead-mining sites, particularly post-1825 (Burt 1982, 26-28). Within a stamping mill, stamps shattered the rock rather than crushing it (ibid, 28). Generally later and more common than stamping mills are crushing mills, usually employing multiple sets of rollers to break the rock. The first mechanically powered versions of these were introduced in England around the start of the 19th century (ibid, 21). At least two of the mills in Scordale can be identified as crushing mills. One of the earliest mills was in the vicinity of Lowfield Hush, with another possibly located higher up the slopes towards High Shop. These are the least well preserved mills, particularly the latter which can only be traced through cartographic evidence, adding weight to them being the earliest structures. It seems unlikely that the early mills worked concurrently with the later mills, the latter potentially superseding the original structures, partially as a reflection of the shifting focus of extractive activity within the valley and possibly of the developing technology. At least one mill had been built opposite the confluence of the Scordale Beck and Great Augill by the mid-19th century. Cartographic evidence demonstrates that this crushing mill was extended and altered considerably between the 1860s and 1890s, and by the latter date had been joined by two further mill buildings, which probably had different functions. The main crushing mill was retained in

use into the early twentieth century, when barytes was being extracted and worked on the site.

The earliest mill for which there is firm evidence was situated *c*120m to the north-east of Lowfield Hush, forming part of a small mining complex consisting of levels, leats and spoil heaps. Whilst there are no substantial structural remains surviving above ground, there is a large rectilinear platform (626), with evidence of revetment walling to the south-west. On top of this platform and overlying the revetment walling is a considerable amount of dressing waste, indicating that processing of ore was occurring here. There is not sufficient evidence to indicate the size or form of the mill which is likely to have been here. A leat (335) leading towards the area from a natural spring approximately 150m to the north-east may have provided the water required for processing, but how this was transferred to the structure is not clear, as no evidence survives. It is possible that the mill had a waterwheel, but the position of it is similarly unclear from the surviving field evidence. It seems unlikely that it was as large as the waterwheels known to have operated further north-east along the valley, as there is no evidence of a substantial wheel-pit, as seen at other mill sites (*see below*). However, the waterwheel may have been relatively small-scale, but in the absence of firm positional evidence, it is impossible to say. It is possible that the 'mill' at this location, potentially a stamping mill, was merely an open, roofed structure built to protect basic machinery and offer some protection to workers.

There is a 'Crushing Mill' depicted on the 1820s plans of the site (NIEMME 1824; CRO(K) 1828), which is clearly in a different location to the building labelled as a crushing mill on later maps. Although it is not possible to accurately rectify these 1820s plans, the position of the crushing mill relative to other features, such as Great Augill and Mason Holes, locate it slightly downslope from High Shop. The slopes in this area are very steep, so detailed investigation of the area was not possible for health and safety reasons during the present survey. There are some traces of tracks (857) leading to an area just below leat 809, close to what appear to be the very fragmentary remains of a pair of ore bins (379), all of which, although circumstantial, would indicate this as a focus of activity and a potential site of a crushing mill. In addition, a crushing mill in this vicinity would have been able to deposit processed ore into the ore bins (380) below, via a system of chutes. The absence of any strong evidence of a building having stood here, such as a platform or masonry, may throw some doubt on to this interpretation, but given the steepness of the slope, it is quite feasible that any structure, once abandoned, could have collapsed and building rubble tumbled down the slope, thus leaving scant trace of its existence. It is also possible that a mill may have been deliberately dismantled, particularly if fixtures and fittings were to be re-used elsewhere. Given that there is nothing depicted in this location on the First and Second Edition 6- and 25-inch maps of the 1860s and 1890s (Ordnance Survey 1861; 1863; 1899a; 1899b), it is possible to say with a degree of confidence that the crushing mill here had ceased to be used by this date and had possibly been dismantled, presumably reflecting the shifting focus of operations to the beckside site, of which so much still survives.

One of the principal surviving structures in Scordale is the building labelled as 'Crushing Mill' on the OS historic mapping (feature 29). The map evidence indicates that between

the 1860s and the 1910s (the earliest and latest periods of mapping), the building underwent a number of changes (Figure 65). The First Edition 25-inch map (Ordnance Survey 1861) depicts the structure as a rectangular building, measuring approximately 10m by 6.5m, with a channel taken off Scordale Beck leading to it labelled as 'Mill Race', and a level immediately behind the structure, with a tramway leading out of the level and into the mill building. There is a tail-race emanating from the southern corner of the building and what appears to be an unroofed annexe a short distance to the south. The field evidence does not reflect this position or layout of the main mill building, even allowing for inconsistencies in the map rectification, as the surviving structure is much larger and on a different alignment. However, traces of flooring material (laid sandstone and brick) were recorded just to the south-west of the mill building (77), which indicate the possibility that there was formerly a structure here; this broadly corresponds with the unroofed annexe depicted on the map. No trace of the accompanying level was recorded on the ground, suggesting that later activity in this area, particularly dumping of material from above, has obscured the level entrance. There was no trace of the tail-race visible on the ground either. However, it is perhaps not surprising that evidence from this period has been lost, as the ensuing decades saw a period of intense activity in this area and numerous changes were undertaken.

By the time that the Second Edition 6-inch map was revised in 1897 (Ordnance Survey 1899b), the crushing mill had been greatly extended and expanded, creating a structure almost 30m by 20m. Although slightly larger than the structure recorded at the time of the present survey (29), the footprint of the building on the map is broadly analogous with the surviving remains. The cartographic evidence suggests that the earlier building was incorporated into the subsequent, larger building shown on the later map. The larger dimensions of the later building may indicate that the structure was built to cover over areas which were previously unroofed, for example the annexe (77). Adjacent to the flooring material to the south-west of the mill building are the remains of concrete machine beds, indicating that this area was in use during the later period, and thus strengthening the argument that this area was covered by a roofed structure. The depiction of the mill building is the same on the Third Edition 6-inch map (Ordnance Survey 1920), suggesting that little changed during the final stages of large-scale ore processing on the site.

The field evidence reflects the core elements of this second phase, larger building – the structural remains evidence a stone-built rectangular structure consisting of a north-south wheel pit with three adjoining compartments on its eastern side. The wheel pit walls have a dressed stone exterior, with dressed stone corners and evidence of mortaring, with a rubble core. According to the sales particulars of 1895, the machinery and plant for sale with the site included 'One 46-ft. by 3½-ft. Waterwheel' (CRO(K) 1895). The dimensions of the wheel-pit of crushing mill 29, 17.2m by 1.3m (56ft 5ins by 4ft 2½ins), correlate with a wheel of this description. There are piers on the interior faces of the east and west walls of the wheel pit, indicating the point at which the waterwheel would have been supported. The three compartments are situated perpendicular to the wheel pit and all appear to have been open to the east, as no walls are visible across this part of the structure. To the east of the mill is an area of fine chippings. Whilst the structure is mostly covered with stony tumble, a number of wall faces are occasionally

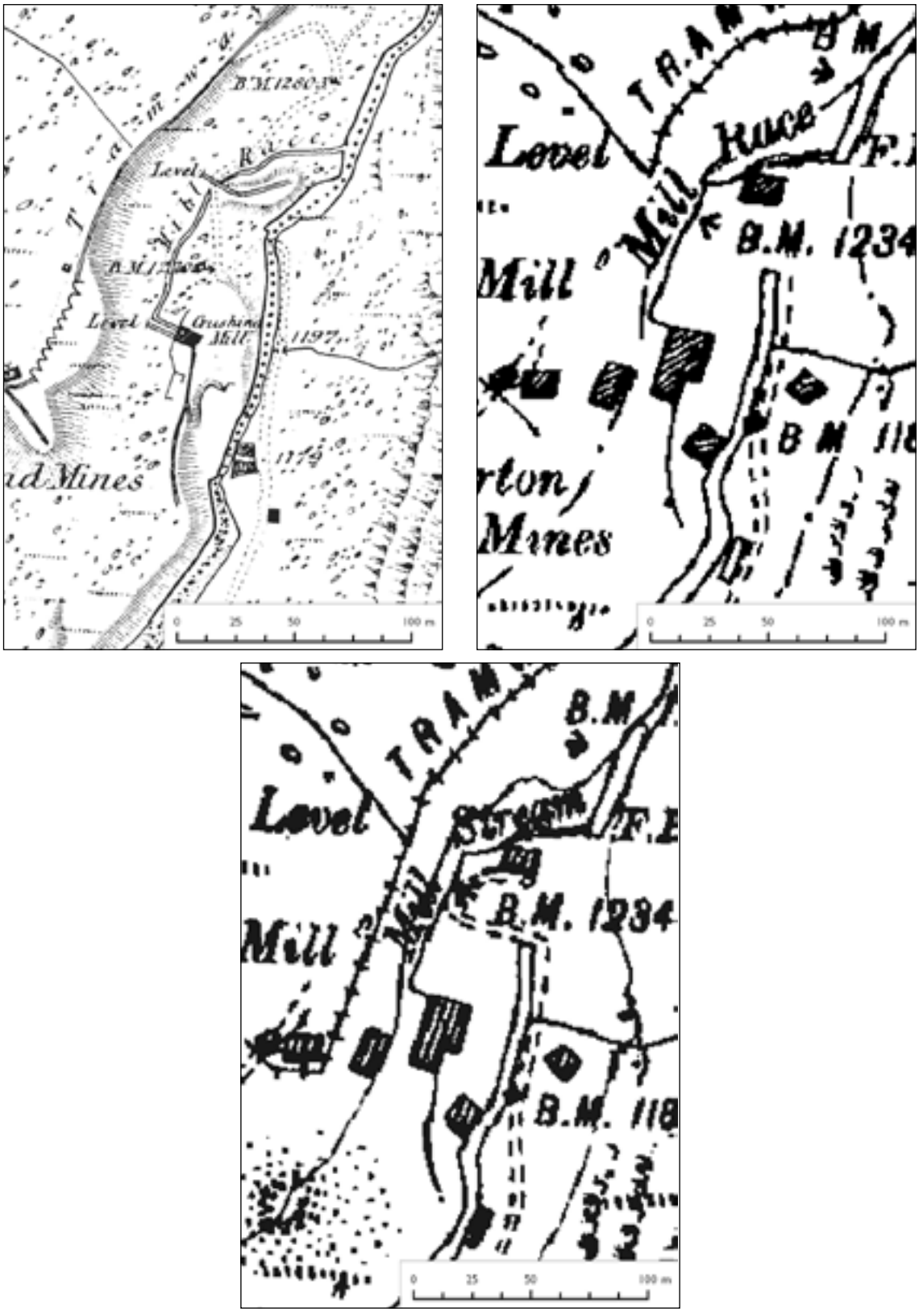

Figure 65 Extracts from historic Ordnance Survey mapping showing the changing depiction of mill 29 and its environs. First Edition 25-inch map, surveyed 1859 (top left), Second Edition 6-inch map, revised 1897 (top right) and Third Edition 6-inch map, revised 1911-13 (bottom)

Reproduced from the 1861, 1899 and 1920 Ordnance Survey maps.

visible through the rubble. The quantity of rubble suggests that the walls originally stood much higher, an assumption backed up by aerial photographic evidence, which shows the walls of the mill standing to full height in the 1950s (RAF 1953 and RAF 1956). A modern military emplacement has been dug into the most southerly compartment. The whole building stands upon a large, level mound.

Further evidence of the appearance of the structure in its final phases exists in the form of an old photograph, likely to date to the late 1890s, which shows a group of workers with a traction engine standing in front of a building (Figure 57). The building in the background, which is unequivocally the crushing mill, appears to be principally of timber construction with a corrugated iron roof. At the rear of the building, a waterwheel of considerable size can be seen. At the top of the photograph, a right-angle timber launder can be seen delivering water to the waterwheel, thus demonstrating that it was an overshot wheel. The position of the timber launder and the height at which the water was fed on to the wheel would indicate that a combination of leat 69, which ran along the foot of wall 44, was being used to supply water to the wheel from Scordale Beck; this also corresponds with the depiction of the 'Mill Race' on the OS historic mapping. The mill was a two-storey structure, as there are windows in the upper part, although these may only have been for the provision of light and do not necessarily indicate a floor within the building. The ground floor level had doors and windows, with at least two doors on the south-east side and one to the south-west. At least two chutes can be seen coming out of the building, delivering crushed material into cart below, which appears to be waiting in a loading bay. This may point to two different types of crushing occurring in the mill, either with the same or differing outputs. The mill building itself appears to be situated on top of a heavily revetted mound, as drystone walling can be seen facing the large platform; judging by the scale of the people in the photograph, the level platform which supported the mill was around 4m high. In front of the mill building and behind the traction engine is what appears to be a large spoil heap, possibly consisting of waste material cleared out from the mill via the doors on the south-east side. The traction engine is parked close to what appears to be a bridge over the beck, abutted by well-constructed revetment walling alongside the edge of the beck. It is difficult to be certain, given the perspective, but some of the structural remains (80) visible in the section of the spoil heap below mill 29 revealed by river erosion may correspond to this abutment or revetment. The fact that there was such substantial revetment at this point is an indicator of how extensively the beck was managed in this area.

This structure was surveyed in detail, at 1:200 scale, in order to ensure that its form was recorded as the potential for the collapse due to undermining by river erosion is very high (Figure 66). Excavations were also undertaken close to the eastern part of the mill building during July 2007 (Giecco 2008); trench 1 was positioned to investigate the south-eastern side of the structure. Wooden troughs or chutes, still *in situ*, were uncovered, generally of a similar date, each containing slightly different types of mineral residue, but generally evidencing barytes processing (Paynter 2009, 7-10). The samples indicate that the mineral was becoming purer and more processed as the chutes progressed southwards, suggesting that the final product was taken out of the mill at its southern end. The location of the trench was such that the features uncovered almost certainly

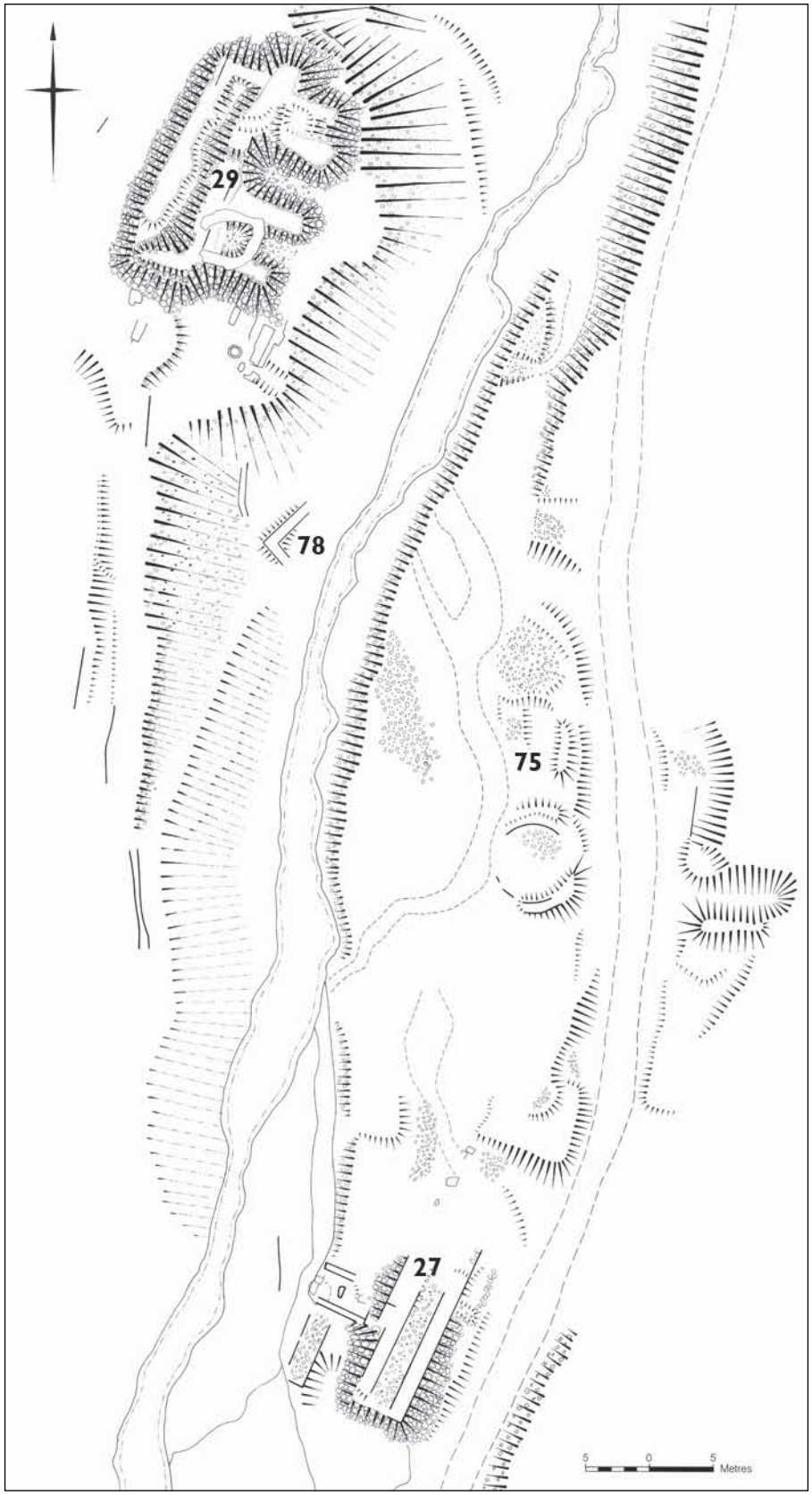

Figure 66 Hachured plan of the principal crushing mill (29) and its environs. A further mill (27), a series of buddles (75) and the remains of another structure (78) are also shown.

date to the later phases of expansion of the crushing mill, as it did not originally extend so far to the south-east. This is consistent with the evidence of barytes processing in this location, which only started after 1896. However, spoil underneath the chutes relates to the earlier period of activity, prior to the mill's expansion and the mineralogical content suggests that it is spoil from lead processing (Paynter 2009, 8).

Structural remains of a second mill (27; *see* Figure 66) survive some 90m to the south of mill 29, on the eastern side of Scordale Beck. Mill 27 is not depicted on the First Edition 25- and 6-inch mapping (Ordnance Survey 1861; 1863), but it is shown on the later Second and Third Edition 6-inch maps (Ordnance Survey 1899b; 1920), suggesting that its construction and use dates to the tail-end of London Lead Company undertakings at the site or may possibly have been connected with the revival of activity on the site in 1892-3, as documented in the sales particulars of 1895. It does appear to be depicted as an unroofed building on the Second Edition map, but this is not certain.

The remains of mill 27 consist of a wheel-pit, measuring approximately 15m by 5m to its external edges, an outshot attached to the north-west edge of the wheel-pit and a freestanding masonry construction (28), most likely a buttress, to the west (Figure 67). The mill was constructed of dressed stone slabs and mortared, with double-faced walls with a rubble core, but is now in a poor state of repair, with most of the walls having collapsed; on the east side of the wheel-pit, the wall stands to only *c*1.3m high. The quantity of spoil within and surrounding the structure suggests that the walls were originally significantly higher. River-deposited material around the structure also suggests some degree of erosion due to fluctuating water levels in the beck. The walls of the outshot only survive to *c*0.3m, but this may be because they were only ever intended

Figure 67 Mill 27 viewed from the west. The outshot can be seen in the foreground, while the standing remains of the western wall of the wheel-pit can just be seen amongst the rubble behind.

to be sleeper-walls, upon which a timber superstructure was built; this is supported by contemporary photographic evidence (discussed below). Internally, the structure has been greatly disturbed by stream/river erosion. A number of internal features are visible, including, timber, shuttering, brickwork (collapsed sections) and large sandstone slabs - the latter have marking-out grooves on them, but are *ex situ*. In the south-east corner of the adjoining structure are the remains of a timber chute which still contains residual silty material, possibly process waste or slimes (Figure 68). Excavation of part of the outshot of this mill did not elucidate the function of the structure significantly further, although it confirmed that there had been a substantial piece of machinery housed there (Giecco 2008, 32).

The scale of this mill, relative to crushing mill 29, and its position further down the valley suggests that a different process was being carried out here. Mineralogical analysis of residual silty material from a timber chute in the structure, although potentially not original and possibly contaminated, found that it had some galena content and that the particle size was predominantly fine (Paynter 2009, 13). This may, therefore, have been a dressing mill, used in the latter stages of the lead ore refining process, but the levels of contamination in the samples make a definitive statement almost impossible. There was nothing within the samples taken from this structure to suggest that the processing of barytes or witherite occurred here. If this is the case, then it would seem that the structure lay idle during the years of barytes production from 1896 onwards. If this is the case, then a late 19th-century photograph of crushing mill 29, which shows a group of miners standing by a traction engine below the mill (Figure 57), apparently on a loading bay fed by chutes from the mill, would suggest that the material being deposited within the cart behind the traction engine was going to be transported off the site. There is the possibility that it was being loaded up to be taken from mill 29 across the beck on a bridge and along mine road 32 to mill 27 for further dressing, but photographic evidence suggests that a chute leading across the beck directly from mill 29 to mill 27 could have fulfilled the role of transferring material between the two structures.

Figure 68 Detail of features within mill 27. Left: a sandstone slab with marking-out grooves. Right: a timber chute containing a silty residue.

Photographic evidence of mill 27 survives (Figure 34), likely to date to the late 1890s, although the precise date of the photograph is unknown. It is conceivable that this photograph was taken to illustrate the lots being put up for auction when the site was sold in 1895. The photograph confirms what the field evidence demonstrates, that the structure identifiable as mill 27 consisted of a wheel-pit - the waterwheel is shown *in situ* - with an outshot. The waterwheel in the photograph can fairly confidently be identified as one of the 'Two 40-ft. by 4ft. ditto [waterwheels]' itemised in the 1895 sales particulars (CRO(K) 1895), further corroborated by the measurements of the wheel-pit, which would have comfortably housed a wheel of this size. The photograph also shows that the outshot was a timber and corrugated iron structure. In addition, a series of three buttresses are visible supporting a timber launder, bringing water to the waterwheel from the other side of the beck. Two of these buttresses were identified on the ground (28 and 17); the third has presumably been destroyed by river erosion. Running alongside the elevated timber launder carrying the water to the waterwheel is another narrow trough supported on trestles, which appears to be feeding into a chute leading directly into mill 27. This suggests that at one stage material from mill 29 was intended to be carried directly to mill 27 for the next stage of processing. To the south-east of the wheel-pit adjacent to the mine road (32) was a timber and corrugated iron structure which is directly adjoining the wheel-pit, however, there is now no evidence of this structure on the ground.

The other substantially surviving mill building (81) is located further to the south-west along Scordale Beck. The structure (Figure 69) consists of a rectangular wheel pit on a north-south alignment with a second parallel and adjoining wheel pit and possible beam engine slot, built of roughly-dressed, mortared stone with rubble core. The quantity of

Figure 69 The tumbledown remains of mill 81. The mill race (871) approaching the structure can be seen in the foreground.

tumbled rubble indicates that the walls originally stood to a much greater height. Like mill 27, this structure does not appear on Ordnance Survey mapping until the 1899 Second Edition 6-inch map (Ordnance Survey 1899b), suggesting that this too was built towards the end of the London Lead Company's tenure, or even in the 1880s or 90s. However, there is a length of stream depicted on the First Edition 25-inch map (Ordnance Survey 1861), upon the line of which the mill appears to have been constructed. The water channel leading from the nearby dressing floor (83), shown on the Second and Third Edition 6-inch mapping (Ordnance Survey 1899b; 1920), appears to be a modification and extension of this natural stream course, to create a mill race (871). It approaches the eastern corner of the mill, turns to follow the north-eastern end of the structure, before re-joining the main channel of the beck. A faint linear earthwork to the south-west of the mill indicates the probable position of a tail-race. Although the river channel now skirts around the mill, it is likely that originally, water was entering the mill on its north-eastern side to provide under-shot power to the waterwheel. There is no evidence of water being conveyed at a higher level to power an overshot wheel. However, documentary evidence suggests that the waterwheel may never have been installed in this building, as the 1895 sales particulars record 'Two 40ft. by 4-ft. ditto [waterwheels] (one not erected)' (CRO(K) 1895). Given that of the three waterwheels mentioned in this document, two can confidently assigned to the other mill buildings in the valley, and photographic evidence corroborates the fact that these were erected and operational, it is a strong likelihood that the waterwheel which was described as 'not erected' in 1895 belonged to this mill. This could indicate that this mill was incomplete, and possibly relatively new, at this date, or that it had previously been operational but had been dismantled. There is not a great deal of waste material scattered around this site, which could potentially indicate that the mill saw little use.

Mill 81 appears to have functioned initially in conjunction with the nearby dressing floors (83) and possibly with a level (88) to the north-east. The apparent construction of a tramway (337) and chute (90), as evidenced by the historic mapping, and a possible incline (89) near to mill 81 may indicate the insertion of elements of infrastructure connected with spoil re-working, or the re-establishment of extraction, on Amber Hill. However, there is no firm evidence to confirm the process which was occurring in the structure or the mineral that was being processed.

Close to mill 81 are two platforms (85 and 91) cut back into the steep natural slope. These both have the appearance of building platforms and may have housed timber or corrugated-iron structures. It is conceivable that these may have been ancillary buildings associated with mill 81.

Dressing Floors

The 'dressing' of bouse refers to the process of separating the lead ore from the gangue material and rock; this process was universally known as 'washing' in the North Pennines (Hunt 1970, 89). However, in order to avoid confusion, only the term 'dressing floors' will be used here. Dressing was initially undertaken on a small-scale, often close to the point at which the ore was brought to ground level, and would have been done by hand. It was not uncommon for women and children to be employed for this work. The remains from this stage of the processing are often little more than a patch of

uniform-sized stone on the ground, indicating where the dressing occurred. With such ephemeral remains, it is difficult to ascertain the precise methodology being employed in the processing of the ore, but it is generally possible to differentiate between areas where dressing was being done by hand and by machine. Over time, the dressing process became increasingly mechanised and large-scale, often with substantial buildings constructed to house the necessary machinery. Outdoor dressing floors are therefore generally seen as chronologically earlier, while the large mills are associated with the gradual industrialisation of the lead mining industry witnessed during the 19th century. Of the features recorded within the survey area, approximately 40 were interpreted as relating to the dressing process. As well as dressing floors, ore was also separated in buddles (wooden or stone-lined troughs of various designs used to concentrate the ore, Barnatt and Penny 2004, 104), particularly in the later stages of processing; the examples recorded in Scordale are included in this section.

Examples of relatively isolated and small-scale dressing floors, thus interpreted as potentially early features, were recorded to the north of Great Augill above Dow Scar. The principal components of the group are a series of three dressing floors (186, 189 and 190), which lie adjacent to hush channel 179. These dressing floors take the form of patches of pea-sized white and brown tailings, with a lack of vegetation cover (Figure 70). This latter characteristic of the areas suggests a heavy-metal content to the waste, typical of lead dressing. The tailings have a high barytes content and some galena-rich chunks of ore are deposited around the area. Associated with all three areas of dressing waste were patches of flat stones laid on the ground, potentially indicating a deliberately constructed floor; a timber superstructure or shelter may possibly have been constructed over these areas. Water management features including dams (188 and 184)

Figure 70 Dressing floor indicated by a patch of tailings (189), situated to the north of Great Augill. Fragments of flat stones, possibly the remains of flooring, can be seen at the right of the dressing floor.

and outflow channels (185, 187, 191 and 193) demonstrate that water was being managed in this area, possibly with water from the reservoirs carried in timbers launder to feed onto the dressing floors. The small scale of the remains and the remnants of galena left on the surface suggest that hand- rather than machine-dressing was taking place here, and possibly of a relatively early date, as the process does not appear to have been rigorously efficient at extracting the maximum galena from the bouse. Adding further weight to the relatively early date of this complex is the fact that path 848 cuts across, and overlies, dressing floor 190 demonstrating that it is of a later date. Although there is not sufficient evidence to give a precise date, a late 18th- or early 19th-century, or even earlier, is not inconceivable, particularly as the cartographic evidence, which starts in 1824, does not show evidence of workings in this area.

On the western side of the beck, a short distance from tramway cutting 863, is an area of crudely sorted dressing waste (63), approximately 6m by 4m (Figure 71). This has been interpreted as an area of ore storage (*see above*), but the presence of medium-sized chippings and stone, suggests that hand-dressing was also occurring here, or in the vicinity. Feature 63 is on the northern side of the mine road (32), whilst on the opposite side of the road is a pair of hollows, which appear to have functioned as washing pits (64). This indicates that the two features were potentially in contemporaneous use, with the road allowing access to both. It is not clear where the material being processed would have originated, especially given the small-scale of the features. The possibility is that they relate to an early phase of the site's use or a small-scale trial to ascertain the proportion and quality of mineral deposits. A short distance to the south-west of these features, cut into a stony bank and former tramway bed (39), is a small circular platform, *c*2.5m diameter. The platform consists of small dressed stone, probably dressing waste, indicating that there may have been a small hand-dressing floor. These small dressing

Figure 71 Area of dressing waste (63) close to tramway cutting 863

floors may pre-date the bulk of the late 19th-century, large-scale production in this area, surviving as traces of earlier activity, possibly from the mid-19th century.

Further examples of potentially early hand-dressing floors were recorded on the high ground in amongst the group of shafts to the north-east of High Shop. Dressing floors 794 and 797 both consisted of dressing waste, the former palm-sized and the latter palm- to pea-sized waste. Both areas displayed hints of underlying stone platforms. The waste was rich in lead and barytes, suggesting that this was an early hand-dressing floor, given the inefficiency and small-scale of the processing. Nearby leats (800 and 796) may have fed water to the dressing floors, possibly incorporating short sections of timber launder to transport the water directly to where it was needed.

Areas of dressing waste (291, 292 and 297) on the steep slopes above tramway 54 indicate some form of dressing in this area, although there are no formal dressing floors. The waste is primarily pea-sized white and/or brown tailings. The most likely explanation for these patches of dressing waste is that the rock outcrops situated in this area were being worked for mineral deposits. The extracted mineral may then have been subject to hand-dressing in this area, before being sent down a chute (295) for further processing in the crushing mill (29) below. It is not entirely clear whether this waste relates to lead or barytes extraction. The whiteness of the waste suggests barytes, but the occurrence of barytes within the waste may actually be an indicator that it was not barytes that was primarily being sought.

Within Mason Holes, below the main worked face and between two large hush channels, are the surviving remains of a group of features relating to the dressing of ore. The group is situated to the east of reservoir 835, which appears to have supplied water to the dressing process. To the north-east of the reservoir are the remains of a structure (500), with evidence of a packed earthen floor at the eastern end and possibly *in situ* flat stone slabs at the western end (Figure 72). There is also a quantity of palm-sized chunks of bouse piled up against the northern wall of the structure, possibly indicating where material was stored prior to processing. There is no evidence within the structure to indicate the presence of any machinery. Leading downslope from the eastern end of this structure is a trail of fine white chippings towards a large area of similar bright, fine white chippings (501). There are no traces of structural remains amongst the white tailings, but it would appear that this was the next stage of the dressing process. The partial remains of a short stretch of stone-capped culvert (504) between this area of dressing waste and the structure upslope (500) indicate that this area was supplied with water. It is possible that water was taken from reservoir 835 via leat 509 and carried to this dressing area. A short distance downslope to the east are the fragmentary remains of another structure (502), with very fine white chippings in and around it, apparently representing a further stage of processing. All that survives of this are partial single course walls; a lack of tumbled debris in the vicinity suggests that the walls never stood much higher and that they were sleeper-walls supporting a timber superstructure. A channel (519) leading out from structure 502 indicates that waste material and waste waster was washed away and into the adjacent hush 518, also demonstrating that the initial creation of the hush pre-dated the dressing complex. These are therefore not the earliest remains in this area, but may date to the 18th or early-19th century, particularly as they are not depicted on any historic mapping of the area.

Figure 72 The remains of structure 500 within Mason Holes. The large area of pale dressing waste (501) can be seen in the distance.

Evidence of dressing was also recorded in the vicinity of Lowfield Hush. The largest area of dressing waste was recorded on platform 626 and just adjacent to it (629), *c*120m to the east of the Hush. This has been interpreted as a possible mill site (see *above*), but may have been simply an open, roofed structure on top of a platform, protecting workers undertaking hand-dressing or simple machinery. No evidence of a structure survives and no associated artefacts were found in this area, making it difficult to be certain of the processes and methods of dressing being undertaken here. Further evidence of dressing was observed *c*100m to the west, at the end of the Hush and to the south and south-east of level 632, where two areas of dressing waste (774 and 777) survive. Area 774 is overlain by deads, which appear to be from level 632, and also by structure 775, the fragmentary remains of a structure of indeterminate function. Dressing waste 777 also appears to be mixed with deads, suggesting that this waste does not relate to level 632 either. This dressing waste could relate to an earlier period of mining activity in Lowfield Hush, possibly processing the ore extracted from the open face workings within the hush.

A set of three, possibly four, relatively well-preserved buddles (75) survive on the east side of Scordale Beck, close to the confluence with Great Augill (Figure 73). The location of these features so close to the beck means that they have already suffered from erosion by the rising and falling water levels and flow patterns and much of the western part of the features has been lost. Due to this active erosion, the buddle complex was surveyed in detail (Figure 66) and it was decided to excavate part of the buddle complex in order to record the features before they were lost to erosion as part of the excavation programme in 2007. Surviving remains of circular buddles are generally more common on tin mining sites and are less common in the Pennines (Burt 1982, 53), so these features are of particular interest.

Figure 73 View of the series of buddles adjacent to Scordale Beck (75). The ranging poles show the position of the two clearest examples in this group.

The surviving remains of the series of buddles take the form of four levelled areas which step down in height from north to south. The most northerly feature is a roughly rectangular area defined by earthen scarps; within the southern of these is a stone face. This area is covered by a large patch of packed-down tailings, suggesting that this may be a buddle floor or settling pond. A short distance to the north, fragmentary timber remains were observed in the eroded face of the river bank, potentially indicating the position of a timber chute, possibly feeding material to this area. Faint earthwork scarps to the south of this rectangular area indicate the existence of a circular feature, although there is a lot of river-deposited material covering this area. In the eroded section on the western edge of the feature, there is a part of a curved stone feature with a cement lining, indicating that this was almost certainly the location of a circular buddle. To the south of the buddle is another rectilinear area defined by earthwork banks, with patches of stony material. This may potentially have been another dressing floor, but it is also possible that these rectilinear areas were actually bases for tubs or shaking tables. The most southerly feature is a grassed over circular mound with a large amount of stone deposited on it and with protruding, curving sections of stone walling with a cement lining (Figure 74). This is almost certainly another buddle, with a diameter of c6m. The western side of this feature has been partially lost due to river erosion. Further to the south, there is a lot of river-deposited material which would obscure any further features in this series. It appears that these features would have formed stages in the processing of the ore, passing material from a dressing floor or shaking table (the rectangular areas) into the buddles for further concentration of the ores.

In terms of the date of this series of features, it seems likely that they date to the middle of the 19th century, primarily as it is known that circular buddles were developed around

Figure 74 Photograph of one of the series of buddles (75) after excavation. The curved form of the feature can be seen, as can the cement lining, visible at the right-hand side of the photograph.

the 1830s (Burt 1982, 52). In addition, they are depicted on the First Edition 25-inch map (Ordnance Survey 1861). The symbol with which they are depicted is non-standard, but suggests a number of tanks within a rectilinear area, possibly an unroofed structure. The extent of the cartographic depiction indicates that further parts of this processing complex may have been lost to river erosion to the west. The buddles are not depicted on the subsequent map editions indicating that they were out of use by the end of the 19th century and thus demonstrating that they were part of the lead production process, rather than the barytes exploitation, which occurred later, around 1900. Excavation revealed traces of walling beneath the circular buddles indicating an earlier phase of activity in this area (Giecco 2008, 22). The nature of this earlier activity could not be confidently ascertained from the excavated evidence, as only a small part of the walling was uncovered. However, it is quite possible that there was an earlier phase of buddling occurring here, potentially representing the first half of the 19th century or earlier and perhaps incorporating trunk buddles and square pits.

Samples taken from the buddles during the course of the excavation were subjected to mineralogical analysis. Low levels of galena were found in the sample sediments, but not as high as would be expected if the sediments had been in situ. The likelihood is, therefore, that the sediments consist of re-deposited waste from the lead ore processing. Samples from underneath the buddles indicate that they were constructed on top of more lead processing waste (Paynter 2009, 11). There were no traces of barytes contained within the samples from the buddles, a contrast to the samples taken from trench 1, near crushing mill 29, which displayed high barytes content. It thus appears that the buddles were part of the lead processing operations in Scordale, but were not used

in barytes processing. This would explain the fact that the buddles are not visible on a late 19th-century photograph of the site, which shows their location apparently covered with rubble.

A further possible buddle (20) was identified close to the western edge of Scordale Beck, approximately 100m south-west of buddle complex 75. The field remains consist of a right-angled length of low stony bank with a slight hollow behind it, the western side of which is covered by river-deposited stone, thus masking the full extent of the feature, although it would appear to be no more than 5m by 8m. There do not appear to be any further features associated with this possible buddle, although given its precarious position so close to the beck, it is quite conceivable that nearby features might have been totally eroded.

The only other feature which could be interpreted as a buddle, or a feature similar in form, was recorded on the slopes below Dow Scar, to the north of Great Augill (6). This is discussed further below (*see* Section 5.2.2: 'Barytes Mining')

Perhaps some of the most fragile, ephemeral dressing floors in Scordale were identified on the valley floor, in an area now covered by a number of braided channels of the Scordale Beck, a short distance to the south of its confluence with Stow Gill. This area has been subject to waterlogging and is covered by river-deposited rubble and sediment. Amongst this debris, a small number of low, damaged earthworks survive which partially define three rectangular, level areas, stepped down the gradual slope of the valley bottom (83). The form of the earthworks would suggest that they are former dressing floors. Whilst the remains are slight, from a vantage point higher up the slopes when the water level of the beck is high, the water finds its way through channels which form distinctive right-angled patterns, indicative of man-made structures (*see* Figure 36). It is probable that they were supplied with water via a timber launder from the termination of a stone-capped leat (1) just over 100m to the north. On the edge of one of these the remains of a length of timber shuttering (0.9m long, 0.18m wide and 0.04m thick) appears to be in situ. On its north face are inscribed the numerals 'XIIII' (Figure 75). It is placed against a rectangular stone block set into the ground. Other, loose timbers lie in this area.

Figure 75 Detail of carving 'XIIII' on a timber found among the remains of dressing floor 83

Despite the fragile nature of the remains, it is very likely that these features actually date to the late 18th century. The dressing floors are not shown on the First Edition 6- and 25-inch mapping (Ordnance Survey 1861; 1863), but there are a series of three rectangular structures, possibly unroofed buildings or tanks, depicted in this location on the Second and Third Edition 6-inch maps (*see* Figure 36; Ordnance Survey 1899b; 1920). The maps also show a leat leading from the south-west corner of the southernmost structure/tank to mill 81, some 60m to the south-west. The inference from this is that these features

were contemporaneous and that they were part of the same process. These may be the only example of this type of industrial-scale sedimentation process in the valley.

One of the most obvious processing areas in Scordale, referred to as the principal processing area in this report, is on the west bank of Scordale Beck, opposite the confluence with Great Augill. There are extant structural remains of a number of processing buildings (such as mill 29) and a large amount of dressing waste, indicative of machine dressing, which stratigraphically is clearly part of the latest activity on the site. Much of the dressing in the final stages of mining in Scordale would have been undertaken within the mill buildings shown on the contemporary maps and photographs, but there are still some traces of evidence of other dressing areas. One example is the open, paved area (77) to the south of mill 29. The flooring and concrete slabs, which are likely to have been machine beds, suggest that dressing was being carried out here. It is difficult to ascertain if any specific areas of dressing waste are specifically related to this area, as there is such a huge quantity of waste in this area.

Waste Management

The large volume of extractive activity within Scordale has created a great deal of waste. Earlier periods of mining were often undertaken on a relatively small scale and would have exploited the most readily accessible mineral deposits exposed on the ground surface or a short distance below, consequently generating a relatively modest amount of spoil. This early waste is difficult to identify, as it is likely to have been spread over the ground surface and may subsequently be covered over by later deposits and mingled with dressing waste. In addition, spoil from early mining operations was often reworked in later periods, when more efficient techniques enabled small quantities of lead in rock discarded after the original processing to be salvaged and other minerals, such as barytes, had become profitable and could easily be retrieved from the earlier waste. Eight large, distinct spoil heaps were recorded in Scordale, most of which appear to have been formed by the deposition of 'deads' removed from the underground workings in the course of creating levels to access mineral veins. The majority of these large spoil heaps appear to date from the 19th century, associating them with the increasing commercialisation of the period, and the growing need to mine further underground to access profitable veins.

A significant amount of material has clearly been removed from the Mason Holes opencut, an area of Scordale which is known to have been exploited for a number of centuries. The topography of this part of the valley appears to have dictated that the spoil was discarded by allowing it to spread down the steep slopes below. As much of this waste is natural overburden it is difficult to differentiate specific phases of dumping. There are no distinct, deliberately formed spoil heaps within Mason Holes, but there is a vast quantity of waste, some overburden cleared from the vertical rock-face and some material moved by the large hushes, distributed across the area. This is likely to be a reflection of the mining techniques employed here, predominantly open face and opencut, coupled with the topography. In places, there are instances of drystone walls having been constructed (498, 499 and 513) apparently to revet areas of spoil and prevent them slipping onto paths or structures, which suggests that the spreads of spoil and deads were being actively managed.

There is a spoil heap (628) in the vicinity of Lowfield Hush which has the form of a finger dump. It seems that this spoil heap may be overlying a field wall, which has subsequently be reinstated on top of the spoil heap (Figure 76). There is no obvious evidence of a level at the end of the spoil heap, as would be expected with a finger dump of this form, but it is possible that natural slippage has obscured the level entrance. The date of the feature is unclear, and the date of the drystone wall is unknown, but evidence suggests that mining activity in this area was being undertaken in the early 19th century and before.

Large spoil heaps were recorded associated with levels 202 and 200 (203 and 156/157), both of which are likely to have been exploited in the 1820s, as evidenced by the 1824 plan (NEIMME 1824). These too take the form of a finger dump, demonstrating that waste was being removed from the level by barrow and deposited down the hillside, eventually forming a large, splayed, linear mound. Spoil heap 203 mainly consists of grey shaley material and medium-sized natural stone, suggesting that this was natural rock removed from the level. It is depicted on the First Edition 25-inch map in a similar form to its present shape (Ordnance Survey 1861). Spoil heap 156 consists of grey shaley material, medium deads, a few orange tailings, natural stone and one visible piece of timber. A further deposit of waste material (157) close to the base of spoil heap 156 contains pale material, mainly fine white chippings, with a few palm-sized chunks of rock. This is most likely to be dressing waste and appears to have been created in the extraction of barytes, indicating that this is later re-working of the spoil from 156 and is one of the best examples of this practice found in Scordale.

Figure 76 Spoil heap 628 surmounted by a reinstated field wall

One of the most prominent spoil heaps in Scordale is the large split spoil heap (537) associated with level 540. The spoil heap is discussed above (in the 'Levels' and 'Tramways and Barrow-runs' sections), with the conclusion that the level may have been operating in 1824 as 'Pasture Gate Level' (NEIMME 1824). The spoil heap is depicted on the First Edition 25-inch map, but smaller than the present footprint of the feature and a single feature, suggesting that the spoil heap was added to subsequent to the map being surveyed (Ordnance Survey 1861). The spoil heap is not shown on later 6-inch map editions, potentially indicating that the level had ceased productivity by the end of the 19th century (Ordnance Survey 1899b; 1920). As the spoil heap grew, it appears to have begun to spill on to the footpath (339), creating the need to split the spoil heap with material on either side of the path; the south-east section appears to have been revetted with a section of stone walling (538) which still survives, albeit in a dilapidated state (Figure 59). The flat-topped form of the heap suggests that a tramway once ran along it, allowing the tipping of material at the end of it. If this was the case then it would have needed to be supported over the gap between the two parts of the heap, for which the section of walling may also have been used.

Much of the 'platform' upon which crushing mill 29 is built upon consists of waste material, from the earlier lead processing in this area. In particular, the eastern extension of the mill, which can be dated to the period between 1860 and 1899 from map evidence, can be demonstrated to be built on top of a significant quantity of processing waste. Mineralogical analysis of samples taken from the excavation trench in this area demonstrates that the timber conduits were cut into accumulations of earlier waste material, containing minerals consistent with lead ore processing (Paynter 2009, 16). It would thus appear that from the mid-19th century, when mill 29 was in full use for lead ore processing, until its extension later in that century, waste was deposited from the mill building on to land to the east, potentially impacting on the flow of the beck in this area and ultimately enabling the construction of a suitably solid platform out of the material to allow an extension of the mill building to be constructed on it.

It is possible to firmly date spoil heap 41, which lies across Scordale Beck, approximately 50m north of Great Augill (Figure 63). There is no spoil heap depicted in this location on the First Edition 25-inch map, but on the Second Edition 6-inch map, there is clearly a feature overlying the beck, although its form is not shown on the map (Ordnance Survey 1861; 1899b). The spoil heap was thus created between 1860 and the late 1890s. It is made up of fine or small waste material and dark earth with a few medium deads, which may have come from the main processing area and nearby level 61. The beck is carried under the spoil heap in a stone-lined tunnel (35); the tunnel collapsed in 2000, but has been reinstated, and a large slump occurred in the rear of the spoil heap at a similar time.

Bank 39, which has been identified as a tramway track-bed, consists of packed stone, mainly medium-sized deads and some dressing waste, suggesting that it originated as a spoil heap. The First Edition 25-inch map shows that this was a tramway (Ordnance Survey 1861), allowing material from level 61, to be taken to the beck edge and deposited into the watercourse. It also depicts the spoil heap that the tramway was constructed on. Different coloured material and fine chippings spilling down the beck side at the end of bank 39 and exposed by erosion demonstrate different phases of deposition.

The spoil on the slopes opposite Great Augill around the principal processing area are covered with a huge quantity of waste material. There are likely to be many layers of spoil dumping, making it difficult to establish a chronology from surface remains alone. It is noteworthy that much of the top layer of spoil spread across the area around mill 29 and chute 47 is white in colour, suggesting that it is a by-product of barytes processing, rather than lead-mining waste. This is consistent with the continued use of structures in this area for mineral processing up to the early twentieth century, when barytes was the primary product. It is likely that earlier waste relating to lead mining in this area may have been re-worked for barytes, as its proximity to the processing machinery would have provided a relatively easily accessible source. The colour of the waste material is more distinctively pale or white in the vicinity of the end of chute 47, above mill 29, and above the northern end of wall 44, suggesting that there may have been re-working of waste for barytes in these areas.

Smelting

Within the valley of Scordale itself, no clear evidence of smelting was observed. Early smelting may have taken the form of a 'bole', or depression in the top of a mound or hill generating an updraft, for the purpose of small-scale smelting, but nothing that could be confidently identified as such was recorded. Documentary records indicate that from at least the late 17th century ore was being removed from the valley to be smelted at a mill in Hilton village, a practice that continued up until the early twentieth century. The field evidence suggests that the earlier mining was occurring in the lower reaches of the valley, so it may be that it was indeed more convenient to transport the ore back to the village, rather than smelting it on site. The remains of a smelt mill, although possibly not the original mill, still survive close to the village of Hilton, at the south-western end of Scordale.

Although located outside the survey area, and thus not surveyed in detail as part of this study, the smelt mill at Hilton was an integral part of the process of producing lead and barytes in Scordale. There are still a number of earthwork remains relating to the smelt mill, including the flue, part of the chimney base and a leat supplying water to the mill (Figure 77). The earliest document relating to the site, which dates to 1698 (*see above*), records that the parties extracting lead from the Hilton and Murton mines 'shall have one of the mills at Hilton for a smelting mill'. Although there appears to have been a smelting mill in Hilton from the late 17th century, it is not certain that this was in the same location as the mill on the 19th-century maps, but it is possible. A smelt mill is depicted on the 1824 map, comprising of a principal building with adjacent structures and a flue leading to the chimney. The smelt mill is shown in some detail on the First Edition 25-inch map (Ordnance Survey 1861; Figure 78), comprising of a principal building with what appear to be attached open bays, a second, smaller building, a chimney and a mill race. The depiction is essentially the same on the Second Edition 25-inch map (Ordnance Survey 1899a), with the exception of the contraction of the number of embayments to the south from four to three and the disappearance of a track to the south-east of the mill, but most significantly, the mill is described as 'Disused' at this date. This ties in with the fact that the London Lead Company stopped working the mines in Scordale in 1876 and barytes production didn't commence until 1896, potentially leading to the mothballing of the smelt mill.

Figure 77 The flue of Hilton smelt mill, now surviving as a linear earthwork depression, where the original feature has collapsed and, in places, been dug out

Although the mill is still depicted as 'Smelt Mill (Disused)' on the Third Edition 25-inch map (Ordnance Survey 1915), there appear to have been a number of major changes, with an altered layout of the buildings and a re-routing of a substantial part of the mill-race, to follow a contour further up the natural slope. The flue leading to the smelt mill chimney has been almost entirely dug out by this date, as the map shows the route of the flue initially as a stone-lined channel, becoming an earthwork depression. Towards

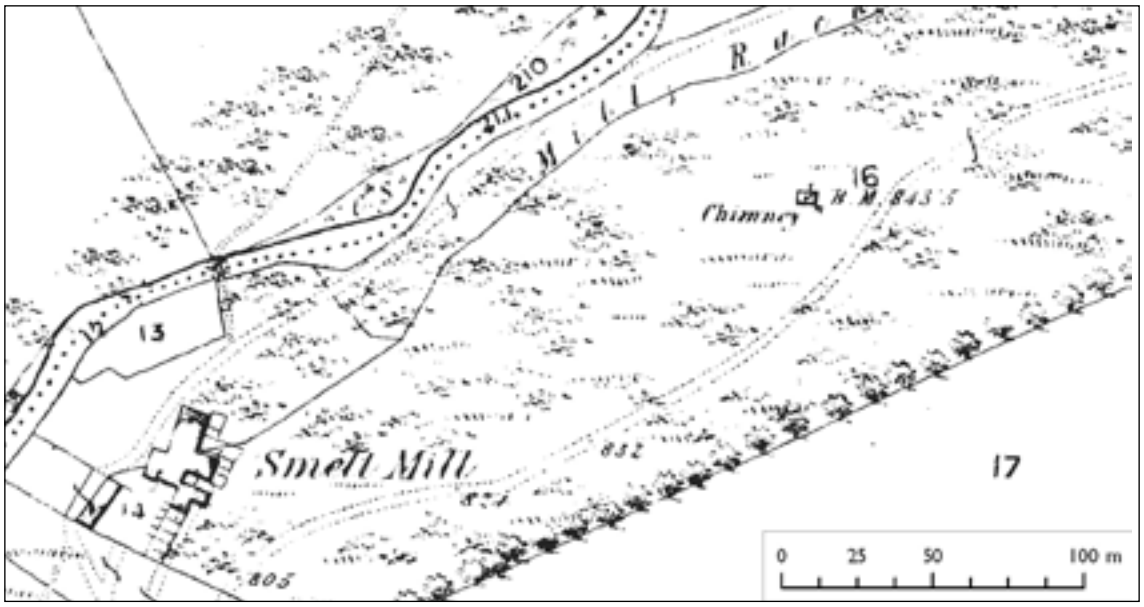

Figure 78 Hilton smelt mill, as depicted on the OS First Edition 25-inch map
Reproduced from the 1861 Ordnance Survey map

its south-western end, the earthwork channel is cut through by the re-routed mill race, clearly indicating that it was no longer functional; it is at this point that there is a sluice in the mill race and an overflow channel flowing to the north-west, back into Hilton Beck. Beyond the sluice, the mill race flows in a channel to the south-west before turning sharply at the top of the slope to feed into the top of the mill; early photographs of the smelt mill show the elevated launder and feeder-pipe taking water into the mill on a series of trestles (Figure 79). An outflow from the mill is also shown on the map, emanating from under the main track (mine road 32) and feeding back into Hilton Beck, possibly also in a pipe. The explanation for this radical change to the water-management system is that it was needed to power turbines installed in the mill. The higher course of the mill race, for example, would have given a more substantial drop to allow greater water pressure to power the turbines. The *Memoirs of the Geological Survey*, in describing the 'grinding-mill at Hilton', records that 'power for the plant is supplied by a 40 h.p. water-turbine, assisted when necessary by a gas engine' (Wilson *et al* 1922, 47). Further evidence that the mill at Hilton was still operating in the early 20th century can be found in this passage, which refers to April 1921, with a detailed description of the workings of the mill and a description of the barytes extracted from the Hilton Mines (at this date, only from Dow Scar and South Levels, to the north of Great Augill) being 'carted 2½ miles to the grinding-mill at Hilton' (Wilson *et al* 1922, 47). This also demonstrates that the mill was functioning at the time, but had been converted from a smelting mill for lead to a grinding mill for barytes, and was not disused. The retention of the description of the structure as 'Smelt mill (Disused)' on the 1899 and 1915 Ordnance Survey map may have been a reference to the fact that it was no longer being used for smelting, despite the fact that it was almost certainly being used for grinding. By September 1945, the 'plant at Hilton' was described as having been dismantled (Dunham and Dines 1945, 42).

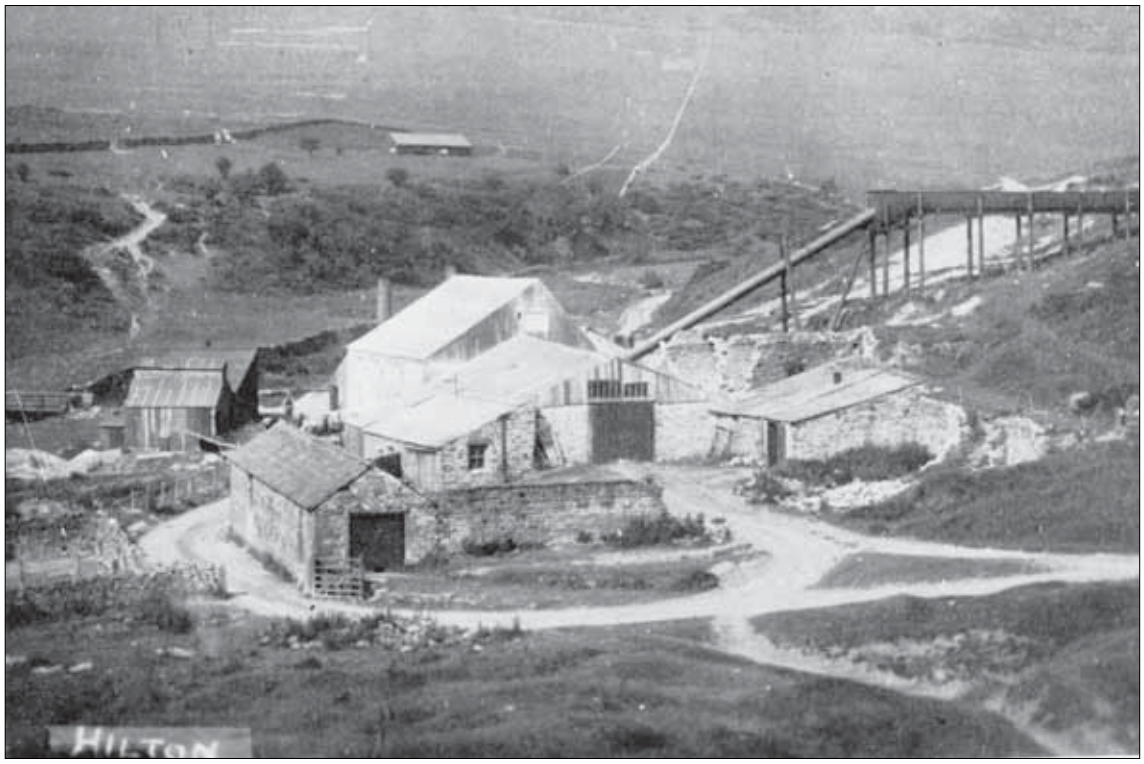

Figure 79 Photograph of Hilton smelt mill, date unknown, but possibly early twentieth century
Reproduced by kind permission of Beamish Museum Ltd Photographic Archive. Ref.: 16313

Two black and white photographs exist in a collection at Beamish Museum which show the extent of the smelt mill in its final stages and after abandonment. The earlier of the photographs, Figure 79, is likely to date to the early 20th century, possibly around 1920. The mill buildings are shown relatively intact with doors and windows in place and the elevated launder and feeder-pipe still in place. The later photograph (Figure 80), possibly dating from the 1930s, shows the structures still largely standing, although some walls have begun to fall down and some windows and doors are missing. The elevated launder and feeder-pipe are still standing *in situ* and the chimney can be seen in the distance, still standing to almost full height, possibly with a little damage to its upper part. The mill was almost certainly not in use when this later photograph was taken.

Ancillary Buildings

Lead mines would have required a number of ancillary buildings to support the mining operations. Approximately 26 structures were recorded in Scordale, including processing buildings, but many of these do not survive in good condition and some are very small, informal buildings. The use of iron tools, tramways and horses on site would have meant that a smithy was an essential requirement, particularly in later centuries. The mine companies would also have required offices or administration buildings from which to oversee the operations. The miners themselves would have needed a mine shop in which to shelter and to store there tools, and also to provide accommodation, as it was not uncommon for miners to live on site, particularly if they had been employed from some distance away or overseas. In general the larger, more formal buildings can be associated with the larger, more commercialised undertakings of the 19th century, whilst the smaller, fragmentary buildings are quite likely to be remnants of the earlier, more piecemeal, small-scale approach.

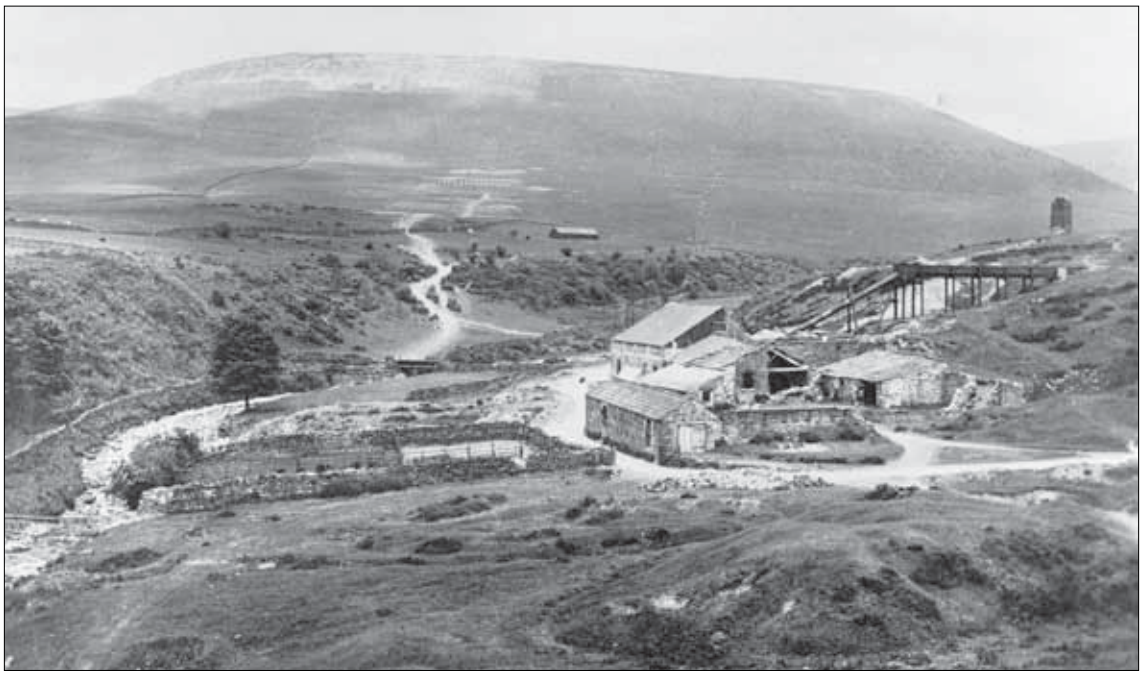

Figure 80 Photograph of Hilton smelt mill, possibly dating from the 1930s, showing the mill in a more dilapidated state than the earlier photograph (Figure 79).
Reproduced by kind permission of Beamish Museum Ltd Photographic Archive. Ref.: 15422

Smithies

The 1824 plan of the site depicts a structure, which is labelled as 'Smith's Shop', a short distance to the south-east of the 'Lodging House', identified as the surviving High Shop (338), and just above a series of 'Teams'. The field evidence indicates that the Smith's Shop is most likely to be structure 363 (Figure 81), as this is positioned correctly in relation to High Shop and the nearby ore bins (354-356 and 359-361). The surviving remains indicate that it was a rectangular single-celled building with a small square annexe on the south-west side. There are no discernible internal or external features. A well-constructed, sloping buttress supports the south-east side of the structure, presumably to prevent it toppling down the slope on to the ore bins below. The structure is also shown on the OS mapping of the site, appearing on both the First Edition 25-inch and Second Edition 6-inch maps (Ordnance Survey 1861; 1899b), but apparently not shown on the Third Edition 6-inch map (Ordnance Survey 1920), suggesting that had possibly been dismantled by this date. On none of these maps is the structure labelled or assigned a specific function. General chronological evidence from maps and documents would suggest that this area was not being extensively worked after the mid-19th century, suggesting that this building originated in the early 19th century, or before.

Field evidence suggests that there may have been another smithy, located close to crushing mill 29. To the south of the mill, and on the slopes above, and to the west of, the partial remains of structure 78 (*see* Figure 66) is a large quantity of slag. Traces of revetment walling can be seen in amongst the slag waste, acting as a retaining wall to stop the waste tumbling down the slope. Although no smithy or forge has been specifically identified here on the cartography, it is possible that the southern end of the

Figure 81 Remains of structure 363, possibly the early smithy close to High Shop. The collapsed supporting buttress can be seen at the right-hand side of the photograph.

enlarged mill building, dating to the end of the 19th century, may have been used for these purposes, with the waste deposited a short distance from the building.

The sales particulars of 1895 include a 'Smithy' in the inventory of buildings to be sold with the site. It is not possible to positively identify this structure with any of the surviving remains, as it is not specific about its location.

Workshop/Store

A small, rectilinear structure with curved corners (327; Figure 82) survives on the floor of Lowfield Hush, approximately 50m to the west of the level 632. It measures approximately 4.5m by 2m with an entrance to the east and is substantially built, incorporating a large number of boulders in the walls. The walls stand to *c*1.8m high and there is a small cupboard/recess built into the north-west corner. The quality of build is a clear indication that it is not a modern military shelter. The function of the building seems most likely to be connected with mining activity, possibly acting as a tool store or miner's shelter, similar to a 'coe', potentially related to level 632. In terms of dating the structure, it clearly post-dates the principal clearing of Lowfield Hush, but could be associated with phases of working exposed veins subsequent to the active hushing, therefore a date in the first half of the 19th century, if not earlier, is entirely plausible.

Fragmentary remains of a structure (163) on the plateau created by opencut 872 consisting of an L-shaped section of walling, appear to represent part of a structure associated with the mining activity. It is loosely-built of rough stone but with some parts fairly well-built, suggesting that it is not military. The walls stand to *c*1.5m high, although there is not a large amount of tumble surrounding the structure, suggesting that they were not originally much higher. There are lots of large boulders, some very large,

Figure 82 Structure (327) within Lowfield Hush. This is likely to have served as a shelter or a tool store.

around the structure, but this is natural tumble. It is possible that this functioned as a shelter or store, but it is difficult to be certain given the limited evidence.

A building (48) was recorded adjacent to level 49 at the end of tramway 54 (Figure 83). It is a stone-built structure, with evidence of mortar in parts of the walls, but the upper part of it has collapsed leaving the walls standing to a maximum of *c*1m high in places. It measures *c*5m across by *c*8m long, roughly on an east-west orientation and shows evidence of a central dividing wall. Surviving fragments of stone slates with nail-holes in the debris surrounding the building, indicate the roofing material used. Within the eastern end of the building, there is an arrangement of stone creating a 'floor' with a slightly curved appearance & 'herring-bone' in style. This may be collapse of the gable end of the building, but it is also possible that it was deliberately created in this form to house a piece of machinery, potentially indicating that some processing occurred here. This concave feature is only visible in the eastern end of the building. It seems likely that the structure was used in association with the adjacent level, perhaps operating as a store or workshop. There is no evidence of slag or burnt waste in the vicinity, so it is unlikely that it was utilised as a smithy. It is also possible that this may have been an office, but there is insufficient evidence to confirm this interpretation. A photograph from the end of the 19th century shows part of this building at the edge of the frame apparently with a chimney at its eastern end, although the image is not particularly clear (Figure 34, top left-hand corner of the photograph). Given that the building is still surviving in the 19th century photograph, it would have been included in the sale of the site in 1895. However, it is not possible to confidently identify this structure with one of the specific buildings listed in the sales particulars (CRO(K) 1895).

Figure 83 Remains of structure 48. The wall lines are just discernible amongst the rubble tumble and part of the herring-bone, curved arrangement of stones can be seen at the left-hand end of the building.

Offices

Only one surviving structure within the survey area can confidently be ascribed to the administration of the mining activities in the valley. This is a ruined building (3), located close to the principal processing area, which probably served as the mine office. The building measures approximately 7m by 3.5m and the walls now survive to only 0.5m high. There was a small porch on the south-west side of the building and a small, crudely-built annexe adjoining the south-east side of the building. The latter appears to have been open ended on the south-west side, indicating that it may have been used for storage. The building is accessed from the main mine road (32) by path 25, although the northerly part of this path has been lost due to erosion at the western end of Great Augill. A short section of leat (4) to the north-east of the building indicates that the building may have been supplied with water, possibly taken from Great Augill. The sales particulars for the Scordale Lead Mines, dating to 1895, include an 'Office' in the list of buildings included in the sale. In conjunction with the depiction of a structure in this location on the Second Edition 6-inch map (Ordnance Survey 1899b), this evidence suggests that the mine office in this location dates to the latter part of the 19th century. The existence or position of an earlier office, assuming one existed, was not firmly identified during the course of this survey.

Explosives Store

There is only one building still surviving in Scordale which can be confidently interpreted as an explosives store. It is a small, roughly square structure (571) situated to the north of Stow Gill (Figure 84). Much of the structure is collapsed, but what remains of the walls indicate that it was constructed of roughly-dressed stone as a double-face wall with narrow rubble infill, with evidence of mortar bonding in places; the extant walls under the rubble are *c*0.4m thick and stand to *c*0.4m high. There are stone roof-tiles with nail-holes amongst the building rubble, one of which has an *in situ* copper nail. There is a central entrance to the west. Some timbers lie on the surface of the rubble and some are embedded in the walls. The structure is located on a stone-revetted terrace which has been cut into the hillslope at the east and built up at the west to form a platform. Approximately 5m to the north-east is a small rectangular cut into the slope, which is accessed from the platform; this may be the site of a small shelter. The relatively isolated location of this structure and the use of copper nails in its construction are a strong indication that this was a powder store. The sales particulars of 1895 list an 'Explosives Magazine' in the schedule of buildings included in the auction of the mines and it is possible that structure 571 is the magazine referred to in this document (CRO (K) 1985). It is also depicted on the Second and Third Edition 6-inch maps (Ordnance Survey 1899b; 1920). The construction of the structure would be consistent with the 'The Explosives Act 1875' which set out the regulations regarding the storing of gunpowder on industrial sites. Its position adjacent to path 570, which gave access to the workings on Amber Hill to the south, would suggest that powder stored there was being used in the workings to the south. The structure retained its roof until the 1950s (RAF 1953 and RAF 1957).

Figure 84 The remains of structure 571, probably an explosives store

Shelters

Potentially dating to the earlier phases of mining in the valley, small, crude structures were recorded which may have functioned as a shelter for miners. One example of such was 631, a small structure abutting the field wall close to Lowfield Hush, which survives as two fragmentary walls, which only stand to about 4 or 5 courses high, *c*0.7m. It is possible that this is a small shelter, although there are no discernible internal features, but the surviving parts are reasonably well built.

Just over 50m to the north of this, close to the mining complex of level 625 and mill 626, is another structure (624; Figure 85). It is roughly-built using some dressed and some rough stone and is keyed in to a field wall. The structure consists of two chambers, the more southerly of which has an open front, and has been tentatively identified as an ore store (see *above* 'Ore Storage' section). The more northerly chamber projects a further 1.75m beyond the other and is also built into the field wall. The chamber is approximately 1.9m by 3m. A recess capped with a stone lintel has been built into the field wall at the rear of it. This is a fireplace, as a flue can be traced in the stone wall above. The walls of this chamber survive to around 1m high and are built of rough stone. Given the existence of the fireplace, this structure appears to have been used as accommodation or for administration of the mining complex in this area. This would potentially date it to the early 19th century, and quite likely earlier.

Just to the north of Jacques Level, a wall standing to 0.3m high was recorded in a small gully (244). It is constructed with crudely-laid stones and has a level platform above it, roughly measuring 4m by 3m. It is possible that this wall acted as a downslope revetment to a shelter or structure, possibly constructed of timber and presumably associated with the mining nearby.

Figure 85 Remains of a shelter (624), built into the pre-existing field wall. The aperture with a lintel, at the right-hand side of the photograph, is the fireplace.

Miners

Navigating the Landscape

Throughout Scordale there are numerous remains of roads, paths and tracks which allow access to many areas of the valley, some of which are still in use today. In total, sixty-seven features were recorded in this category, ranging from small, informal footpaths to properly metalled roads. Many of these clearly relate to the mining activity in the valley, linking levels to dressing floors and processing areas, and creating a central part of the infrastructure. Some of the transport routes, such as the principal mine road (32), have already been discussed above in relation to transporting ore around site and off-site (*see above*, 'Transport' section). However, there are other paths and routeways which provided access routes to the mines and onto and off site for the miners themselves.

Of the routes through the valley, there are two principal footpath routes, sections of which still survive as earthworks. On the eastern side of the valley, to the north and east of Dow Scar, three sections of path were recorded, which are likely to have originally formed a single feature giving access to the mines known as 'Hilton Lead Mines' on this side of the valley. The more northerly section of the path (162) runs between Great Augill and Scordale Beck; its northern extent ends at the edge of Scordale Beck, but no continuation of the feature was observed on the opposite side of the beck. Although this section generally appears as little more than a sheep-track, the fact that there are sections of revetment where it crosses hush channels or water channels demonstrates its deliberate construction. A branch of this track (848) was recorded crossing hush channel 179, on top of dam (184), and leading up to Great Augill. Although only *c*1m wide, it

is definitely a deliberately created path, as it is cleared through scree in places and has occasional revetment on the downslope side. The path appears to cut through dam 188 and dressing floor 190, indicating that it is later than these features. To the south of Great Augill, the route of the path appears to be continued by feature 250, which extends for some 350m towards the head of Stow Gill. The feature was not traced beyond this, making it difficult to ascertain the origin of this path. This path does not appear on any of the Ordnance Survey map editions, suggesting that it may have had a pre-1860 date. It clearly post-dates opencut working 872 and, if 848 is indeed a contemporary branch of the path, it also post-dates hush channel 179 and the adjacent dressing floors (190 and 186). A relatively early date had been postulated for these features, so it is still possible that the path may have originated in the late 18th or early 19th centuries.

The other principal footpath which was recorded within the survey area is 339, on the north-western side of the valley, approaching High Shop from the south-west. Mapped evidence shows that this path originally ran between Murton village, to the south of Blue Hill, across Mell Fell, past High Shop, to the principal processing area, around crushing mill 29 (Ordnance Survey 1861). The importance of this route is reflected in the fact that it was depicted as a path through to the Third Edition 6-inch map of 1920 and, in part, is still retained as a public footpath today (Ordnance Survey 1861, 1899b, 1920). This route would have given access from the village of Murton to the 'Murton Lead Mines'. The field remains suggest that the path originally turned sharply after High Shop, taking a south-westwards route to the north-eastern end of Mason Holes. The end of this feature appears to have been truncated by the workings at this end of Mason Holes, suggesting that this section of the route has an early date, and may originally have given access to the workings in this area before the focus moved north-east up the valley in the early 19th century. The fact that the path respects High Shop before making the turn towards the end of Mason Holes is further evidence that elements of the workings in Mason Holes and High Shop were in contemporary usage.

Cartographic evidence also shows that from at least 1860 there was another footpath from Murton village, to the south of the path described above, which led to a fording point on Scordale Beck, to the south-west of Lowfield Hush (Ordnance Survey 1861; 1899b; 1920). This ford was a focal point for a number of routeways, creating a junction between paths along Swindale Edge and along Scordale, in both directions. A hollow way terraced into the slope (767) represents a stretch of this path at its eastern end. Although not leading directly to Lowfield Hush, this path would have given access to this area from Murton village. This general route corridor has been used for movement through the landscape for many centuries and the origins of this particular path may date back a number of centuries, however, in relation to the mining activity in the valley, it is likely that it was utilised to give access to Lowfield Hush, an area which was potentially mined in the 18th century.

On the north-west side of Scordale Beck there is field evidence for a routeway, not shown on any maps. Earthwork remains of a path (770/332) were recorded, which appear to represent an early access route to Mason Holes. Path 332 seems to be approaching shepherd's cottage 333, but there is a continuation of the path (770) beyond the building, leading towards the south-western end of Mason Holes. The apparent

construction of the structure over the course of the path indicates the chronological relationship, which places the structure later than the path. A stretch of path (535) survives in the south-western part of Mason Holes, cutting across hushes 533 and 532; this appears to be on the same alignment as path 770 and may be a continuation of it. Structure 333 dates to some time before the 1860s, as it is not shown on the Ordnance Survey map editions, which indicates that the path potentially has at least an early 19th-century date, which corresponds with the documentary references to early workings in the Mason Holes area.

Across Mason Holes, fragments of paths were recorded (such as 497, 511, 521, 523, 535). The quantity of activity in the area has left little undisturbed ground surface and as a result it is difficult to trace complete paths and to establish firm chronologies. Some paths clearly post-date the hushing, such as 497, which is cut into the edge of the hush. Other paths appear to have been created *ad hoc* to provide access to areas of open face mining (such as 511, accessing 512). It is clear that many original pathways from the early stages of mining in Mason Holes will have been lost as subsequent campaigns of mining have worked away rock faces and ground surfaces.

Throughout the valley examples of paths linking working areas were recorded (for example 52,112, 293 and 680), as well as paths giving access to reservoirs (such as 137, 138, 341, 349 and 663) presumably to allow miners to reach them to undertake maintenance and to manage the water flow through sluices or breaches in the dam. In places, particularly along paths 138 and 349, the paths also had the appearance of a leat, suggesting that they may have performed a dual function. However, it may be that natural watercourses have merely found the easiest route and consequently started to flow along the paths. Path 341, which appears to be linking High Shop and reservoir 300, appears to be overlain by the series of trial shafts 309-311, providing evidence that the shop and the reservoir, and levels 782-4, were in operation contemporaneously and before the trial shafts (309-311) were.

Figure 86 Extract from the GIS showing paths and other features in the vicinity of Amber Hill

On the eastern side of the valley, to the north of Amber Hill, sections of paths were recorded, indicating how this area was accessed (Figure 86). One of the earlier paths leading to the Amber Hill area is 570, which originates at the mine road, some 40m south of mill 27, then cuts across a geological fan of material in Stow Gill, passing powder store 571 before traversing the steep natural slope

towards path 667 and the working areas on Amber Hill. Slumping at the point of contact with miner's path 667 confuses the precise relationship between the two, but 667 appears to be the later of the two. Path 89 would also have given access to the workings here, and is also potentially an early access route. The path, which survives as a linear hollow ending in a butt-end at the north-west, is cut by the upper part of 88, a later modification of the original level, and by chute 90. These latter features can be dated to the early twentieth-century revival of workings in this area, as evidenced by the Third Edition 6-inch map (Ordnance Survey 1920). Also on Amber Hill, path 667, which is a 1m wide, terraced path running for *c*140m along the contour on the steep west-facing valley slope, was also an important access route. At the west it is truncated by deep open mining but at the north has a genuine terminal where it meets the chute (90). Although truncated by the mining at the west, it seems that it would have linked with path 680 which connects a number of contour-following drifts higher up the slope and facilitated movement of mined minerals to the chute (90). As such, the date of this activity may be the same as for the date of the chute, i.e. between 1899 and 1920 based on cartographic evidence (Ordnance Survey 1920). However, it may be an original path which was adapted into a tramway at the later date.

As has been demonstrated, there was a network of paths through Scordale, enabling the miners across the centuries to travel through the landscape and access the workings as they developed. Many routeways have been lost as they have fallen out of use, but subsequent mining activity has also removed some of the paths, or sections of them, from the archaeological record. It is clear that aside from the main arterial mine road (32), most of the other tracks and paths linking the elements of the lead-mining landscape were informal footpaths, often little more than worn tracks, created on an *ad hoc* basis, as mining activity moved to the next productive area.

Living and Working

Due to the remote nature of many mines, it was often necessary to provide accommodation for the miners on, or close to, the site that they were working on. This was particularly important, as there is evidence that miners, particularly those with specific skills, were often brought in from other parts of the country, and sometimes from abroad; an article in the Cumberland and Westmorland Herald refers to 200 German miners being employed in Scordale (CWH 1974). These buildings were commonly known as lodging shops or mine shops and, in addition to accommodation, would also have provided a dry place for storing tools and equipment, sometimes incorporating stables and blacksmith's shops as well. Conditions within mine shops were often cramped and unsanitary; an 1842 report on the employment of children and young people in lead mines describes a lodging shop to the south of Stanhope, a two-storey building, approximately 18 feet by 15 feet (*c*4.5m by 5.5m), the upper room of which contained 14 beds to sleep a minimum of 28 men. The author described the smell in the sleeping quarters as 'most noxious' (Mitchell 1842, 22-23). Lodging shops were often well built and consequently survive reasonably well. Examples of well preserved mine shops which have been restored and reconstructed can be seen at Nenthead, Cumbria and Killhope, Co Durham. At Scordale, whilst many of the miners would have resided in the villages of Hilton and Murton, others would have needed on-site accommodation and three lodging structures can still potentially be identified. These include High Shop (338),

a structure (151) on the eastern side of the valley to the north of Great Augill and the remains of a structure (40) close to crushing mill 29.

Potentially the earliest of the mine shops constructed in Scordale lies on the eastern side of the valley, to the north of Great Augill within opencut 872. Early maps depict an 'Old Shop' (NEIMME 1824) in between Jacques Level and Great Augill and although it is difficult to be sure of the precise location of Old Shop on the ground, given the difficulties in rectifying the plan and its inaccuracies, structure 151 is roughly in the right position and is a strong, and possibly the only, candidate for this feature. The structure itself appears to have originally been a large, single-celled building with an entrance to the west, with an annexe subsequently added to the northern end, which comprised of 2 compartments/rooms (Figure 87). There are no discernible interior features surviving. In places the walls of the original build survive to 1.5m high, and the annexe to c1m high. The amount of rubble surrounding the building suggests that the walls were not much higher than they appear now, implying that the building was only single-storey. The slopes behind the building, to the east, are covered in scree, at the foot of which is a roughly-constructed wall which turns through approximately 90° and runs back to the south-east corner of the building. This encloses an area to the rear of the building, possibly a paddock, as well as protecting the building from boulder slippage. The building appears to have been accessed via a path (162) running to the west of it. Whilst there is no direct evidence that this was a lodging house, it is a strong possibility, particularly given the attached paddock which would suggest extended occupation of the structure. Given the location and the potential cartographic evidence, it seems likely that this lodging shop or cottage was associated with the lead-mining activity at least as early as the 1820s, and probably earlier, given that it seems to have been referred to as 'Old Shop' in 1824. It is unlikely that this structure correlates to any of those listed on the 1895 sales particulars, as the fact that there are two phases of construction evident mean that it cannot be the 'incomplete' stone cottage listed in the sales particulars, as it was clearly sufficiently complete to enable an annexe to be added.

One of the most extensive structures within the survey area, and one of the best surviving, is High Shop (338; Figure 88). This building is located high up the valley side on a natural plateau, a short distance from the north-eastern end of Mason Holes. The function of this building was as a mine shop, providing accommodation and shelter for the miners, and it appears to have served as such for a considerable period. In terms of dates for High Shop, it is very likely that there was a structure in this location by the 1820s. There is a 'Lodging House' depicted on the 1824 plan of the site and, although it has not been possible to accurately rectify this plan, given the relative positions of various features which have been identified on the ground, it seems that this corresponds with the 'High Shop' shown on later maps. The structure is depicted on all editions of the OS mapping for Scordale and this definitely corresponds with the surviving structure on the ground. However, it is only on the First Edition 25- and 6-inch maps (Ordnance Survey 1861; 1863), which were surveyed between 1856 and 1860, that the building is labelled as 'High Shop'. The suggestion is that by the time subsequent editions of the map were published, then the building had gone out of use as a mine shop. This would tie in with the fluctuating fortunes of the lead industry, which saw the London Lead Company withdraw from Scordale in 1876 followed by infrequent and, in some cases, unsuccessful

Figure 87 The remains of possibly the earliest mine shop in Scordale (151). The attached annexe can be seen at the right of the structure and the rubble walls of the enclosure at the rear of the building are just visible in the centre foreground and left centre.

Figure 88 View of High Shop (338) from the north

workings by smaller concerns over the next 20 years. The switch to barytes production around the turn of the century would have required a smaller labour force and appears to have been focussed on areas closer to Scordale Beck, thus such an extensive lodging house in this location would have been superfluous during this period.

Overall, High Shop measures just under 30m long by about 4.5m wide and comprises of five principal adjoining rooms with a porch on the south-eastern side and an annexe at the south-western end (Figure 89). Although the rooms are all adjoining, the evidence in the construction of the building suggests that it was extended at least twice. In places the walls still stand to *c*2m high, but other parts of the building only survive to less than 0.5m or as piles of rubble. The walls are of drystone construction with a rubble core; evidence of mortar adhering to the walls is scant, but can be found on the rear (north-western) wall and around one of the door jambs. Given the exposure to the elements in this location and the state of collapse, it is perhaps unsurprising that so little of the mortar survives. There are numerous thin stone slabs with nail-holes lying around the structure, which indicate that it would have had a stone slate roof.

The core of the building, and the earliest phase, is the main compartment (A), which consists of a rectangular chamber of *c*4.5m by 4m. This appears to be one single build, with all the walls keyed into one another. with a doorway in the south-eastern wall. Compartment B, adjoining the south-western end of A, is likely to have been added on after A had been built, as the walls of B connect to A with straight joins. B is a larger room, approximately 6.5m long, and a small annexe (D) has been built on to its south-western side; this is a more crudely built structure and displays no evidence of internal features. The main doorway into B is in its south-eastern wall and the doorway is protected by a porch, the walls of which survive to *c*1m. The porch was accessed via an entrance to the south-west. To the north-east of A is another large compartment (C), which measures approximately 8m in length. It adjoins A with straight joins, suggesting too that this was a subsequent addition, rather than a part of the original build. To the north-east end of C is an annexe (E), which only survives to around half its original extent, as the north-eastern wall has totally collapsed. This also adjoins C with straight joins, suggesting that it was of a separate building episode.

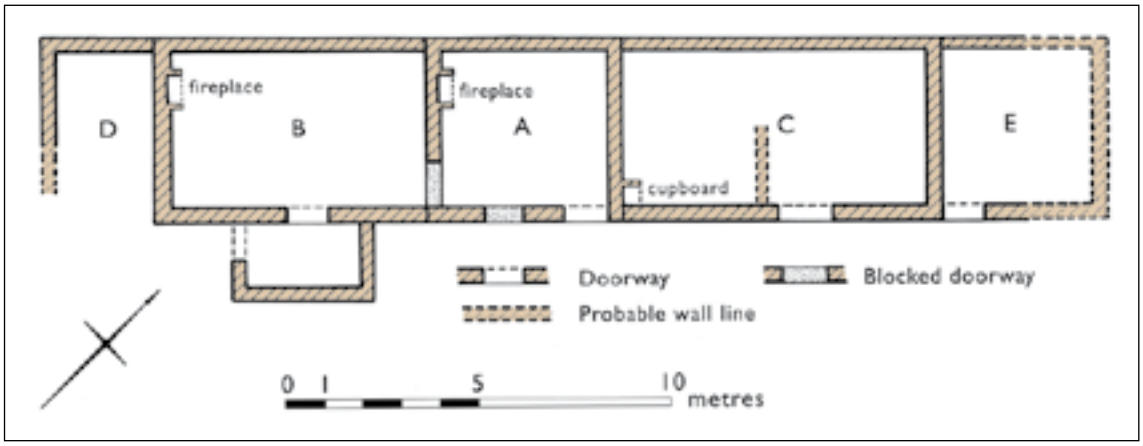

Figure 89 Plan of High Shop

Of the surviving internal features, there is a fireplace in the south-west wall of compartment A, consisting of two upright stone slabs recessed slightly into the wall, a fireplace in the south-western wall of B, partially destroyed by wall collapse, and a small, stone-built cupboard in the southern corner of C (Figure 90), presumably utilised for storage. All of these confirm that this structure was built for human habitation. The structure also appears to have had access to a supply of water from a pond behind it (802), a feature discussed in the 'Water Storage' section, above.

The surviving remains of High Shop thus suggest that the building began as a small structure, consisting of A. Subsequent extra rooms were added on (B and C) although the order in which this occurred is not clear from the surviving evidence. B is slightly better preserved, thus presenting clearer evidence. Given the existence of fireplaces in A and B, it seems most likely that these were used for accommodation. C may also have been used for accommodation, but without evidence for a fireplace, an alternative purpose may be more likely. Annexe D, which may have been open on one side, seems most likely to have been an earth closet. It is possible that E was a further extension of the occupied accommodation, as it has the constructed doorway, but without the full building surviving, it is difficult to be certain of its function. The better survival of A and B could be interpreted as evidence that these areas were retained in use for a longer period. It is possible that the doorway between A and B was blocked in order to make B the sole occupied area, possibly at the time that the porch was built on to the structure, thus potentially making B the latest occupied part of the structure. The number of compartments which make up the structure indicate that it probably housed a number of different functions, although there is no specific evidence, for example smithing waste, to allow these to be identified.

High Shop was accessed via a number of footpaths, some of which can still be traced. The principal access from Murton was along path 339, the north-easterly part of which can still be traced on the ground, although this also the route of a present day public footpaths. This path, on the First Edition 25-inch map (Ordnance Survey 1861), then

Figure 90 Internal features in High Shop. The cupboard in compartment C (left) and the fireplace in compartment A (right).

skirted around High Shop before traversing the valley side towards level 49. Whilst this is still the route of the path on modern 1:25 000 mapping, the path is barely discernible on the ground and the steepness of the terrain makes this route somewhat treacherous. It is possible that there was a more defined path here in the 19th century, but small-scale geological slippage appears to have wiped out most traces of it; today, in places, it is impossible to differentiate the path from numerous parallel sheep-tracks. Path 341 appears to provide access to High Shop from the north-east, but no path is shown in this location on the OS mapping, perhaps suggesting that this was an earlier path, dating to at least the early 1800s.

It is interesting to note that on Hodgson's map of Westmorland, dating to 1828, there appears to be a structure in this vicinity labelled as 'Scordale Hall'. The small scale of this map and the lack of identifiable control points have mean that rectification is impossible, but the juxtaposition of a 'Crushing Mill', 'Murton Mine' and 'Scordale Hall' would put the latter in the locality of High Shop. It is difficult to find an explanation for this nomenclature, as there is no evidence of a pre-existing domestic structure in this area which could be considered a 'hall' in a conventional post-medieval sense. Perhaps the most convincing explanation is that this was indeed a representation of the High Shop, but the term 'hall' was used in the sense of 'hall of residence'.

Whilst the two positively identified mine shops have been discussed above, there is a third building which may also be classed in this category. On a plateau just behind, to the north of, spoil heap 41 are the remains of a structure (40). The field remains consist of an approximately rectangular structure, possibly with an annexe attached to the eastern end. All that survives of the walls are the footings, which are barely visible above the ground. Within the centre of the building is an area of grey silty material/mortar and fire bricks, which appears to have been a fireplace or a chimney base. Late 19th-century photographs of the site corroborate that there was a building in this location (Figure 91).

Figure 91 Extract from late 19th century photograph showing the possible mine shop (40) situated on spoil heap 41. Crushing mill 29 is at the left of the photograph and culvert 35 can be seen below the building.
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However, the photograph suggests that the building was originally larger than the surviving footprint would suggest. It is just about possible to make out a corrugated-iron/timber structure on the photograph, which seems to consist of two adjoining, principal structures (each with two windows and a central door, with a chimney between the two), an annexe to the east and a possible smaller annexe or shed to the west. The cartographic evidence demonstrates that this structure dates to the latter part of the 19th century, as it is not shown on the First Edition 25- and 6-inch mapping (Ordnance Survey 1861; 1863). However, it appears on both the Second and Third Edition 6-inch mapping (Ordnance Survey 1899b; 1920). On the latter map, the

main mine road has been extended to lead to this structure. The dating of this structure would suggest that it was potentially part of the improvement works undertaken on the site by the Scordale Lead Mines Syndicate Ltd in 1892-3, prior to their liquidation, and presumably it can thus be associated with the list of buildings in the 1895 sales particulars. It is difficult to firmly ascertain the function of this structure, but it seems likely that it may have provided accommodation. The centrally located chimney, confirmed by the field remains of the fireplace, suggest a domestic usage, as it indicates a desire or need to maximise the heat potential of the fireplace. Other possibilities are that this was a smithy, which seems unlikely, given the lack of slag and other waste material in the area, or a carpenter's shop, but this is also unlikely, as a carpenter's shop would not have required a large fire. It can therefore be hypothesised that this was the mine shop, or mine cottage as referred to in the 1895 sales particulars, associated with the barytes processing of the late 19th- and early 20th-century.

The three likely accommodation structures broadly reflect the shifting focus of mining activity on the site, with the earliest ('Old Shop') to the north of Great Augill, associated with the opencut working (872) there. High Shop suggests a shift of focus to the western side of the valley, while the possible 'Mine Cottage' (40) relates the latest phase of activity, the barytes extraction and very late lead mining of the end of the 19th century, which focused on the confluence of Scordale Beck and Great Augill.

5.2.2 Barytes Mining

The switch to barytes extraction and processing in Scordale occurred in 1896, and its exploitation lasted for a period of around 25 years, until the early 1920s, from a relatively limited area, primarily to the north of Great Augill. A documentary reference from 1922 records that in 1921 barytes was still being worked 'from two old lead levels of the Hilton Mine' using 'a kind of pillar-and-stall, the pillars as a rule being dead, or pinched, ground, and little or no timber is required' (Wilson *et al* 1922, 46-7). The text also implies that barytes had also once been taken from the Amber Hill workings and witherite from 'a level near the old crushing-mill'. It would also appear that the crushing mill (29) was retained in use at this time for further processing the barytes. Samples taken from wooden chutes uncovered during the excavation of mill 29 have been subject to mineralogical analysis and the results indicate that the composition of the samples is consistent with the processing of barytes (Paynter 2009, 7-9). It seems likely that as well as mining barytes from underground workings, it was obtained by re-working the existing waste heaps from the lead mining activity, which were often rich in the hitherto undesirable mineral. Given that the time period in which the barytes was being worked was relatively short, the evidence appears to be of almost all one phase.

A number of features were recorded to the north-east of the confluence of Great Augill and Scordale Beck which can confidently be ascribed to the extraction, processing and transportation of barytes. A photograph of this area from the early 20th century has helped to confirm the identity of some of these features (Figure 92). One of the levels referred to in the 1922 document as being reworked for barytes would appear to be level 109, potentially Dow Scar Level. The photographs appear to show a chute emanating from the area of the level leading to an opencut and further section of

chute below. At the time of the present survey, it was thought that the remnants of a chute could be seen below the level entrance, but the extreme topography precluded a closer inspection. Further down the slope, in an opencut and between limestone buttresses is an area of revetment formed by crudely dressed stones (12), presumably acting as the base for the chute visible in the photograph. From the level, the mineral was thus delivered to a stone-walled structure (10) on the slopes below. The remains of this structure consist of an 'L' shaped platform measuring approximately 9m by 5m. At the north, concrete flooring is visible, the remains of in situ timber posts, firebricks and some large dressed stone blocks. The east and north sides may have been open ended as there is no sign of any stone walling; the photograph does not show conclusive evidence of this. A spread of waste running downslope from structure 10 to the mine road (32) below was originally thought to be the former line of a timber chute, but given that dressing was occurring in structure 10, it seems likely that this was waste material being discarded from the structure, with hillwash carrying it down the slope. A further level (11) can be postulated a short distance to the east of structure 10, as conjectural

Figure 92 Photograph possibly dating to the late 19th, or early 20th, century, looking across to Dow Scar. Great Augill is at the right of the photograph and the waterwheel of crushing mill 29 is visible in the foreground.

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Figure 93 Fine, white, sandy residue below the buddle (6) on the slopes below Dow Scar

evidence, in the form of a linear spoil heap and collapsed rubble, indicate that there was a level here. It seems most likely that barytes won from level 109, and possibly level 11, was being-dressed within structure 10, probably using a mechanical crusher, before being transported across the valley for further processing at the main crushing mill (29).

A short distance to the south-west of structure 10 is a feature which has the attributes of a small settling-pond or buddle (6). It survives as an oval-shaped, boggy hollow, measuring approximately 7m by 4m, which has been terraced into the steep slope. It is retained by drystone revetment on the downslope side and has a central breach through which there is a constant flow of water (24) from above. Although this breach has suffered some collapse, it may mark the site of an original outlet. Below the feature is a dump of fine, white, sandy residue (slimes) which has been cleared from the hollow during its working life (Figure 93). There is nothing clearly marked in this position on the historic OS mapping, although a mark on the Third Edition 6-inch map (Ordnance Survey 1920) may possibly be indicating the location of a feature, but this is far from clear.

Once the barytes had been dressed in structure 10, it was taken across the slope on a barrow run (8). This was traced for about 25m on the ground and survives as a narrow, level terrace cut into the steep slope. The termination of the barrow run at this point may be genuine, as the photographic evidence shows a chute, possibly no more than 20m long, leading downslope at this point; no evidence of this chute was traced on the ground. The photograph shows the chute leading to what appears to be a terraced tramway, which is carried across the beck on a wooden bridge. Although no substantial length of tramway was visible in this area, a short stretch of a narrow, level terrace (36) cut into the steep slope, approximately 5m in length, was recorded. It is highly likely that the feature recorded on the ground is part of the same tramway visible on the photographs, the northern end of which has been lost due to slumping and erosion caused by the river in this deeply-incised section of the valley.

The tramway would almost certainly have continued on the western side of the beck and its route appears to be marked by a level, stony bank (39) which would have acted as a track-bed; this track-bed would have already been in existence, as it was mapped as the route of a tramway coming out of level 61 in the 1860s on the Ordnance Survey First Edition 25-inch to the mile map. From here, the logical route would be to follow trackway 59, which is broad enough to accommodate a tramway as well as a track, and is heavily revetted to the east (by wall 44) and the west (by wall 60). It is not clear how the partially processed ore would have been moved on from here, as the terminus of trackway 59 is obscured. However, it would most likely have been transferred to the

chutes (47) above the crushing mill 29, which fed material into the building. A line of three fragments of timber uprights were recorded protruding through a discrete patch of waste material on the alignment of trackway 59 and these may indicate the continuation of the tramway, or an associated structure, supported on timber posts.

As well as taking barytes from the Dow Scar level (possibly 109), documentary sources refer to another level being worked for barytes at this time 'commencing about 200yds to the north' known as South Level (Wilson *et al* 1922, 47). The measurement given would suggest that the level being referred to was level 200, conjecturally identified during the present survey on the basis of a large spoil heap (156) and slumping of material from above where the level entrance should have been positioned. Spoil heap 156 is created from a large quantity of waste material, and has a flat top to it, suggesting that it was used as a tramway to remove material from the level. Adjacent to the foot of 156 is another spread of waste, 157, which is different in character, consisting of paler material which was mainly fine white chippings. This may indicate that material from the level was tipped down the spoil heap and was undergoing preliminary dressing here, or it may indicate that material from the original spoil heap was being re-worked at a later date, most likely to extract barytes. From here, it appears that material was transported down the slope, possibly in a chute, and delivered into a hopper, constructed within the entrance to level 66 below. This would have enabled it to join the main tramway system (54), which was still linked to this area in the early twentieth century, and then delivered material to the crushing mill via the main chutes (47).

The use of the crushing mill (29) to process the barytes is evidenced by the mineral analysis of samples taken from the vicinity of the structure during the programme of excavation. The trench (Trench 1) was positioned parallel to the long axis of the mill, north-east to south-west, cutting into the extensive platform of waste upon which the mill was built. The trench partially uncovered four square-profile wooden conduits, some with timber lids still *in situ*. The sample from the most northerly conduit, which was of a more substantial construction than the others in this trench (Giecco 2008, 17), was shown to contain relatively unprocessed material, a mixture of barytes and gangue material with approximately 40% in excess of 5mm (Paynter 2009, 8). The next conduit to the south, the lid of which had not survived intact, thus necessitating a more cautious interpretation of the sample, contained smaller material, the majority being under 5mm in size. This sample also principally contained barytes with a proportion of gangue material. Further south again, a small sample was taken from another conduit which contained little gangue material a substantial part of the sample exceeding 5mm; this suggests that this material had been processed, probably by hand picking, to remove the gangue. The final sample from this trench, taken was taken from a chute at the southerly end, contained predominantly barytes less than 5mm in size, the implication of this being that the material had been crushed or passed through a mesh (Paynter 2009, 9).

The mineralogical analysis thus implies that the material was being fed into the mill at the northern end and processed to increasing fineness to the south of the mill. Although the excavated chutes could be interpreted to be of different dates due to their stratigraphic relationship, the nature of the samples taken from the fills of the chutes suggest that they were contemporary (Paynter 2009, 9). The trench has confirmed that the latest evidence

of activity within the crushing mill was related to the processing of barytes, which confirms the documentary and cartographic evidence. A sample taken from the large spoil heap upon which crushing mill 29 was built contained different types of limestone and some mineral types, but the spoil generally appeared to be what would be expected from the mining & processing of lead ore, therefore connecting it to the earlier phases of use of the crushing mill (Paynter 2009, 7). Presumably this can be tied in to the earlier incarnation of the crushing mill, the smaller structure positioned further to the north-west as depicted on the First Edition 25-inch map (Ordnance Survey 1861), the waste from which appears to have been utilised to create a solid, levelled platform upon which to subsequently extend the crushing mill structure.

Documentary evidence states that Amber Hill was also being worked for barytes. The 1916 memoir of the Geological Survey records that the workings on Amber Hill were 'in the development stage' at that date and states that the flats had 'only recently been opened out', but indicates that infrastructure had already been put in place to move the material off the hillside, mentioning a tramway, a 'shoot [*sic*]' and a loading-station by the roadside below (Carruthers *et al* 1916, 31). The account also suggests that the material was taken from the mine directly to the mill at Hilton, which is referred to as a 'crushing-mill'. Field evidence for the features mentioned can be clearly identified on the ground, with the tramway corresponding to path 667, the 'shoot' being feature 90 and the loading-station being the modification to level 88 at the foot of the slope (*see* Figure 86). The documentary and field evidence is confirmed by the cartographic evidence, which only shows these features on the Third Edition 6-inch map, which was revised between 1911 and 1913 (Ordnance Survey 1920). The mining activity recorded on Amber Hill (drifts 666, 668, 670, 676, 677, 679 and 681, and shafts 669 and 672) may have had its origins in earlier lead mining, but it was re-visited to obtain barytes at this later date. This is clearly one of the latest attempts at commercial mining, albeit on a small scale, in Scordale.

Although the production of witherite, a barium carbonate mineral, is mentioned in a number of documentary sources (Wilson *et al* 1922, 40; Dunham and Dines 1945, 42; Dunham 1948, 138), the mineralogical analysis of the samples taken from crushing mill 29 and mill 27 contained no traces of witherite. It may be that witherite was only produced in the early years of the Scordale Mining Co.'s tenure (1896-1906) and that subsequent focus on barytes production has overwhelmed any earlier traces. It is virtually impossible to identify any specific archaeological features in Scordale relating to the processing and extraction of this mineral without more extensive mineral sampling and testing. It is quite likely that barytes and witherite would have been extracted and processed using the same methods and techniques, thus there may be no witherite-specific remains to be found.

5.2.3 Stone Quarrying

There are broadly two types of stone quarrying within the Scordale landscape:, small-scale, *ad hoc* quarrying to supply stone for specific construction purposes, and more extensive quarrying of limestone, suitable for burning within limekilns. Examples of this latter type were recorded on the upper part of the slopes of Swindale Brow, consisting

of a number of deep and shallow scoops, some of which join together to form larger quarries. Four principal features were recorded (441-2, 455, 459). All of these displayed evidence of discrete small heaps of loose limestone, broken down into hand-sized chunks ready for removal. There is no evidence of any minerals exposed in the outcrops or heaps, indicating that the purpose of these quarries was to provide the right quality of limestone to burn in limekilns. These quarry features lie within close proximity of the braided hollow ways on Swindale Edge (443, 727-8, 731); hollow way 443 runs directly between quarries 441 and 442 and then descends the slope to the main mine road (32). These hollow ways would have given access to limekilns 434 and 436.

Scattered across the valley are also a number of small quarries, which appear to have had the specific purpose of supplying building material for individual features. These include a quarry (334) adjacent to cottage 333 to the north-east of Lowfield Hush, which was almost certainly used as the main source of building material for the structure (see 'Steadings' section, above). A small quarry (661) on Amber Hill, near dam 658, displays a similar type of stone to that used in the construction of the dam, thus indicating that the material from the quarry was used for this purpose, rather than being transported away further.

There are some quarry scoops evidently used for material for drystone walls (e.g. 754, in association with field wall 599 situated on high ground to the north of Lowfield Hush). However, given the extractive activity and geological character of the valley, there are numerous places where limestone suitable for field walls (and similar constructions) occurs in abundance on the ground surface, thus resulting in fewer specific quarry features.

5.2.4 Limekilns

Four limekilns were recorded in Scordale during the course of this survey, all located in the south-western part of Scordale. Two of these limekilns still survive as recognisable stone structures (623 and 269). Limekiln 269 is located adjacent to mine road 32, at the very edge of the survey area, and is in a very good state of preservation (Figure 94). The source of limestone for this kiln is not known, and may lie outside the survey area. The kiln is located amongst a multi-braided hollow way (270), which indicates that it had good links for transporting material to and from it. This limekiln is not depicted on the 1861 25-inch or 1863 6-inch Ordnance Survey maps, but it is shown on the Second and Third Edition 25-inch OS maps as 'Old Limekiln' (Ordnance Survey 1899a; 1915). This seems to indicate that it was potentially constructed and abandoned between 1863 and 1899, or that it was out of use by 1863 but not depicted on the map; perhaps the former is the more likely.

Limekiln 623 is located to the north-east of Lowfield Hush, close to the small group of mining remains. This too is in a reasonably good state of repair, as the access arch is still surviving and at the rear of the chamber, a small draw-hole can still be seen (Figure 95). There is some potential that the arch may collapse and some of the upper part of the kiln has been lost, as the interior of the pot can be seen from above. This limekiln is depicted as an active limekiln on the First Edition 6-inch map (Ordnance Survey 1863), it is not

shown on the Second Edition 6-inch map (Ordnance Survey 1899b), but then appears on the Third Edition 6-inch map (Ordnance Survey 1920) as an 'Old Limekiln'. This clearly demonstrates that the kiln was active in the middle of the 19th century. The First Edition 6-inch map (Ordnance Survey 1863) also shows a track crossing Scordale Beck at a fording point, near the confluence with Swindale Beck, which bifurcates, with one arm leading upslope to the rear of the limekiln and the other arm leading directly to the front of the limekiln. This clearly indicates that limestone was arriving at the kiln from across the beck to the south-west and lime was being taken from the kiln in the same direction. There is no surviving earthwork evidence of this route.

The other two limekilns (434 and 436) stand in close proximity to one another at the western end of Swindale Beck; both survive primarily as earthworks. The better preserved of the two is 436, which is built into the steep south-facing slope of Swindale Brow. The kiln is 7m square, and the partially collapsed west and east walls, which are slightly curved towards the southern end, are formed of large dressed stone blocks (Figure 96). It would have been loaded from hollow way 727, which runs along Swindale Edge, and is shown on the First Edition 6-inch map (Ordnance Survey 1863).

Around 40m to the west of 436 are the remains of another limekiln (434), comprising of an earth and stone mound measuring 10.5m by 7m and standing to a height of over 1m which has been partially cut into the old stream banks. The form of this mound is typical of a limekiln, as it has a recess on the west side which marks the site of the draw-hole, and a hollowing on the top of the mound which marks the pot. Access to the kiln was via an earthwork loading ramp (733) at the east side. Based purely on the level of preservation, it would appear that 436 post-dates 434. Difficulties in dating limekilns

Figure 94 Limekiln 269, situated close to the southern edge of Hilton Beck, just under 1km to the north-east of Hilton village.

Figure 95 The surviving draw-hole in the rear wall of the chamber of limekiln 623

occur because there was a continuity of building methods, materials and design and adjacent kilns may sometimes have been used in sequence; if a kiln was not worth repairing after a period of use, then stone may have been removed and another constructed (Robertson 1999, 5). In this case, the lack of stonework surviving in kiln 434 could be explained by the dismantling of the kiln to build kiln 436. Kiln 434 is not depicted on any of the editions of the Ordnance Survey mapping, which further suggests that it is of an earlier date.

The size and small number of limekilns suggest that this was not a commercial-scale operation, but that these were typical field kilns for the burning of limestone to obtain lime for the improvement of agricultural land. Their location towards the south-western end of the survey area is consistent with this use, as the more productive agricultural land is on the more gentle terrain at this end of the valley

Figure 96 Limekiln 436, situated close to the confluence of Swindale and Scordale Becks

5.3 Military Activity

A number of military emplacements were identified across the site during the course of this survey, comprising approximately 7.5% of the total features recorded. Scordale became part of the MoD estate when the Warcop Military Training Area was established in 1942 and all of these military features within the survey area post-date this. However, towards the mouth of the valley, just outside the survey area and c500m from Hilton village, are the remains of a rifle range, of conventional design. This rifle range was not shown on the First Edition 6-inch map, surveyed in 1859, but does appear on the Second and Third Edition 6-inch maps, revised in 1897 and 1911 respectively (Ordnance Survey 1863, 1899b, 1919), indicating a military presence in the area from the latter part of the 19th century, which may have lasted up until the World War II. The majority of the emplacements within the survey area consist of crudely constructed walling no more than two or three courses high, of stone gathered from the environs. They are often sited on elevated places, carefully situated to provide good visibility, for example, at valley junctions, or covering dead ground. A continuous series of nine emplacements (96-104), for example, can be found on a slope between Scordale Beck and the north-west side of the mine road (32). The emplacements, on the whole, appear to have functioned as look-outs, shelters or small-arms weapon emplacements. In some cases, they have been fashioned from standing archaeological features; aerial photographic evidence demonstrates one emplacement was dug into crushing mill 29 after April 2000 (NMR 2000a and b). Statutory protection was not granted to the mining remains until 1999, which meant that a number of structures and mining-related features were damaged during military exercises between 1960 and 1980. The main crushing mill (29) and the building adjacent to level 49 (48), for example, still had standing walls in aerial photographs from 1953 and 1956 (RAF 1953 and RAF 1956). However, by 1965, most of the standing buildings on the site appear to have been flattened (RAF 1965).

A number of the levels on the site have been deliberately blasted or otherwise blocked to prevent access, in the interests of health and safety. An example of the former can be seen to the west of crushing mill 29, where level 49 (Hardside Low Level) has been deliberately blasted. Levels which have been blocked with iron bars or metal gates include levels 154, 177, 262 and 109, all to the north of Great Augill and above Dow Scar; the latter two levels were principal entrances to the Hilton Lead Mines. Levels 262 and 109 contain colonies of bats which inhabit the mine tunnels, the means of blocking here is intended to allow the continued use of the bat roosts.

Some military artefacts were also discovered within the survey area, primarily unexploded ordnance, although judging by the corrosion, these appear not to be too recent (Figure 97). These were all reported to the MoD for appropriate action.

Figure 97 Ordnance (173) wedged into stones alongside a watercourse c250m north of Great Augill

6. SUMMARY AND CONCLUSIONS

The initial impetus for the present survey arose from the immediate threat presented by fluvial erosion to a number of components of Scheduled Monument 27842, the Scordale Lead Mines. In completing the 1:2500 survey of a large part of the valley, it has been possible to inspect a broad range of archaeological remains, both within and outwith the Scheduled areas, and to assess the nature of threats and the levels of risk to them. The new research demonstrates that there is a wealth of previously unrecorded archaeological remains in Scordale, relating not only to lead mining, but also to other industries, to agriculture and pastoralism, and to settlement. This improved understanding has provided a platform for a range of conservation measures undertaken by the MoD, including excavations targeted at various structures most threatened by fluvial erosion, consolidation of several vulnerable buildings, and the introduction of series of information panels for visitors. Most importantly from a conservation angle, perhaps, the new research offers a clearer understanding of the contribution made by historic mining activities to the serious fluvial erosion problems in the valley, particularly relating to the Scordale Beck itself. These issues have been dealt with in previous reports (Hunt and Oswald 2006; Hunt and Ainsworth 2007a), leaving the current report to concentrate on the purely archaeological findings. In order to draw together the various strands and to present some general conclusions and observations, the evidence will be presented chronologically, discussing the impact each phase of activity has had on the landscape and how land-use change over time has affected the condition of the field remains.

Settlement and agriculture in the prehistoric period

The pattern of settlement within the survey area is very much confined to five, or possibly six, discrete communities, largely living within the fields around their homes, although the scale of the field systems varies. The larger scale of the settlement and field system towards the mouth of Scordale on the lower, more hospitable slopes, and probably more fertile soils, suggests a largely arable economy (Hunt and Oswald 2006). On the whole, this is likely to be Bronze Age in date, and possibly earlier than the rest of the settlements. On the higher slopes, where the topography is more inhospitable and complex, the opportunity for settlement and cultivation is limited to a small number of sheltered terraces. Whether the relatively small areas defined by clearance features identified on these terraces ever hosted significant arable cultivation is debatable. It is possible that these higher, smaller settlements, some of which may simply represent small family groups, had a more pastoral-based economy, taking maximum advantage of the limited potential for arable cultivation offered by these high terraces, but also exploiting the greater potential for grazing, particularly during the summer. Recent excavations in an area of lead mining at Bollihope Common, in County Durham, have suggested that late prehistoric roundhouses and enclosures were involved in both agricultural and industrial production (Young and Webster 2006; 2009), but this remains to be demonstrated through further survey and excavation in other mining areas. Whether the outlying sites in Scordale had a similarly mixed economy remains an unanswered question. It is possible that they were satellites of a larger, more agriculture-based focus of settlement towards the mouth of the valley, raising the possibility that all the settlement sites in Scordale might have Bronze Age origins. However, this potentially much longer chronology -

perhaps spanning the 2nd millennium BC to the early 1st millennium AD - cannot be confirmed by analysis of the final form of their earthworks alone. Although there is very limited physical evidence for settlement chronology within the survey area, the changes in the field system and the incidence of the small courtyard settlement (280) at the east end of the large field system towards the mouth of Scordale may be indicative of a change or evolution in morphology of settlement form from the unenclosed platform settlement to the west. As the morphology of this courtyard settlement is similar to three others on the higher ground this may point to the outlying sites being of the same period or function. Similarly, there are recognisable variations in the form of some of the other outlying settlements, but these may reflect functional, rather than chronological differences.

Settlement and agriculture in the post-Roman, Medieval and post-Medieval periods

As noted above, it may be inferred that occupation within a number of the settlements which have prehistoric origins in Scordale continued, or was re-established, in the early part of the 1st millennium AD. After this, it is difficult to assess the nature of settlement, if any existed, in the post-Roman/early medieval period. Based on its unusual morphology, the small courtyard settlement with rectangular structures appended to it (589) may be the strongest candidate to fill this vacuum, but this suggestion is highly speculative. The two settlements which comprise the triple, conjoined structures (139, 598) towards the north end of the valley are also unusual, but these too are not unambiguously either prehistoric or later in date. It does, however, seem probable that some of the rectangular shieling-like structures and smaller steadings are of medieval date, by comparison with other examples elsewhere, such as those excavated at Crosedale in Cumbria (Hair *et al* 1999). Given the context of the rich lead veins in Scordale, it is reasonable to propose from the circumstantial evidence that at least some may be dwellings occupied by miners and their families, as discussed further below. The identification of numbers of small, isolated shielings without any obvious other associations indicates that traditional transhumance was also practiced here. Some of these buildings are likely to have a medieval context, and it seems probable that transhumance would have continued, even during the periods of mining, up to the late 16th or early 17th century, when the practice is likely to have ceased (Ramm *et al* 1970, 3-6). It may be from this date onwards that the more substantial, stone-built steadings were introduced; these too may be closely affiliated to the mining settlements and the subsistence needs of the miners. A detailed study of the historical documentation for this area, and knowledge of the details of settlement, ownership and landholding system in both the lowlands to the west and fells to the east, would be required to provide a fuller analysis of the medieval and later patterns of shielings, steadings and agricultural practice in Scordale. This level of documentary research falls outside the remit of this project.

Pre-19th century mining and associated settlement

Whilst no definitive field evidence for mining activity dating to the prehistoric and Roman periods has been identified in Scordale, there is a strong likelihood that the rich mineral resources in the valley were being exploited during these periods. Roman industrial

exploitation of the region followed so swiftly on the heels of the occupation that it seems logical to infer some existing level of knowledge amongst the indigenous population. The prehistoric settlement evidence in Scordale, discussed above, could quite conceivably have been accompanied by associated small-scale industrial activity, the evidence for which may only be retrieved through excavation. Recent research into Roman period activity in this region supports the long-held theory that the occupying force invested heavily in the exploitation of galena, for both silver and lead, driving roads, such as the so-called 'Maiden Way', with considerable difficulty into the heart of the North Pennine massif and establishing a permanent settlement near Alston, the remote town which became the centre of the post-medieval mining boom (Went and Ainsworth 2009). There must, therefore, be a suspicion that the Romans would also have sought out ore deposits like those in Scordale, which lay close to major routes where settlement and farming were undoubtedly long established. However, on the strength of current evidence, such a proposal, whilst eminently possible, must remain entirely speculative.

It is often assumed that all trace of early mining activity must have been eradicated by more widespread and intensive post-medieval extraction, and this may well be the case for the prehistoric and Roman evidence and for a proportion of the medieval and early post-medieval evidence. However, the field evidence can be used to infer, with an increasing degree of confidence, medieval and early post-medieval mining, although little of the dating evidence is clear-cut. A secondary documentary reference to mining in the valley during the 14th century exists (Wilson *et al* 1922, 48), but specific supporting evidence for this assertion is difficult to find. The description of the field remains (Section 5) has highlighted a number of surviving mining and processing features which, based on morphology and location, are clearly pre-19th century. These mining features tend to be more remote, broadly characterised by small-scale, piecemeal extraction, undisturbed by later mining activity and often with only minimal associated infrastructure. Examples of individual shafts with small associated spoil heaps, within a short distance of early settlement clusters and rough footpaths, have been recorded on the slopes on the north-west side of the valley opposite Great Augill, on Low Hause and to the south of Great Augill itself; these are almost certainly of an early post-medieval or medieval date. It is also likely that isolated mining features to the north-west of Lowfield Hush are similarly remnants of an earlier period of activity. Specific features, such as the beehive-capped shaft (586) to the south of Great Augill, are also clear indicators of the location of relatively early extraction. The likelihood is that mines of this form, and their associated settlements, were abandoned by the time that industrial activities expanded and intensified in the early 19th century. In terms of the industrial archaeology of this area, and indeed nationally, the identification of the group of features (206-10, 212-5) on the north-west side of the valley opposite Great Augill (and potentially one other similar site) as possible early mining settlements is seen as a potentially very significant discovery.

Even the large open-cut mines, such as Mason Holes, Amber Hill and Lowfield Hush, are likely to date to, or originate in, the earlier periods of activity, representing the end-products of a gradual amalgamation of multiple small-scale open face workings over a prolonged period. Dunham's description of Mason Holes as 'an ancient opencut' (1948, 137) is fully justified by analysis of the field remains and limited documentary evidence. In the absence of any evidence for centralised organisation prior to 1824, the

eventual scale of the extractive activity here, depicted on the 1824 plan in a relatively developed state (with an area of hushing and worked faces), is itself strongly suggestive of a long duration prior to the 19th century. Much of the evidence for this process must necessarily have been destroyed as the working face was advanced, but the traces of associated hushing operations offer strong circumstantial evidence. There is also complex stratigraphy to be found within the hushing feeder channels - of which there are at least ten separate examples above the rock face forming the north-western edge of Mason Holes - indicating that this technique was used repeatedly over what must have been a prolonged period, of decades if not centuries. Since many of these channels have been truncated as the rock face has been worked back, it would be logical to infer that other, earlier examples must once have existed further down the slope. This gradual expansion process also appears to have been at play in creating the bench in the valley side (872) to the north of Great Augill, which appears to have largely been created by conjoined phases of open face mining activity, possibly enhancing a pre-existing natural feature. The use of hushing and the absence of any depiction of this extractive area on late 19th century mapping is suggestive of a relatively early date. Dressing floors to the south of this area appear to have been used to process material from this open-cut.

The field remains of Lowfield Hush and its absence from maps produced after the 1820s suggest that this was another area which saw substantial post-medieval, and perhaps earlier, exploitation prior to the intensive mining activity witnessed elsewhere in the valley at the tail end of the 19th century. It is perhaps unsurprising that this area was targeted relatively early, as the deposits in Lowfield Hush were evidently rich and the orientation of the vein means that it would initially have been exposed in section in the valley side. Early exploitation was - presumably - often focused in easily accessible areas, where the vein could be worked without the need for costly levels being driven into the hillside and the ore could be transported out of the valley easily and at low cost. The discrete, self-contained nature of the mining activity also suggests that Lowfield Hush was worked as a single entity; the series of dams and truncated channels associated with it show that a process of hushing was employed to expose the mineral vein, which were then worked back using open face techniques and then hushed again. Field evidence suggests that ore was processed in the vicinity, with the possible remains of a mill (626) and substantial quantity of dressing waste (629) a short distance from the lower end of the hush. To the north-west of the feature, remains of individual mining features, as mentioned above, suggest that Lowfield Hush, as viewed today, represents the end-product of a protracted campaign of extraction, stretching back decades, or even centuries.

Cartographic evidence, discussed below, shows that by 1824 extraction was under way in certain areas of Scordale. The plan made at the start of the London Lead Company's tenure, in 1824, depicts workings at a scale which strongly suggests pre-existing mining activity around Mason Holes and High Shop, parallel to Great Augill and at the head of Stow Gill. In the vicinity of some of these areas there are concentrations of surviving features potentially relating to this pre-existing activity, which, in places, was subsequently expanded and intensified. Based on the form of the remains, namely the clustering of extractive features (levels or shafts) and associated buildings and storage features, these can tentatively be identified as areas of late 18th- and early 19th-century activity. Approximately 75m north-east from the end of the Mason Holes opencut, for example,

there is a group of features (353-64; 374-9)which gives the impression of a well-organised enterprise (fragmentary remains of ore stores, levels, paths and revetment walling), but one which is still smaller in scale than those seen elsewhere in the valley and assigned a later date.

Assuming that medieval and early post-medieval mining was a fact, it is very likely that many of the miners would have lived in the villages of Hilton and Murton. The names applied to the two principal areas of workings and used on the historic OS mapping - Hilton Lead Mines and Murton Lead Mines - suggest that mining rights may originally have related to different parishes or communities. This may hark back to a division or arrangement established in the medieval period; more detailed documentary research may elucidate this, but such an exercise is beyond the scope of the current study. However, among the field remains within Scordale, a number of temporary shelter-like structures were identified, often apparently associated with areas of mining, suggesting that the miners may have lived, albeit temporarily, in the valley. These less permanent shelters are likely to be some of the earliest mining settlements within the valley and could conceivably date to the medieval period. In some cases these appear to have developed into something more substantial; on Low Hause a series of enclosures with associated structures were discovered, in proximity to a number of extractive features. In the later post-medieval period, the settlements associated with the mining activity appear to have become more organised and consolidated, in the form of stone-built mine shops. These multi-purpose buildings provided communal accommodation for the miners and other facilities associated with the mining process. At least two such buildings were recorded during the present survey, one of which (High Shop) shows evidence of extensive alteration and expansion, suggesting a prolonged period of usage, probably from at least the late 18th century until the latter decades of the 19th century.

In summary, whilst it is difficult to place a specific chronology on the medieval and post-medieval mining remains up to 1824, a relative chronology can be ascertained from the field evidence. Low Hause and Mason Holes seem to have been *foci* of early activity, the latter functioning as a productive mine for a number of centuries, along with more dispersed small-scale features in other areas of the valley which did not develop into larger undertakings. Lowfield Hush may be slightly later, possibly still worked up until the 1820s, but not beyond. It is highly likely that Amber Hill saw early extractive activity, but the evidence is somewhat confused as it was reworked a number of times right up until the 1920s. The area around High Shop appears to have been active from at least the 18th century up until the 1820s, but subsequently, up until the 1870s-80s, it is possibly that only High Shop and an adjacent level were retained. Post-1824 activity in the area of the Hilton and Murton Mines has obliterated much evidence of earlier activity. However, survival of various mining and processing features outside the most intensively exploited areas indicate that there was earlier piecemeal activity which can still be traced, stretching back to the 17th century and, most likely, earlier.

London Lead Company: 1824-1876

The arrival of the London Lead Company in 1824 saw the consolidation of the lead mining activities into an efficient, intensive undertaking on a grand scale. The company's

arrival prompted the creation of the first large-scale map of the workings and brought about a genuine sea-change in the degree of mechanisation and the scale of production. The plan dating to 1824 is a valuable document as it provides a snapshot of the mineral grounds at the outset of the exploitation by the London Lead Company. It is clear that at this point, the focus of the mining activity, the scale of which indicates that it was pre-existing, was in three discrete areas; Mason Holes and High Shop, parallel to Great Augill and at the head of Stow Gill. The vein depicted parallel to the north side of Great Augill has little associated infrastructure and was clearly being expanded in the early years of the London Lead Company's tenure, as pencil annotations on the plan show that the workings along this vein were being actively expanded to north-east between 1827 and 1830 (NEIMME 1824). This could be read as an indication of where the company's resources were initially being focused.

The First Edition 25-inch map surveyed in 1856-60 provides a source of evidence for the site some thirty years after the London Lead Company took over the site (Ordnance Survey 1861). The main inference to be drawn from this map is that the focus of the mining activity had shifted almost exclusively to the area around the confluence of Scordale Beck and Great Augill. The crushing mill is shown close to the western edge of Scordale Beck, with no reference to a mill in the vicinity of High Shop, as had been shown on the earlier plan. The active levels depicted on this edition of the map are generally following the principal mineral deposits crossing the valley on a north-east to south-west alignment; the exception to this being a level at the top of Stow Gill. At this date, the areas around Jacques Level and at the head of Little Augill are described as 'Old Lead Mine', indicating that these were potentially disused by the late 1850s. The level at the head of Little Augill is tentatively identifiable with 'Browns Level' on the 1824 plan, which annotations on the plan record as being started 24th May 1824 (NEIMME 1824), so it may only have been worked for some 30 years before the deposits were, perhaps, exhausted and it was abandoned. Only a few other levels were being worked elsewhere in the valley at this time, for example, a level adjacent to a field wall some 250m south-west of High Shop; although an outlier of the area of core surface activity, this level is situated on the principal mineral vein This appears to have been in active use at the time that the First Edition 25-inch map (Ordnance Survey 1861) was surveyed, as the spoil heap depicted on the map was not at its full extent, as recorded on the ground and compared with later mapping editions, indicating that it expanded subsequent to the late 1850s and developed into the substantial split spoil heap (537) which survives today.. It is possible that this corresponds with Pasture Gate Level, as shown on the 1824 plan, suggesting it has pre-London Lead Company origins, but it is difficult to be certain. It would thus appear that the early years of the London Lead Company undertakings in Scordale were taken up with a consolidation of activities and a shift of the infrastructure to a more manageable and accessible area, principally focusing on the main mineral vein trending north-east to south-west across the valley.

Post-1876

The falling price of lead between 1861 and 1880, which dropped from £21 9s per ton to £16 7s 6d (Burt 1982, 64), doubtless contributed to the eventual cessation in 1876 of lead mining in Scordale by the London Lead Company. Although attempts were made

by other companies to exploit the mineral resources of Scordale in the following period, primarily Scordale Lead Mines Syndicate Ltd which took on the lease in 1889 before going into liquidation in 1895, these were unsuccessful. A sale schedule relating to the auction of the site in February 1895 lists all the structures and machinery included in the sale, giving an idea of the grand aspirations of the company, which had invested heavily in the site in 1889. It seems that the market value of lead was not sufficient to support a lead mining undertaking at the end of the 19th century, but that barytes offered a more lucrative future. Or perhaps dwindling mineral reserves were offering a diminishing, and thus uneconomic, tonnage return. Barytes, having first been identified in the late 18th century, was being commercially exploited elsewhere in the North Pennines from as early as the 1850s (Dunham 1990, 4), but it was not worked in Scordale until 1896, by which date lead mining had ceased. Initially barytes was extracted by the Scordale Mining Company, followed by at least two other companies, which continued to work barytes in the valley until the early 1920s. The barytes extraction was even more tightly focused than the lead mining around the confluence of Great Augill and Scordale Beck, demonstrating a significant contraction of activity from the preceding centuries.

As a result, it is likely that a number of the structures and machinery on the site, installed for lead processing, would have been superfluous; the third waterwheel, listed in the 1895 sales particulars as 'not erected', may well have remained so, particularly given the mineralogical evidence that barytes was only being processed at the main crushing mill in its latter period of usage.

The field evidence, read in conjunction with archive photography, shows that the final stages of the exploitation of barytes in Scordale were primarily located in the area below Dow Scar, to the north-east of the confluence of Great Augill and Scordale Beck. The evidence has been discussed in detail above, but it is clear that the principal crushing mill (29) was retained in use for the processing of barytes, possibly with some of the machinery inside the building altered to suit the different mineral. However, there was clearly another area of activity between Amber Hill and Stow Gill. The Third Edition 6-inch map (Ordnance Survey 1920) shows that a tramway and a chute had been constructed to allow the removal of minerals from the workings to the south-west of Stow Gill. Documentary evidence confirms that this was one of the last stages of activity in Scordale, with the Amber Hill flats being opened out around 1916 (Carruthers *et al* 1916, 31). This text also records that a level (88) was converted into a hopper/loading bay below the chute and tramway, allowing barytes to be removed and transported to the mill at Hilton for further processing.

The small-scale workings recorded as being undertaken in 1930-39 (Dunham 1948, 138) have not been distinguished through the rapid field survey. If they were minor trials within existing workings, used to gauge whether sufficient quantities of mineral existed to warrant further input of time and money, then there would have been little investment in developing the areas and potentially little or no processing, thus creating minimal physical impact on the landscape. The fact that the massive increase in demand for metals brought about by World War II did not re-activate mining in Scordale, as it did at other abandoned mines, must indicate that the surviving mineral deposits were not considered viable.

The story of mining in Scordale is a long and complex one spanning at least five centuries and the present survey has served to elucidate the evidence of human activity, including mining, in the periods prior to the known documentary and cartographic sources. The field remains reflect the development of mining in the valley and demonstrate chronological shifts in the geographical areas being exploited in response to changing techniques and economic circumstances, as well as the vagaries of the mineral deposits themselves. The mining remains are complemented by the remains of settlement and subsistence, both earlier and contemporary, illustrating the development of human exploitation of the valley over millennia. The fragility of some of the archaeological remains is clear to be seen with many features adversely affected by collapse and fluvial erosion; the contribution of mining activity to that erosion has also been clarified. However, the current survey will act as a baseline record of the quantity and quality of the archaeological remains, and offer a basic understanding on which future research, management and conservation can be based.

7. METHODOLOGY

The survey and recording methodology devised for Scordale was specifically tailored to the rapid recording of archaeological features within this type of upland landscape, where access and time available for ground survey was severely restricted due to constraints imposed by the MoD, and where, for Health and Safety reasons, the severe topography precluded ground investigation of some areas. The concept behind the methodology adopted was to base the recording system on digital, vertical orthophotography (that is, photography which has been computer-adjusted and scaled to OS National Grid so that it has the benefit of the imagery for identification of features and statement of land-use at the time, but also has the additional benefit that is has the same metrical accuracy and properties of a map (in this case 1:2500 scale) for rapid identification and recording of archaeological features as part of an air/ground survey of the whole valley. This approach was integrated with other levels and scales of survey to meet the specific aims and phases of the project.

Phase 1

Digital aerial imagery at 10cms resolution of the whole valley was captured by Simmons Aerofilms in July 2005. A total of 38 images in two strips covering the area were obtained. A number of ground control points visible on the imagery were located by survey-grade GPS and used by the English Heritage Metric Survey team to rectify the images. The triangulation and processing of images was carried out using BAE Systems SOCET SET software and as part of this process, a digital terrain model (DTM) with a 5cm post spacing was generated. Composite orthophotographs at 20cms and 50cms were produced. The orthophotography was also broken down and supplied as 500m x 500m blocks for use with the GeoXT field GPS/dataloggers. In addition, orthophotographs of two smaller areas (around Amber Hill/Stow Gill and covering the Bronze Age field system at the south-west of the survey area) were produced at 10cm level. A contour model for the Amber Hill/Stow Gill area was created with a 0.25m contour interval.

Phase 2

The survey of Area A was undertaken at 1:1000 scale using survey-grade differential GPS (Trimble 5800). The GPS data was transformed to OSTN02 using Trimble Geomatics software and Geosite 5, before being exported into AutoCAD. Plots of the survey data were then taken into the field and completed or enhanced using traditional tape and offset methods (see Hunt and Oswald 2006).

Phase 3

Areas B, C and D (areas being identified at most immediate risk from river erosion) were surveyed at 1:200 scale with a buffer zone surveyed at 1:1000 scale where appropriate to contextulalise the threatened features. The equipment and process adopted was the same as Phase 2 above (see Hunt and Ainsworth 2007a). As part of this phase, the surviving structural remains of dressing mill 28, bridge abutment 80 and culvert 35 were

photographed in stereo using a Kodak DCS Pro 13 mega-pixel digital camera, especially calibrated for photogrammetric work. Small targets were attached to the structural remains so that at least four control points would appear in each stereo-model, i.e. overlapping pairs of photographs. The targets were surveyed using a Leica TCR 1203 total station theodolite with the EDM set to reflectorless mode. The survey observations for each area were linked to the OS National Grid by traversing from survey stations that had previously been established by the Archaeological Survey & Investigation Team using survey-grade GPS.

The co-ordinates for the targets were computed using GeoSite Pro by Korec. These co-ordinates and the digital images were then loaded in to a digital photogrammetric workstation running SOCET SET by BAE Systems. The digital photogrammetric workstation enables stereo-models to be set up so that accurate drawings can be traced, by a skilled operator, viewing them on a 3D screen. The drawings were supplied as AutoCAD .dwg files.

Phase 4

The whole survey area was surveyed at 1:2500 scale and was fieldwalked using the orthophotographic imagery as a base for overlays of the polyester photogrammetric plots mounted on a portable drawing board. This enabled the field team to rapidly identify and trace features onto the overlay without the need for time-consuming field survey, and to delineate features which were not accessible on the ground but could be observed from a distance. Features which were not visible on the orthophotography were recorded using Trimble GeoXT mapping-grade, hand-held GPS. This offers an accuracy of 0.5m, with real-time transformation to OSTN02. These devices were used with the modern Ordnance Survey 1:10 000 scale maps of the area as a background layer, with points recorded using the differential GPS signal or manually added where sufficient mapping was available. Data was collected as points, lines or polygons (in some cases, plan-form of a monument was recorded, but only where it was considered relevant) with attached user-defined attribute tables compiled using Korec's FastMap Mobile software. These attribute tables included monument type, brief interpretation and condition of each feature. The raw survey data, which exists as a .job file, was then converted to ESRI shapefiles using Korec FastMap Workflow software and then imported into ESRI ArcMap, using ESRI ArcCatalog. More comprehensive notes were recorded into field notebooks, as the small size of the hand-held GPS screen, whilst suited to taking brief notes or filling-in short forms, was not conducive to entering extended text.

The data from all phases has been brought together within ESRI ArcMap GIS. Field digital data was directly downloaded into the GIS and manually-captured data was digitised on a computer in the office. The textual data for each feature was added to a Microsoft Access database and this was linked to the GIS using a common system of Unique Identifier (UID) numbers, enabling all the data to be viewed by interrogating the GIS.

8. REFERENCES

Ainsworth, S 2006 'Scordale Lead Mines, Cumbria: Warcop Army Training Area'. English Heritage unpublished Project Design

Ainsworth, S 2008 'Miner-Farmer Landscapes of the North Pennines AONB.' English Heritage Research Department unpublished Project Design

Ainsworth, S Bowden, M and McOmish, D 2007 *Understanding the Archaeology of Landscapes: a guide to good recording practice.* Swindon: English Heritage

Ainsworth, S and Hunt, A 2007 'A fluid landscape: lead mining and river systems in the North Pennines' in *Research News* **5**, 38-39 Portsmouth: English Heritage

Barnatt, J 1990 *The Henges, Stone Circles and Ring Cairns of the Peak District*. Sheffield: University of Sheffield

Barnatt, J 1994 'Excavation of a Bronze Age unenclosed cemetery, cairns and field boundaries at Eaglestone Flat, Curbar, Derbyshire, 1984, 1989-90. *Proceedings of the Prehistoric Society,* **60**, 287-370

Barnatt, J 1996 'Recent research at Peak District stone circles, including restoration work at Barbrook II and Hordron Edge, and new fieldwork elsewhere'. Derbyshire Archaeological Journal, **116**, 27-48

Barnatt, J and Penny, R 2004 *The lead legacy*: *The Prospects for the Peak Districts Lead Mining Heritage*. Baslow: Peak District National Park Authority

Beswick, P and Merrills, D 1983 'L H Butcher's survey of early settlements and fields in the southern Pennines'. *Transactions of the Hunter Archaeological Society,* **12**, 16-50

Boutwood, Y 2002 Warcop Army Training Estate NMP: Summary Report. Unpublished English Heritage internal report

Bowden, M 1996 'Recent archaeological fieldwork in the Howgill Fells by the Royal Commission on the Historical Monuments of England' TCWAAS, **96**, 1-11

Brennand, M 2006 *The Archaeology of North-West England: Volume 1 Resource Assessment*. CBA North West

Bulman, R 2004 *Introduction to the Archaeology of Alston Moor.* North Pennines Heritage Trust

Burgess, C 1980 'Excavations at Houseledge, Black Law, Northumberland, 1979, and their implications for earlier Bronze Age settlement in the Cheviots'. *Northern Archaeology* **1.1**, 5-12

Burt, R 1982 *A Short History of British Ore Preparation Techniques in the Eighteenth and Nineteenth Centuries.* Lelielaan: De Archaeologische Pers Nederland

Carruthers, R D, Eastwood, T, Wilson, G, Pocock, B and Wray, D 1916 *Memoirs of the Geological Survey. Special Reports on the Mineral Resources of Great Britain. Vol II – Barytes and Witherite.* Second Edition. London: HMSO

Clare, T 1982 'The evidence for continuity of settlement in Cumbria' in Clack, P and Haselgrove, S (eds) *Rural Settlement in the Roman North*, 43-54, Durham: CBA

Coggins, D, Fairless, K J and Batey, C E 1983 'Simy Folds: an early medieval settlement site in Upper Teesdale, Co Durham'. *Medieval Archaeol* **27**, 1-26

Cranstone, D 1989 'The Archaeology of Washing Floors: Problems, Potentials, and Priorities' in *Industrial Archaeology Review* **12**, 40-9

Cranstone, D 1992 'To hush or not to hush: where, when, and how?' in Chambers, B (ed) *Men, Mines and Minerals of the North Pennines*. Friends of Killhope, 41-8

CRO(K) 1698 *Agreement re Hilton and Murton Lead Mines*. Held in the Cumbria Record Office (Kendal), ref. WDY/138

CRO(K) 1828 Hodgson's *Plan of the County of Westmorland*, surveyed 1823-5. Held in the Cumbria Record Office (Kendal)

CRO(K) 1895 *Sales particulars for the leasehold mining property of Scordale Lead Mines – auction to be held 13th February 1895.* Held in the Cumbria Record Office (Kendal), ref. WD/HH

CWH 1974 'The Last of the Scordale Miners Dies' in *Cumbria and Westmorland Herald*, 6 July 1974

Defence Estates 2003 *The Warcop Training Estate Integrated Land Management Plan*

Dunham, K C and Dines, H G 1945 *Barium Minerals in England and Wales*. Wartime Pamphlet No. 46. London: Geological Survey of Great Britain

Dunham, K C 1948 *Geology of the Northern Pennine Orefield. Volume 1: Tyne to Stainmore*. London: HMSO

Dunham, K C 1990, *Geology of the Northern Pennine Orefield. Volume 1: Tyne to Stainmore*, 2nd edition. London: HMSO

Forbes, I, Young, B, Crossley, C and Hehir, L 2003 *Lead Mining Landscapes of the North Pennines Area of Outstanding Natural Beauty*. Durham: Durham County Council

Frodsham, P and Waddington , C 2004 'The Breamish Valley Archaeology Project 1994-2002' in Frodsham, P (ed) *Archaeology in Northumberland National Park*, 171-89

Gates, T 1982 'Excavations at Hallshill Farm, East Woodburn, Northumberland'. *Archaeological Reports for 1981,* 7-9. Universities of Durham and Newcastle Upon Tyne.

Gates, T 1983 'Unenclosed settlements in Northumberland', in Chapman, J C and Mytum, H C, (eds) *Settlement in Northern Britain, 1000 BC - AD 1000.* British Archaeological Reports, British Series **118**. Oxford

Gates, T and Ainsworth, S 1979 *Field Survey in Northumberland.* Unpublished report. National Monuments Record

Gates, T and Ainsworth, S 1981 *Field Survey in Northumberland -1981: a report.* Unpublished report. National Monuments Record

Gates, T 2009 'Excavation of a late second/early first millenium B.C. Unenclosed Roundhouse at Halls Hill, near East Woodburn, Northumberland'. *Archaeologia Aeliana*, (ser 5) **38**, 43-85

Giecco, F 2008 *Archaeological Field Evaluation at Hilton Mine, Scordale, Cumbria for Phil Abramson, Defence Estates.* Unpublished draft report. North Pennines Archaeology Ltd Draft Client Report No. CP/478/07

Gill, M C 2004 'Lead Mining Affected Landscapes of the Yorkshire Dales' in White R F and Wilson P R (ed) *Archaeology and Historic Landscapes of the Yorkshire Dales.* Yorkshire Archaeological Society Occasional Paper No.**2**, 51-60

Hair, N, Newman, R, Howard-Davis, C and Newman, C 1999 'Excavation of medieval settlement remains at Crosedale in Howgill'. *TCWAAS,* (ser 2) **99**, 141-58

Hoaen, A W, and Loney, H L, 2003 'Later prehistoric settlement in Matterdale and Hutton parishes: recent survey results.' *TCWAAS,* (ser 3) **3**, 51-65

Hopkins, B 2008 *Warcop Training Camp, Cumbria: Archaeological Condition Survey Report*. Unpublished report

Hunt, A and Ainsworth, S 2007a *Scordale Lead Mines, Cumbria: A Preliminary Assessment of the Threat From River Erosion.* English Heritage Research Department Report Series no. 15/2007

Hunt, A and Ainsworth, S 2007b 'Nature takes its course: understanding a threatened lead-mining landscape' *The Archaeologist* **63**, 22-3

Hunt, A and Oswald, A 2006 *Scordale, Cumbria: An archaeological survey and investigation of a Bronze Age field system and dispersed settlement*. English Heritage Research Department Report Series no. 78/2006

Hunt, C J 1970 *The lead miners of the northern Pennines in the eighteenth and nineteenth centuries.* New York: Augustus M Kelley

Institute of Geological Sciences 1972 *Geological Special Sheet (Solid & Drift) Cross Fell Inlier.* Southampton: Ordnance Survey

Jobey, 1962 'A note on scooped enclosures in Northumberland', *Archaeologia Aeliana*,(ser 4) **40**, 47-58

Jobey, 1964 'Enclosed stone built settlements in north Northumberland'. *Archaeologia Aeliana*,(ser 4) **42**, 41-64

Jobey, 1965 'Hillforts and settlements in Northumberland'. *Archaeologia Aeliana*,(ser 4) **43**, 21-64

Jobey, G 1980 'Unenclosed platforms and settlements of the later second millennium BC in Northern Britain. *Scottish Archaeological Forum,* **10**, 12-26

Jobey, G 1981a 'Green Knowe unenclosed platform settlement and Harehope cairn, Peebleshire'. *Proceedings of the Society of Antiquaries of Scotland,* **110**, 72-113

Jobey, G 1981b 'Groups of small cairns and the excavations of a cairnfield on Millstone Hill, Northumberland'. *Archaeologia Aeliana*, (ser 5) **9**, 23-43

Jobey, G 1983 'Excavations of an unenclosed settlement on Standrop Rigg, Northumberland and some problems related to similar settlements between Tyne and Forth'. *Archaeologia Aeliana*, (ser 5) **11**, 1-21

Johnson, N and Rose, P 1994 *Bodmin Moor: An archaeological survey,* London: English Heritage

Lane, S and Dugdale, L 2006a *Hilton Beck, River Eden, Cumbria. Fluvial Audit: Science Report*. Durham University unpublished report

Lane, S and Dugdale, L 2006b *A Tale of Two Rivers* (Public information leaflet)

Mitchell, J 1842 *Children's Employment Commission 1842: The Evidence. Lead-Mines, &c., in Durham, Northumberland, and Cumberland* Ashton-in-Makerfield: Picks Publishing

NEIMME 1824 *General Plan of the Mineral Ground in the manors of Hilton and Murton in the county of Westmorland.* Held in the North of England Institute of Mining and Mechanical Engineers (NEIMME), ref. NRO 3410/LLC/Plans/1/103

Nevell, M 2006 'A major change in human evolution' *British Archaeology* **86**, 30-33

NMR 2000a Aerial photograph, ref: NY 7622/3 5-Apr-2000, NMR 17454/28

NMR 2000b Aerial photograph, ref: NY 7622/3 5-Apr-2000, NMR 17454/29

North Pennines AONB Partnership 2001 *The North Pennines Lead Industry - key sites and proposals for action.* Report commissioned from Ash Consultants for the North Pennines AONB Historic Environment Working Group

North Pennines AONB Partnership 2004 *The North Pennines Area of Outstanding Natural Beauty Management Plan 2004-09*

Ordnance Survey 1861 *County Series 25-inch to the mile map. Westmorland Sheet X.13.* Surveyed 1856-60

Ordnance Survey 1863 *County Series 6-inch to the mile map. Westmorland Sheet X.* Surveyed 1859

Ordnance Survey 1899a *County Series 25-inch to the mile map. Westmorland Sheet X.13.* Revised 1897

Ordnance Survey 1899b *County Series 6-inch to the mile map. Westmorland Sheet X NW and Sheet X SW.* Revised 1897

Ordnance Survey 1915 *County Series 25-inch to the mile map. Westmorland Sheet X.13.* Revised 1913

Ordnance Survey 1920 *County Series 6-inch to the mile map. Westmorland Sheet X NW and Sheet X SW.* Revised 1911-13

Oswald, A, Ainsworth, S and Pearson, T 2008 'Iron Age Hillforts in their Landscape Contexts: a Fresh Look at the Field Evidence in the Northumberland Cheviots'. *Archaeologia Aeliana*, (ser 5) **37**, 1-45

Paynter, S 2009 *Hilton Mine, Scordale, Cumbria: Identification of Mineral Samples*. English Heritage Research Department Report Series no. 20/2009

RAF 1953 Aerial photograph, ref: F21.58.RAF.1156 30-Jun-53, Frame 0020

RAF 1956 Aerial photograph, ref: F22.58/RAF/1959 12-Apr-56, Frame 0092

RAF 1965 Aerial photograph, ref: F22 58 RAF 6681 2-Apr-1965, Frame 0167

Railton, M 2009 'Lady's Rake Mine Archaeological Survey' *Archaeology County Durham* **4**, 24-28

Raistrick, A & Jennings, B 1989 *A History of Lead Mining in the Pennines* Newcastle: Davis Books

Raistrick, A and Roberts, A 1990 *Life and Work of the Northern Lead Miner* Stroud: Alan Sutton Publishing Ltd

Ramm, H, McDowell, R W, and Mercer, E 1970 *Shielings and Bastles*. London: HMSO

RCHME 1998 *High Park, Lancashire and Cow Close, Cumbria*. NMR unpublished report.

RCAHMS 1967 *Peebleshire,* **I**. Edinburgh: HMSO,

RCAHMS 1978 *Lanarkshire.* Edinburgh,:HMSO

Robertson, A 1999 *Limekilns of the North Pennines.* Nenthead: North Pennines Heritage Trust

Topping, P, Barnwell, P, Graty, D, Bewley, R and McCallum, D 2006 *The English Heritage Countryside Survey Pilot Project 200-03: The Collected Papers*. English Heritage Research Department Report Series no. 74/2006

Tyers, I 2010 *Scordale Lead Mines, near Appleby-In-Westmorland, Cumbria: Identification and Dendrochronological Analysis of Softwood Timbers*. English Heritage Research Department Report Series no. 14/2010

Went, D and Ainsworth, S 2009 *Whitley Castle, Northumberland: an archaeological investigation of the Roman fort and its setting*. English Heritage Research Department Report Series no. 89/2009

Williams, R 1989 *Limekilns and Limeburning* Princes Risborough: Shire

Wilson, G V, Eastwood, T, Pocock, R W, Wray, D A and Robertson, T 1922 *Memoirs of the Geological Survey. Special Reports on the Mineral Resources of Great Britain. Vol II - Barytes and Witherite.* Third Edition. London: HMSO

Young, R and Webster, J 2006 'Survey and excavation on Bollihope Common'. *Archaeology County Durham*, **1**, 14-19

Young, R and Webster, J 2009 'Another summer's dig on Bollihope Common'. *North Pennines News*. Stanhope: North Pennines AONB Partnership

APPENDIX 1: FEATURE GAZETTEER

The following list has been derived from the project GIS and contains each feature's UID number (as used throughout the text), the period assigned to the feature, the grid reference (in the form of Eastings and Northings), and (in the case of linear features) the length of the feature in metres. For linear features, the Easting and Northing are derived from the mid-point of the line.

UID	Monument type	Period	Easting	Northing	Length (m)
1	Leat	Post Medieval	376186	522543	49.08
2	Level	Post Medieval	376287	522652	
3	Ruined building	Post Medieval	376292	522690	
4	Leat	Post Medieval	376300	522698	6.06
5	Military fieldwork	20th Century	376311	522679	
6	Buddle	Post Medieval	376335	522718	
7	Water flow	Post Medieval	376343	522713	3.47
8	Barrow run	Post Medieval	376340	522742	21.94
9	Path	Post Medieval	376350	522745	41.09
10	Ruined building/ dressing mill	Post Medieval	376346	522730	
11	Level	Post Medieval	376360	522728	
12	Incline/ revetment	Post Medieval	376362	522734	
13	Military fieldwork	20th Century	376308	522733	
14	Earthwork	Uncertain	376298	522737	
15	?Level	Post Medieval	376183	522574	
16	Level	Post Medieval	376196	522597	
17	Buttress for timber launder	Post Medieval	376239	522621	
18	Mound	Uncertain	376219	522586	
19	Mound	Uncertain	376211	522577	
20	Buddle	Post Medieval	376202	522573	
21	Military fieldwork	20th Century	376205	522626	
22	Hollow way	Post Medieval	376292	522700	7.65
23	Hollow way	Post Medieval	376322	522713	10.75
24	Water flow	Post Medieval	376357	522725	6.50
25	Path	Post Medieval	376287	522693	9.43
26	Opencut mining	Post Medieval	376363	522736	
27	Dressing mill	Post Medieval	376260	522618	
28	Buttress	Post Medieval	376253	522617	
29	Crushing Mill	Post Medieval	376247	522708	
30	Military fieldwork	20th Century	376246	522704	
31	Path	Post Medieval	376257	522551	37.36
32	Road	Post Medieval	375367	521483	3239.32
33	Culvert	Post Medieval	376024	522303	
34	Line of boulders	Post Medieval	376265	522599	
35	Culvert	Post Medieval	376279	522755	
36	Earthwork	Post Medieval	376315	522761	
37	Hollow way	Post Medieval	376224	522620	11.27
38	Dressing waste	Post Medieval	376316	522724	57.41
39	Bank	Post Medieval	376280	522783	38.33
40	Structure	Post Medieval	376275	522773	

UID	Monument type	Period	Easting	Northing	Length (m)
41	Spoil heap	Post Medieval	376283	522759	
42	Chute	Post Medieval	376236	522788	8.12
43	Stone-lined channel	Post Medieval	376245	522754	
44	Retaining wall	Post Medieval	376245	522757	37.89
45	Working area	Post Medieval	376228	522741	
46	Dressing waste	Post Medieval	376228	522729	
47	?Chute/ hopper	Post Medieval	376207	522724	
48	Structure	Post Medieval	376169	522694	
49	Level	Post Medieval	376155	522697	
50	Path	Post Medieval	376209	522696	44.54
51	Stone stanchion	Post Medieval	376213	522723	
52	Path	Post Medieval	376228	522741	37
53	Leat	Post Medieval	376278	522800	53.21
54	Tramway	Post Medieval	376243	522811	284.33
55	Military fieldwork	20th Century	376220	522660	
56	Track	Post Medieval	376233	522718	65.65
57	Water channel	Post Medieval	376243	522732	
58	Embayments	Post Medieval	376214	522669	
59	Track	Post Medieval	376245	522761	43.24
60	Wall	Post Medieval	376245	522770	7.55
61	Platform	Post Medieval	376247	522783	
62	Leat	Post Medieval	376206	522771	63.15
63	Ore storage	Post Medieval	376314	522862	
64	Washing pits	Post Medieval	376322	522856	
65	Path	Post Medieval	376347	522879	42.47
66	Hopper	Post Medieval	376380	522917	
67	Structure	Post Medieval	376290	522814	
68	Dressing floor	Post Medieval	376288	522781	
69	Leat	Post Medieval	376269	522782	95.24
70	Leat	Post Medieval	376263	522608	48.26
71	Platform	Post Medieval	376252	522594	
72	Watercourse	Post Medieval	376245	522566	8.37
73	?Structure	Post Medieval	376281	522638	
74	Platform	Post Medieval	376282	522643	
75	Buddles	Post Medieval	376271	522665	
76	Platform	Post Medieval	376258	522635	
77	Structure	Post Medieval	376239	522696	
78	Structure	Post Medieval	376251	522680	
79	Military fieldwork	20th Century	376330	522908	
80	Structure	Post Medieval	376259	522693	
81	Mill	Post Medieval	376055	522357	
82	Roundhouse	Prehistoric	376416	523172	
83	Washing floors	Post Medieval	376124	522417	
84	Building	Post Medieval	376097	522420	
85	Building platform	Post Medieval	376036	522312	
86	Earthwork platform	Post Medieval	376137	522450	
87	Modern cairn	Mid 20th Century	376188	522537	
88	Level	Post Medieval	376168	522445	
89	Path	Post Medieval	376167	522374	132.15

UID	Monument type	Period	Easting	Northing	Length (m)
90	Chute	Post Medieval	376220	522387	136.52
91	Platform	Post Medieval	376058	522336	
92	Opencut mining	Post Medieval	375887	521958	25.79
93	Platform	20th Century	375927	522231	
94	Track	Post Medieval	375743	522027	30.25
95	Structure	20th Century	375718	522011	
96	Military fieldwork	20th Century	375733	522010	
97	Military fieldwork	20th Century	375726	522004	
98	Military fieldwork	20th Century	375723	521995	
99	Military fieldwork	20th Century	375704	521973	
100	Military fieldwork	20th Century	375684	521948	
101	Military fieldwork	20th Century	375665	521918	
102	Military fieldwork	20th Century	375654	521903	
103	Military fieldwork	20th Century	375641	521877	
104	Military fieldwork	20th Century	375628	521859	
105	Shaft	Post Medieval	375563	521769	
106	Path	Post Medieval	375685	521954	56.72
107	Wall	Uncertain	375706	522018	
108	Military fieldwork	20th Century			
109	Level	Post Medieval	376398	522767	
110	Military fieldwork	20th Century	376321	522906	
111	Military fieldwork	20th Century	376394	522768	
112	Path	Post Medieval	376400	522745	22.52
113	Dressing floor	Post Medieval	376399	522740	
114	Opencut mining	Post Medieval	376406	522767	
115	Reservoir	Post Medieval	376094	522925	
116	Reservoir	Post Medieval	376340	522931	
117	Military fieldwork	20th Century	376351	522925	
118	Military fieldwork	20th Century	376351	522942	
119	Leat	Post Medieval	376363	522954	24.27
120	Leat	Post Medieval	376359	522955	30.47
121	Leat	Post Medieval			
122	Military fieldwork	20th Century	376340	522911	
123	Leat	Post Medieval	376304	522913	25.45
124	Military fieldwork	20th Century	376267	522878	
125	Path	Post Medieval	376242	522888	100.59
126	Military fieldwork	20th Century	376231	522954	
127	?Water channel	Post Medieval	376185	522875	
128	Level	Post Medieval	376207	522862	
129	Path	Post Medieval	376268	522859	40.64
130	?Shelter	Post Medieval	376248	522868	
131	?Shelter	Post Medieval	376238	522874	
132	Military fieldwork	20th Century	376286	522977	
133	Military fieldwork	20th Century	376280	522962	
134	Landslip	Uncertain	376312	523094	
135	Military fieldwork	20th Century	376200	522993	
136	Reservoir	Post Medieval	376156	522958	
137	Path	Post Medieval	376099	522846	65.93
138	Path	Post Medieval	376085	522837	113.03

UID	Monument type	Period	Easting	Northing	Length (m)
139	Settlement	Post Medieval	376478	523181	
140	Military fieldwork	20th Century	376601	523180	
141	Military fieldwork	20th Century	376596	523171	
142	Path	Post Medieval	376531	523085	71.90
143	Level	Post Medieval	376519	523102	
144	Bouse team	Post Medieval	376552	523025	
145	Level	Post Medieval	376562	523004	
146	Structure	Post Medieval	376562	523008	
147	Platform	Post Medieval	376556	523008	
148	Wall	Post Medieval	376548	523025	25.96
149	Wall	Post Medieval	376541	523027	18.80
150	Dam	Post Medieval	376484	523054	
151	Mine building	Post Medieval	376492	522880	
152	Hush	Post Medieval	376452	522871	
153	Wall	Post Medieval	376478	522935	
154	Level	Post Medieval	376463	522928	
155	Wall	Post Medieval	376454	522928	
156	Spoil heap	Post Medieval	376426	522939	
157	Spoil heap	Post Medieval	376406	522923	
158	Opencut mining	Post Medieval	376397	522914	
159	Path	Post Medieval	376384	522932	47.09
160	Spoil heap	Post Medieval	376511	523107	
161	Cutting	Post Medieval	376515	523096	
162	Path	Post Medieval	376473	523104	459.29
163	Structure	Post Medieval	376488	522978	
164	Shaft	Post Medieval	376466	523126	
165	Path	Post Medieval	376488	523224	98.61
166	Shaft	Post Medieval	376486	523157	
167	?Shieling	Post Medieval	376466	523167	
168	Field	Uncertain	376457	523186	
169	Field	Uncertain	376483	523181	97.24
170	Cultivation edge	Uncertain	376493	523126	17.79
171	Shaft	Post Medieval	376504	523070	
172	Shaft	Post Medieval	376504	523064	
173	Bomb	20th Century	376518	523046	
174	Military fieldwork	20th Century	376494	522937	
175	Revetment	Post Medieval	376491	522932	
176	Spoil heap	Post Medieval	376473	522903	
177	Level	Post Medieval	376389	522777	
178	Hush	Post Medieval	376517	522861	79.22
179	Hush	Post Medieval	376469	522807	147.15
180	Shaft	Post Medieval	376490	522817	
181	Drainage level	Post Medieval	376494	522805	
182	Opencut mining	Post Medieval	376433	522787	
183	Shaft	Post Medieval	376461	522802	
184	Dam	Post Medieval	376465	522803	4.66
185	Leat	Post Medieval	376459	522789	25.37
186	Dressing floor	Post Medieval	376449	522786	
187	Leat	Post Medieval	376438	522783	8.94

UID	Monument type	Period	Easting	Northing	Length (m)
188	Dam	Post Medieval	376464	522785	
189	Dressing floor	Post Medieval	376454	522776	
190	Dressing floor	Post Medieval	376456	522809	
191	Leat	Post Medieval	376420	522809	27.03
192	Dam	Post Medieval	376433	522807	
193	Leat	Post Medieval	376444	522807	11.16
194	Shaft	Post Medieval	376453	522827	
195	Shaft	Post Medieval	376452	522835	
196	Shaft	Post Medieval	376459	522825	
197	Shaft	Post Medieval	376459	522834	
198	Shaft	Post Medieval	376449	522849	
199	Shaft	Post Medieval	376530	522840	
200	Level	Post Medieval	376446	522946	
201	Path	Uncertain			
202	Wall/Sluice	Post Medieval	376638	523369	
203	Spoil heap	Post Medieval	376614	523340	
204	Dam	Post Medieval	376444	523249	
205	Structure	Post Medieval	376042	522851	7.03
206	Structure	Post Medieval	376060	522873	24.82
207	Military fieldwork	20th Century	376074	522888	
208	Wall	Post Medieval	376062	522892	16.64
209	Structure	Post Medieval	376052	522880	
210	Enclosure	Uncertain	376043	522881	
211	Channel	Post Medieval	376172	522861	148.37
212	Cairn	Uncertain	376028	522854	
213	Cairn	Uncertain	376031	522854	
214	Settlement	Post Medieval	376017	522862	
215	Military fieldwork	20th Century	376020	522859	
216	Leat	Post Medieval	376190	523072	358.24
217	Military fieldwork	20th Century	376221	523074	
218	Structure	Post Medieval	376292	523154	
219	Structure	Post Medieval	376284	523161	
220	Structure	Post Medieval	376281	523170	
221	Enclosure/ Settlement	Post Medieval	376308	523240	
222	Pen	Post Medieval	376293	523226	
223	Military fieldwork	20th Century	376311	523228	
224	Shaft	Post Medieval	376161	523109	
225	Structure	Post Medieval	376173	523114	
226	Bench working	Post Medieval	376158	523115	40.30
227	Spoil heap	Post Medieval	376103	523065	
228	Level	Post Medieval	376089	523079	
229	Leat	Post Medieval	375965	523022	1512.13
230	Boundary	Post Medieval	375888	523146	327.74
231	Cairn	Uncertain	375893	523155	
232	Military fieldwork	20th Century	376388	523370	
233	Military fieldwork	20th Century	376412	523323	
234	Shake holes	Uncertain	376214	523519	
235	Shake holes	Uncertain	376244	523613	
236	Sheepfold	Post Medieval	376264	523643	

UID	Monument type	Period	Easting	Northing	Length (m)
237	Landslip	Uncertain	376366	523698	
238	Landslip	Uncertain	376370	523731	
239	Cairn	Mid 20th Century	376419	523225	
240	Hollow way	Post Medieval	376385	523087	85.53
241	Shaft mound	Post Medieval	376655	523058	
242	Leat	Post Medieval	376588	522952	129.67
243	Shaft	Post Medieval	376605	523036	
244	Structure	Post Medieval	376609	523041	
245	Reservoir	Post Medieval	376549	522895	
246	Structure	Post Medieval	376717	522871	
247	Path	Post Medieval	376544	522406	36.16
248	Leat	Post Medieval	376541	522407	39.09
249	Structure	Post Medieval	376530	522424	
250	Path	Post Medieval	376490	522610	384.86
251	Structure; Cairn	Uncertain	376536	522453	
252	Enclosure/ Settlement	Uncertain	376555	522454	
253	Shaft	Post Medieval	376550	522423	
254	Clapper bridge	Post Medieval	376501	522640	
255	Shaft	Post Medieval	376490	522706	
256	Cairn	Bronze Age	374504	520736	
257	?Reservoir	20th Century	374574	520695	
258	Cairn	Bronze Age			
259	Quarry	Post Medieval			
260	Track	Post Medieval	374788	520912	613.82
261	Track	Post Medieval	374621	520956	338.83
262	Level	Post Medieval	376387	522821	
263	Shaft	Post Medieval	375036	521171	
264	Cairn	Bronze Age	375167	521125	
265	Cairn	Bronze Age			
266	Cairn	Bronze Age	375370	521682	
267	Cairn	Bronze Age	375115	521127	
268	Track	Post Medieval	375202	521344	186.78
269	Limekiln	Post Medieval	374127	521042	
270	Track	Post Medieval	374210	521079	671.86
271	Reservoir	Post Medieval	375211	521577	
272	Track	Post Medieval	374879	521563	195.91
273	Path	Post Medieval	374823	521631	441.94
274	Field system	Bronze Age	374595	521164	
275	House platform	Bronze Age	374684	521481	
276	Cairn	Bronze Age	374727	521472	
277	Wall	Bronze Age	374905	521452	292.15
278	Cairn	Bronze Age	374930	521454	
279	Hollow way	Post Medieval	375051	521437	220.20
280	Settlement	Prehistoric	375049	521472	
281	Shieling	Post Medieval	375296	521585	
282	Boundary	Post Medieval	375093	521481	154.05
283	Cairn	Bronze Age	375021	521508	
284	Shaft	Post Medieval	375059	521638	
285	Wall	Post Medieval	374908	521523	459.08

UID	Monument type	Period	Easting	Northing	Length (m)
286	Shaft	Post Medieval	375175	521536	
287	Shaft	Post Medieval	375179	521539	
288	Hush	Post Medieval	375193	521551	
289	Reservoir	Post Medieval	375167	521599	
290	Wall	Post Medieval	375312	521569	67.45
291	Dressing waste	Post Medieval	376166	522779	
292	Dressing waste	Post Medieval	376159	522769	
293	Path	Post Medieval	376148	522769	22.72
294	?Level	Post Medieval	376148	522782	
295	Chute	Post Medieval	376167	522750	53.76
296	Open face working	Post Medieval	376127	522764	
297	Tailings	Post Medieval	376133	522736	
298	Level	Post Medieval	376114	522721	
299	Path	Post Medieval	376086	522719	70.31
300	Reservoir	Post Medieval	376017	522748	
301	Reservoir	Post Medieval	376043	522761	
302	Hush	Post Medieval	376053	522714	
303	Dam	Post Medieval	376002	522828	22.83
304	Wall	Post Medieval	376017	522831	55.18
305	?Reservoir	Post Medieval	375999	522816	
306	Leat	Post Medieval	376022	522659	135.49
307	Trial adit	Post Medieval	376013	522671	
308	Trial shaft	Post Medieval	376007	522677	
309	Trial shaft	Post Medieval	375993	522676	
310	Trial shaft	Post Medieval	375988	522670	
311	Trial shaft	Post Medieval	375975	522664	
312	Trial shaft	Post Medieval	375956	522660	
313	Trial shaft	Post Medieval	375942	522665	
314	Trial shaft	Post Medieval	375941	522647	
315	Trial shaft	Post Medieval	375987	522646	
316	Channel	Post Medieval	375240	521577	24.16
317	Channel	Post Medieval	375252	521575	21.61
318	Channel	Post Medieval	375264	521589	38.58
319	Channel	Post Medieval	375286	521590	52.53
320	Hush	Post Medieval	375282	521618	
321	Channel	Post Medieval	375350	521607	72.54
322	Shaft	Post Medieval	375257	521630	
323	Channel	Post Medieval	375283	521639	53.96
324	Waste	Post Medieval	375283	521633	
325	Waste	Post Medieval	375276	521645	
326	Leat	Post Medieval	375306	521651	30.92
327	Structure	Post Medieval	375326	521639	
328	Shaft	Post Medieval	375345	521660	
329	Shaft	Post Medieval	375357	521659	
330	Shaft	Post Medieval	375365	521659	
331	Shaft mound	Post Medieval	375370	521671	
332	Track	Post Medieval	375434	521811	157.81
333	Structure	Post Medieval	375488	521905	
334	Quarry	Post Medieval	375473	521913	

UID	Monument type	Period	Easting	Northing	Length (m)
335	Leat	Post Medieval	375503	521758	123.98
336	Reservoir	Post Medieval	376039	522670	
337	Natural feature	Uncertain	375985	522629	
338	Mine shop	Post Medieval	375913	522587	
339	Track	Post Medieval	375855	522566	560.27
340	Trial shaft	Post Medieval	375903	522637	
341	Path	Post Medieval	375954	522637	113.34
342	Level	Post Medieval	375838	522728	
343	Military fieldwork	20th Century	375792	522682	
344	Level	Post Medieval	375788	522701	
345	Shaft	Post Medieval	375808	522724	
346	Wall	Post Medieval	375766	522773	
347	Structure	20th Century	375772	522827	
348	Bank	Post Medieval	375732	522871	86.22
349	Path	Post Medieval	375758	522736	299.62
350	Reservoir	Post Medieval	375702	522692	
351	Military fieldwork	20th Century	375795	522793	
352	Level	Post Medieval	375925	522555	
353	Wall	Post Medieval	375947	522546	
354	Bouse team	Post Medieval	375989	522583	
355	Bouse team	Post Medieval	375982	522579	
356	Bouse team	Post Medieval	375978	522574	
357	Path	Post Medieval	375982	522573	67.39
358	Level	Post Medieval	375967	522569	
359	Bouse team	Post Medieval	375959	522558	
360	Bouse team	Post Medieval	375953	522553	
361	Bouse team	Post Medieval	375950	522549	
362	Revetment wall	Post Medieval	375943	522568	
363	Structure	Post Medieval	375950	522562	
364	Level	Post Medieval	375955	522537	
365	Shaft	Post Medieval	375902	522539	
366	Reservoir	Post Medieval	375895	522571	
367	Reservoir	Post Medieval	375866	522564	
368	Leat	Post Medieval	375877	522564	31.36
369	Leat	Post Medieval	375843	522555	34.35
370	Reservoir	Post Medieval	375818	522541	
371	Reservoir	Post Medieval	375783	522535	
372	Wall	Post Medieval	375806	522525	
373	Reservoir	Post Medieval	375753	522510	
374	Wall	Post Medieval	375953	522530	
375	Wall	Post Medieval	375972	522520	
376	Wall	Post Medieval	375976	522522	5.68
377	Wall	Post Medieval	375975	522533	
378	Chute	Post Medieval	375958	522520	
379	Bouse team	Post Medieval	375953	522505	
380	Bouse team	Post Medieval	375967	522460	
381	Track	Post Medieval	375939	522401	129.17
382	Pit (Mine shaft)	Post Medieval	375257	521293	
383	Platform (Miner's shieling)	Post Medieval	375342	521319	

UID	Monument type	Period	Easting	Northing	Length (m)
384	Pit (Mine shaft)	Post Medieval	375340	521261	
385	Cairn	Mid 20th Century	375367	521349	
386	Natural feature	Uncertain	375357	521319	13.40
387	Pit (Mine shaft)	Post Medieval	375343	521298	
388	Pit (Mine shaft)	Post Medieval	375341	521279	
389	Miner's Hut; Robbed cairn	Post Medieval	375332	521274	
390	Mining; Quarrying; Natural Fea	Post Medieval	375429	521233	12.01
391	Level	Post Medieval	375434	521251	
392	Quarry	Post Medieval	375435	521251	
393	Level	Post Medieval	375423	521256	
394	Military fieldwork	20th Century	375434	521267	
395	Natural feature	Uncertain	375395	521363	
396	Natural feature	Uncertain	375423	521378	
397	Natural feature	Uncertain	375456	521372	
398	Shieling	Uncertain	375419	521366	
399	Shieling	Uncertain	375580	521256	
400	Enclosure	Uncertain	375464	521048	
401	Shieling/Miner's hut	Uncertain	375465	521066	
402	Shooting Butt	20th Century	375491	521043	
403	Shooting Butt	20th Century	375403	521033	
404	Shooting Butt	20th Century	375438	521045	
405	Shaft	Post Medieval	375444	521097	
406	Military fieldwork	20th Century	375222	520763	
407	Military fieldwork	20th Century	375200	520739	
408	Military fieldwork	20th Century	375190	520738	
409	Military fieldwork	20th Century	375182	520757	
410	Military fieldwork	20th Century	375167	520710	
411	Settlement	Medieval	375137	520677	
412	Settlement	Medieval	375080	520820	
413	Settlement	Medieval	375100	520805	
414	Enclosure	Medieval	375153	520810	
415	Settlement & Enclosures	Medieval	375386	521248	
416	Natural feature	Uncertain	375221	521388	30.15
417	Hollow way	Post Medieval	375293	521436	23.55
418	Erosion	Uncertain	375104	521269	62.87
419	Drain	Post Medieval	374997	521226	12.01
420	Erosion	Post Medieval	374892	521193	38.86
421	Cairn	Bronze Age			
422	Cairn	Bronze Age	375132	521068	
423	Cairn	Bronze Age	375133	521103	
424	Cairn	Bronze Age	375112	521119	
425	Cairn	Bronze Age			
426	Cairn	Bronze Age	375186	521125	
427	Cairn	Bronze Age	375190	521112	
428	Cairn	Bronze Age	375178	521115	
429	Drain	Post Medieval	374770	521073	28.10
430	Bench Mark	Post Medieval	375404	521512	
431	Cairn	Bronze Age	374505	520854	
432	Artefact	Post Medieval	374546	520902	

UID	Monument type	Period	Easting	Northing	Length (m)
433	Causeway	Post Medieval	374543	520900	
434	Limekiln	Post Medieval	375335	521451	
435	Hollow way	Post Medieval	375296	521467	33.87
436	Limekiln	Post Medieval	375379	521444	
437	Cairn	Medieval	375561	521364	
438	Shieling	Medieval	375625	521271	
439	Cairn	Prehistoric	375575	521412	
440	Military fieldwork	20th Century	375683	521503	
441	Limestone Quarry	Post Medieval	375820	521446	
442	Limestone Quarry	Post Medieval	375785	521475	
443	Hollow way	Post Medieval	375611	521548	612.22
444	Dam	Post Medieval	376120	522080	42.35
445	Dam	Post Medieval	376135	522087	22.68
446	Dam	Post Medieval	376148	522097	23.86
447	Dam	Post Medieval	376229	522189	35.71
448	Leat	Post Medieval	376220	522191	14.15
449	Leat	Post Medieval	376205	522165	60.22
450	Leat	Post Medieval	376236	522168	35.52
451	Structure	Uncertain	376257	522180	
452	Hush channel	Post Medieval	376156	522152	71.62
453	Hush	Post Medieval	376201	522171	56.63
454	?Level	Post Medieval	376175	522148	
455	Limestone Quarry	Post Medieval	375753	521500	
456	Dam	Post Medieval	376197	522135	33.74
457	Leat	Post Medieval	376252	522074	136.50
458	Military fieldwork	20th Century	375856	521789	
459	Limestone Quarry	Post Medieval	375652	521585	
460	Dam	Post Medieval	375578	521627	18.39
461	Leat	Post Medieval	375551	521646	59.89
462	Platform	Post Medieval	375540	521668	
463	Military fieldwork	20th Century	376143	522224	
464	Military fieldwork	20th Century	376111	522196	
465	Wall	Post Medieval	376172	522222	
466	Structure	Post Medieval	376178	522217	
467	Open face working	Post Medieval	376143	522178	
468	Ore Vein/Opencut Mining	Post Medieval	376112	522183	
469	Ore Vein/Opencut Mining	Post Medieval	376103	522192	
470	Ore Vein/Opencut Mining	Post Medieval	376075	522136	
471	Ore Vein/Opencut Mining	Post Medieval	376074	522125	
472	Ore Vein/Opencut Mining	Post Medieval	376079	522132	
473	Ore Vein/Opencut Mining	Post Medieval	376091	522132	
474	Level	Post Medieval	376077	522215	
475	Level	Post Medieval	376095	522224	
476	Shaft	Post Medieval	376096	522231	
477	Level	Post Medieval	376095	522239	
478	Wall	Post Medieval	376038	522250	
479	Hush	Post Medieval	376054	522173	
480	Hush	Post Medieval	376077	522215	
481	Hush	Post Medieval	376159	522237	

UID	Monument type	Period	Easting	Northing	Length (m)
482	Hush	Post Medieval	376019	522255	
483	Erosion	Uncertain	376057	522265	
484	Hush channel	Post Medieval	376122	522101	
485	Military fieldwork	20th Century	375856	521785	
486	Military fieldwork	20th Century	375855	521783	
487	Hush	Post Medieval	376532	522902	20.86
488	Structure	Post Medieval	376016	522845	
489	Military fieldwork	20th Century	375852	521782	
490	Structure	Post Medieval	375839	522439	
491	Artefact	Post Medieval	375832	522459	
492	Level	Post Medieval	375841	522488	
493	Level	Post Medieval	375838	522477	
494	Bank	Post Medieval	375831	522443	13.62
495	Open face working	Post Medieval	375802	522470	20.57
496	Military fieldwork	20th Century	375828	522428	
497	Path	Post Medieval	375856	522446	38.13
498	Wall	Post Medieval	375864	522449	
499	Wall	Post Medieval	375871	522445	11.31
500	Structure	Post Medieval	375794	522382	
501	Dressing waste	Post Medieval	375810	522360	
502	Structure	Post Medieval	375824	522360	
503	Shaft	Post Medieval	375793	522354	
504	Conduit	Post Medieval	375805	522366	
505	Dam	Post Medieval	375785	522357	32.30
506	Dam	Post Medieval	375771	522351	10.47
507	Bank	Post Medieval	375781	522344	13.92
508	Military fieldwork	20th Century	375790	522330	
509	Leat	Post Medieval	375781	522370	21.64
510	Cutting	Post Medieval	375765	522385	
511	Path	Post Medieval	375743	522381	45.96
512	Open face working	Post Medieval	375713	522393	38.62
513	Wall	Post Medieval	375723	522389	
514	Military fieldwork	20th Century	375891	522416	
515	Hush	Post Medieval	375867	522416	
516	Channel	Post Medieval	375855	522401	31.13
517	Quarry	Post Medieval	375847	522457	
518	Hush	Post Medieval	375821	522392	
519	Channel	Post Medieval	375834	522370	22.29
520	Hush	Post Medieval	375732	522341	
521	Path	Post Medieval	375744	522344	11.52
522	Shaft	Post Medieval	375718	522338	
523	Path	Post Medieval	375713	522313	55.59
524	Hush	Post Medieval	375722	522320	48.27
525	Shaft	Post Medieval	375735	522319	
526	Dam	Post Medieval	375712	522295	15.92
527	Shaft	Post Medieval	375710	522294	
528	Bank	Post Medieval	375723	522301	16.88
529	Open face working	Post Medieval	375651	522335	35.35
530	Quarried face	Post Medieval	375628	522302	38.77

UID	Monument type	Period	Easting	Northing	Length (m)
531	Quarried face	Post Medieval	375686	522356	37.88
532	Hush channel	Post Medieval	375670	522252	
533	Hush channel	Post Medieval	375599	522245	
534	Hush channel	Post Medieval	375688	522303	
535	Path	Post Medieval	375657	522236	47.19
536	Bank	Post Medieval	375699	522352	4.38
537	Spoil heap	Post Medieval	375687	522484	
538	Wall	Post Medieval	375682	522489	
539	Bouse team	Post Medieval	375666	522502	
540	Level	Post Medieval	375656	522523	
541	Path	Post Medieval	375671	522492	21.83
542	Spoil heap	Post Medieval	375655	522511	
543	Reservoir	Post Medieval	375482	522320	
544	Shaft	Post Medieval	375695	522543	
545	Structure	Post Medieval	375704	522511	
546	Open face working	Post Medieval	375614	522368	
547	Wall	Post Medieval	375656	522564	518.83
548	Bank	Post Medieval	375617	522372	19.91
549	Wall	Post Medieval	375652	522396	10.72
550	Wall	Post Medieval	375655	522404	
551	Wall	Post Medieval	375672	522407	19.79
552	Dam	Post Medieval	375641	522397	9.15
553	Pond	Post Medieval	375638	522399	
554	Dam	Post Medieval	375660	522444	25.77
555	Reservoir	Post Medieval	375659	522449	
556	Channel	Post Medieval	375653	522476	46.90
557	Pond	Post Medieval	375645	522429	
558	Bank	Post Medieval	375508	522315	16.94
559	Dam	Post Medieval	375488	522307	92.75
560	Hush channel	Post Medieval	375603	522368	
561	Hush channel	Post Medieval	375511	522295	
562	Hush channel	Post Medieval	375526	522286	
563	Hush channel	Post Medieval	375563	522304	
564	Hush channel	Post Medieval	375542	522242	
565	Hush channel	Post Medieval	375582	522321	
566	Leat	Post Medieval	375566	522416	199.29
567	Pond	Post Medieval	375646	522498	
568	Hush channel	Post Medieval	375707	522437	
569	Military fieldwork	20th Century	376238	522523	
570	Path	Post Medieval	376295	522407	259.56
571	Mine building	Post Medieval	376304	522482	
572	Bridge	Post Medieval	376315	522473	
573	Geological feature	Uncertain	376250	522514	
574	Military fieldwork	20th Century	376340	522521	
575	Level	Post Medieval	376380	522533	
576	Structure	Post Medieval	376400	522420	
577	Mound	Uncertain	376420	522424	
578	Dressing waste	Post Medieval	376347	522464	
579	Natural feature	Post Medieval	376347	522430	

UID	Monument type	Period	Easting	Northing	Length (m)
580	Level	Post Medieval	376453	522480	
581	Platform	Post Medieval	376477	522477	
582	Platform	Post Medieval	376480	522478	
583	Platform	Post Medieval	376483	522480	
584	Level	Post Medieval	376472	522438	
585	Level	Post Medieval	376426	522423	
586	Shaft	Post Medieval	376520	522756	
587	Shaft	Post Medieval	376522	522714	
588	Military fieldwork	20th Century	376517	522715	
589	Settlement	Prehistoric	376496	522397	
590	Dam	Post Medieval	376518	522354	24.58
591	Leat	Post Medieval	376480	522343	58.25
592	Leat	Post Medieval	376480	522382	78.54
593	Sheepfold	Post Medieval	376494	522334	39.15
594	Steading	Post Medieval	376477	522325	
595	Sheepfold	Post Medieval	376481	522331	
596	Military fieldwork	20th Century	376479	522318	
597	Wall	Post Medieval	376471	522300	27.67
598	Settlement	Uncertain	376472	522356	
599	Bank	Post Medieval	375299	521967	411.28
600	Dam	Post Medieval	375489	522196	17.99
601	Reservoir	Post Medieval	375487	522199	
602	Hush channel	Post Medieval	375480	522188	93.64
603	Hush channel	Post Medieval	375477	522220	103.62
604	Hush	Post Medieval	375549	522144	
605	Hush	Post Medieval	375523	522114	
606	Hush channel	Post Medieval	375538	522297	9.37
607	?Wall	Post Medieval	375557	522316	99.14
608	Hush	Post Medieval	375611	522373	
609	Dam	Post Medieval	375589	522375	20.31
610	Reservoir	Post Medieval	375581	522379	
611	Bank	Post Medieval	375518	522289	51.02
612	Military fieldwork	20th Century	375439	522248	
613	?Drainage Channel	Post Medieval	375301	522098	464.52
614	Aperture	Post Medieval	375650	522488	
615	Channel	Post Medieval	375503	522392	73.35
616	Aperture	Post Medieval	375654	522574	
617	Roundhouse	Bronze Age	375518	522412	
618	Cairn	Bronze Age	375553	522434	
619	Bank	Bronze Age	375549	522443	110.85
620	Possible Roundhouse	Bronze Age	375465	522392	
621	Mine building	Post Medieval	376522	522764	
622	Enclosure	Post Medieval	375458	522361	104.66
623	Limekiln	Post Medieval	375439	521659	
624	Structure	Post Medieval	375452	521665	
625	Level	Post Medieval	375454	521673	
626	Platform	Post Medieval	375462	521667	
627	Channel	Post Medieval	375454	521652	18.09
628	Spoil heap	Post Medieval	375464	521679	

UID	Monument type	Period	Easting	Northing	Length (m)
629	Dressing waste	Post Medieval	375459	521659	
630	Channel	Post Medieval	375472	521677	58.15
631	Structure	Post Medieval	375415	521623	
632	Level	Post Medieval	375378	521636	
633	Bank	Prehistoric	376444	522281	45.52
634	Cairn	Prehistoric	376462	522259	
635	Hut circle	Prehistoric	376429	522281	
636	Hut circle	Prehistoric	376421	522269	
637	Hut circle	Prehistoric	376415	522282	
638	Hut circle	Prehistoric	376409	522277	
639	Enclosure	Prehistoric	376417	522279	18.99
640	Military fieldwork	20th Century	376401	522337	
641	Cairn	Prehistoric	376403	522337	
642	Cairn	Prehistoric	376428	522237	
643	Hut circle	Prehistoric	376367	522204	26.83
644	Hut circle	Prehistoric	376349	522155	
645	Hut circle	Prehistoric	376354	522149	
646	Hut circle	Prehistoric	376359	522157	
647	Bank	Prehistoric	376339	522137	79.33
648	Bank	Prehistoric	376315	522225	47.83
649	Bank	Prehistoric	376263	522135	47.43
650	Quarry	Post Medieval	376242	522132	11.52
651	Quarry	Post Medieval	376257	522134	12.99
652	Hut circle	Prehistoric	376283	522220	
653	Hut circle	Prehistoric	376280	522210	
654	Hut circle	Prehistoric	376271	522198	
655	Leat	Post Medieval	376270	522182	34.35
656	Pond	Post Medieval	376343	522308	
657	Natural feature	Uncertain	376330	522304	10.60
658	Dam	Post Medieval	376340	522313	26.02
659	Hush	Post Medieval	376331	522374	
660	Channel	Post Medieval	376335	522327	
661	Quarry	Post Medieval	376364	522310	
662	Channel	Post Medieval	376333	522319	13.42
663	Path	Post Medieval	376356	522311	110.83
664	Quarry	Post Medieval	376178	522429	
665	Bank	Prehistoric	376431	522297	37.59
666	Drift	Post Medieval	376234	522288	
667	Path	Post Medieval	376211	522282	148.59
668	Drift	Post Medieval	376252	522305	
669	Shaft	Post Medieval	376255	522290	
670	Drift	Post Medieval	376253	522279	
671	Drain	Post Medieval	376246	522287	9.26
672	Shaft	Post Medieval	376266	522277	
673	Dressing floor	Post Medieval	376261	522284	
674	Natural feature	Uncertain	376249	522255	22.62
675	Dressing floor	Post Medieval	376211	522282	
676	Drift	Post Medieval	376219	522276	
677	Drift	Post Medieval	376207	522244	

UID	Monument type	Period	Easting	Northing	Length (m)
678	Drift	Post Medieval	376204	522254	
679	Drift	Post Medieval	376196	522241	
680	Path	Post Medieval	376191	522241	31.57
681	Drift	Post Medieval	376189	522233	
682	Path	Uncertain	376555	524041	17.86
683	Quarry	Post Medieval	376572	524032	
684	Barrow run	Post Medieval	376624	523355	30.01
685	Roundhouse	Uncertain	376002	523770	
686	Path	Uncertain	376567	524052	25.30
687	Tram rail	Post Medieval	376153	522449	
688	Dam	Post Medieval	375173	521594	33.98
689	Dam	Post Medieval	375196	521596	22.93
690	Reservoir	Post Medieval	375196	521589	
691	Dam	Post Medieval	375224	521579	37.29
692	Shaft	Post Medieval	375155	521593	
693	Shaft	Post Medieval	375143	521602	
694	Leat	Post Medieval	375169	521585	61.01
695	Leat	Post Medieval	375205	521598	18.87
696	Structure	Post Medieval	375392	521715	
697	Shaft	Post Medieval	375073	521528	
698	Cairn	Bronze Age	375134	521503	
699	Dam	Post Medieval	375209	521598	8.14
700	Military fieldwork	20th Century	375022	521509	
701	Military fieldwork	20th Century	375018	521507	
702	Cairn	Bronze Age	375160	521517	
703	Cairn	Bronze Age	375108	521489	
704	Clearance bank	Bronze Age	375109	521497	35.15
705	Ore Vein/Opencut Mining	Post Medieval	375234	521616	
706	Field system	Prehistoric	375602	521359	
707	Field system	Prehistoric	375615	521370	100.68
708	Settlement	Prehistoric	375631	521343	21.29
709	Field system	Prehistoric	375630	521306	
710	Cairn	Prehistoric	375625	521335	
711	Dam	Post Medieval	375226	521573	
712	Open face working	Post Medieval	376160	522229	152.64
713	Path	Post Medieval	376164	522257	27.68
714	Opencut mining	Post Medieval	376200	522298	
715	Pit	Post Medieval	376192	522313	
716	Mine building	Post Medieval	376201	522333	
717	Drift	Post Medieval	376199	522342	10.46
718	Artefact	Post Medieval	376106	522295	
719	Artefact	Post Medieval	376077	522298	
720	Hush	Post Medieval	376083	522328	
721	Artefact	Post Medieval	376123	522387	
722	Natural feature	Uncertain	376184	522364	38.35
723	Natural feature	Uncertain	376270	522384	
724	Open face working	Post Medieval	376344	522452	
725	Hush fan	Post Medieval	376271	522452	
726	Culvert	Post Medieval	376193	522504	

UID	Monument type	Period	Easting	Northing	Length (m)
727	Hollow way	Post Medieval	375618	521395	543.58
728	Hollow way	Post Medieval	375512	521447	107.64
729	Path	Post Medieval	375596	521397	22.30
730	Natural feature	Uncertain	375703	521378	71.36
731	Hollow way	Post Medieval	375646	521474	544.79
732	Natural feature	Uncertain	375525	521456	
733	Ramp	Uncertain	375359	521456	
734	Track	20th Century	375457	521460	250.03
735	Bench working	Post Medieval	375142	521575	
736	Bench working	Post Medieval	375109	521561	35.47
737	Leat	Post Medieval	375121	521583	25.29
738	Leat	Post Medieval	375135	521595	91.79
739	Military fieldwork	20th Century	375094	521651	
740	Open face working	Post Medieval	375107	521652	
741	Artefact	Post Medieval	375112	521662	
742	Cairn	Bronze Age	375123	521714	
743	Surface working	Post Medieval	375089	521705	
744	Surface working	Post Medieval	375101	521709	
745	Surface working	Post Medieval	375098	521696	
746	Surface working	Post Medieval	375095	521697	
747	Enclosure	Prehistoric	375115	521730	
748	Field system	Prehistoric	375131	521716	
749	Leat	Post Medieval	375013	521734	53.57
750	Leat	Post Medieval	375023	521766	119.74
751	Path	Post Medieval	374972	521778	142.12
752	Leat	Post Medieval	374994	521815	55.32
753	Leat	Post Medieval	374988	521769	69.12
754	Stone grubbing	Post Medieval	375273	521959	
755	Artefact	20th Century	375170	521749	
756	Military fieldwork	20th Century	375161	521765	
757	Leat	Post Medieval	375198	521639	85.90
758	Dressing floor	Post Medieval	375281	521647	
759	Track	Post Medieval	375359	521672	22.17
760	Field bank	Post Medieval	375379	521660	19.85
761	Dam	Post Medieval	375379	521660	10.03
762	Pond	Post Medieval	375380	521663	
763	Shaft	Post Medieval	375463	521904	
764	Longhouse	Medieval	374925	521453	
765	Unknown	Uncertain	375033	521483	
766	Hollow way	Post Medieval	375153	521415	44.70
767	Track	Post Medieval	375189	521467	129.77
768	Artefact	20th Century	375586	522189	
769	Artefact	20th Century	375565	522169	
770	Path	Post Medieval	375549	522020	181.00
771	Gulley	Post Medieval	375284	521615	72.20
772	Level	Post Medieval	375318	521639	
773	Gulley	Post Medieval	375333	521637	13.82
774	Dressing waste	Post Medieval	375371	521631	
775	Structure	Post Medieval	375372	521625	

UID	Monument type	Period	Easting	Northing	Length (m)
776	Hush	Post Medieval	375393	521641	27.87
777	Dressing waste	Post Medieval	375391	521625	
778	Structure	Post Medieval	376275	523161	
779	Dam	Post Medieval	376002	522802	14.46
780	Leat	Post Medieval	375992	522769	66.72
781	Dam	Post Medieval	376024	522745	55.41
782	Level	Post Medieval	376036	522694	
783	Level	Post Medieval	376044	522698	
784	Open face working	Post Medieval	376053	522715	
785	Hush	Post Medieval			
786	Hush	Post Medieval			
787	Dam	Post Medieval	376050	522756	31.24
788	Leat	Post Medieval	376070	522768	38.62
789	Shaft	Post Medieval	376061	522768	
790	Hush channel	Post Medieval			
791	Hush channel	Post Medieval	376023	522723	18.63
792	Dam	Post Medieval	376044	522671	28.21
793	Path	Post Medieval	376019	522634	61.73
794	Dressing floor	Post Medieval	375941	522659	
795	Military fieldwork	20th Century	375924	522756	
796	Leat	Post Medieval	375936	522749	214.18
797	Dressing floor	Post Medieval	376005	522665	
798	Cairn	Uncertain	375937	522672	
799	Leat	Post Medieval	375971	522644	16.46
800	Leat	Post Medieval	375938	522668	6.13
801	Dam	Post Medieval	375907	522598	12.39
802	Pond	Post Medieval	375901	522589	
803	Hush channel	Post Medieval	375891	522561	65.99
804	Path	Post Medieval	375896	522526	16.99
805	Prospecting pit	Post Medieval	375877	522523	
806	Hush	Post Medieval	375868	522520	
807	Gulley	Post Medieval	375945	522535	9.39
808	Artefact	Post Medieval	375947	522545	
809	Leat	Post Medieval	375953	522574	101.23
810	Shaft	Post Medieval	375967	522587	
811	Hush	Post Medieval	375932	522549	
812	Level	Post Medieval	375925	522557	
813	Hush	Post Medieval	375864	522530	
814	Open face working	Post Medieval	375840	522538	
815	Dam	Post Medieval	375858	522547	
816	Prospecting pit	Post Medieval			
817	Open face working	Post Medieval	375797	522498	
818	Hush	Post Medieval	375806	522525	
819	Dam	Post Medieval	375787	522528	4.40
820	Dam	Post Medieval	375755	522504	8.38
821	Hush	Post Medieval	375763	522481	
822	Open face working	Post Medieval	375817	522511	
823	Open face working	Post Medieval	375651	522401	21.86
824	Open face working	Post Medieval	375577	522332	

UID	Monument type	Period	Easting	Northing	Length (m)
825	Open face working	Post Medieval	375544	522311	
826	Open face working	Post Medieval	375502	522263	
827	Track	Post Medieval	375866	522213	281.05
828	Hush fan	Post Medieval	375959	522332	
829	Open face working	Post Medieval	375897	522373	
830	Open face working	Post Medieval	375886	522385	
831	Open face working	Post Medieval	375859	522408	
832	Open face working	Post Medieval			
833	Open face working	Post Medieval	375827	522436	
834	Level	Post Medieval	375623	522296	
835	Reservoir	Post Medieval	375779	522362	
836	Reservoir	Post Medieval	375773	522353	
837	Open face working	Post Medieval	375806	522334	
838	Hush	Post Medieval	375804	522304	
839	Shaft	Post Medieval	375814	522354	
840	Shaft	Post Medieval	375804	522353	
841	Pond	Post Medieval	375714	522301	
842	Pond	Post Medieval	375707	522291	
843	Dam	Post Medieval	375705	522289	7.97
844	Culvert	Post Medieval	375923	522312	
845	Artefact	Post Medieval	376012	522380	
846	Platform	Post Medieval	376050	522421	
847	Track	Post Medieval	376065	522409	102.54
848	Path	Post Medieval	376457	522814	88.77
849	Military fieldwork	20th Century	376486	522673	
850	Structure	Uncertain	376478	522674	
851	Roundhouse	Prehistoric	376415	522274	
852	Cairn	Prehistoric	375389	521690	
853	Dam	Post Medieval	375819	522535	29.37
854	Dam	Post Medieval	375870	522561	19.10
855	Dam	Post Medieval	376107	522926	55.66
856	Tram wagon	Post Medieval	376183	522558	
857	Track	Post Medieval	375904	522478	92.77
858	Track	Post Medieval	375909	522433	97.39
859	Tail race	Post Medieval	376039	522348	16.51
860	Artefact	Post Medieval	376261	522746	
861	Dam	Post Medieval	376346	522920	28.25
862	Channel	Post Medieval	376327	522904	21.11
863	Cutting	Post Medieval	376331	522892	
864	Leat	Post Medieval	376068	522808	113.92
865	Dam	Post Medieval	376545	522887	23.17
866	Track	Post Medieval	376238	522650	76.19
867	Track	Uncertain	376256	522738	46.10
868	Artefact	Post Medieval	376147	522756	
869	Path	Post Medieval	375721	522555	132.91
870	Dam	Post Medieval	375708	522687	
871	Channel	Post Medieval	376088	522371	79.13
872	Opencut	Post Medieval	376507	522964	

APPENDIX 2: CONSERVATION MANAGEMENT

Based upon a model developed for English Heritage's pilot contribution to the Countryside Survey (Topping *et al* 2006), each feature recorded during the course of the present survey was assigned a level of risk:

- Immediate - feature being actively compromised and destroyed
- High - feature imminently at risk of damage, highly likely to occur if no action is taken
- Medium - feature which may be at risk from a limited amount of damage
- Low - feature unlikely to be adversely affected

Of the 868 features recorded in Scordale, 12 were identified as being at immediate risk and 30 at high risk. Approximately 25% of the remaining features were classed as being at medium risk and 75% at low risk. Unsurprisingly, the features at immediate risk are all located directly alongside Scordale Beck and are being actively eroded by river action; they are also almost all clustered around the 'core' processing area between Stow Gill and Great Augill. Given that mitigation of the risk posed by fluvial erosion is likely to prove costly and difficult, as Defence Estates' experience of dealing with the mine road (32) shows (*see below*), the conservation needs of the features at immediate risk may arguably be addressed most appropriately through a strategy of 'preservation by record'. Indeed, the most pressing needs have already been addressed through the programme of targeted detailed survey at 1:200 or 1:1000 scale and subsequent rescue excavations, whose results have already been published (Hunt and Ainsworth 2007a; Giecco 2008). In some cases though, for example the group of buddles (78) alongside Scordale Beck, the rescue excavations themselves will inevitably have speeded up the erosion of the investigated features.

Like those at immediate risk, most of the features classified at high risk are in the vicinity of the beck, but there are others higher up the valley sides. In management terms, perhaps the most challenging feature within the high risk category is the mine road (32), which stretches for approximately 3.5km along Scordale. Parts of the road are in good condition and at low risk, but other parts are experiencing active erosion and are under immediate threat. The problem of maintenance of access along this road, which is the principal route onto the higher fells but also part of the Scheduled lead mining remains, is a key conservation challenge for Defence Estates and its partners. At the south-western end of the valley, recent attempts to prevent further erosion of the track by Scordale Beck with large boulders have proved ineffective. Management of the mine road is made more difficult because it is now dealt with largely in isolation, without active engagement with the whole historic water management system associated with the mining landscape. This is a widespread issue amongst disused upland industrial landscapes, where natural flow patterns have been disrupted and managed by repeated modifications which, following the abandonment of the industrial operations, are themselves now subject to decay (Ainsworth and Burn 2010). Opposite Mason Holes, culvert 33 is at severe risk from water erosion; when the stream is fast flowing, excess water which cannot pass through the culvert is pouring across the road and running down the sides of the culvert, thus eroding the embankment of the road, which is occasionally still used by vehicles. Where the stream has braided and is widening, other water flows, which would once

have been carefully managed, are now eroding the road embankment at the rear of the culvert as well. Higher up the valley, to the south-west of the confluence of Great Augill and Scordale Beck, braids of the Scordale Beck now flow through dressing-mill 27 and encroach onto the track after periods of rainfall. Also at the northern end of the mine road, water has frequently been seen coursing down the track, apparently issuing from level 61 and posing a significant threat of water erosion. Research at Grassington lead mines in North Yorkshire suggests that the maintenance of historic culverts is particularly important in mitigating against the worst effects of fluvial erosion. In this context, it is worth noting that the track overlying culvert 35 collapsed recently but has been repaired by Defence Estates (P Abramson, Historic Environment Adviser, Defence Estates Environmental Support Team, *pers comm*).

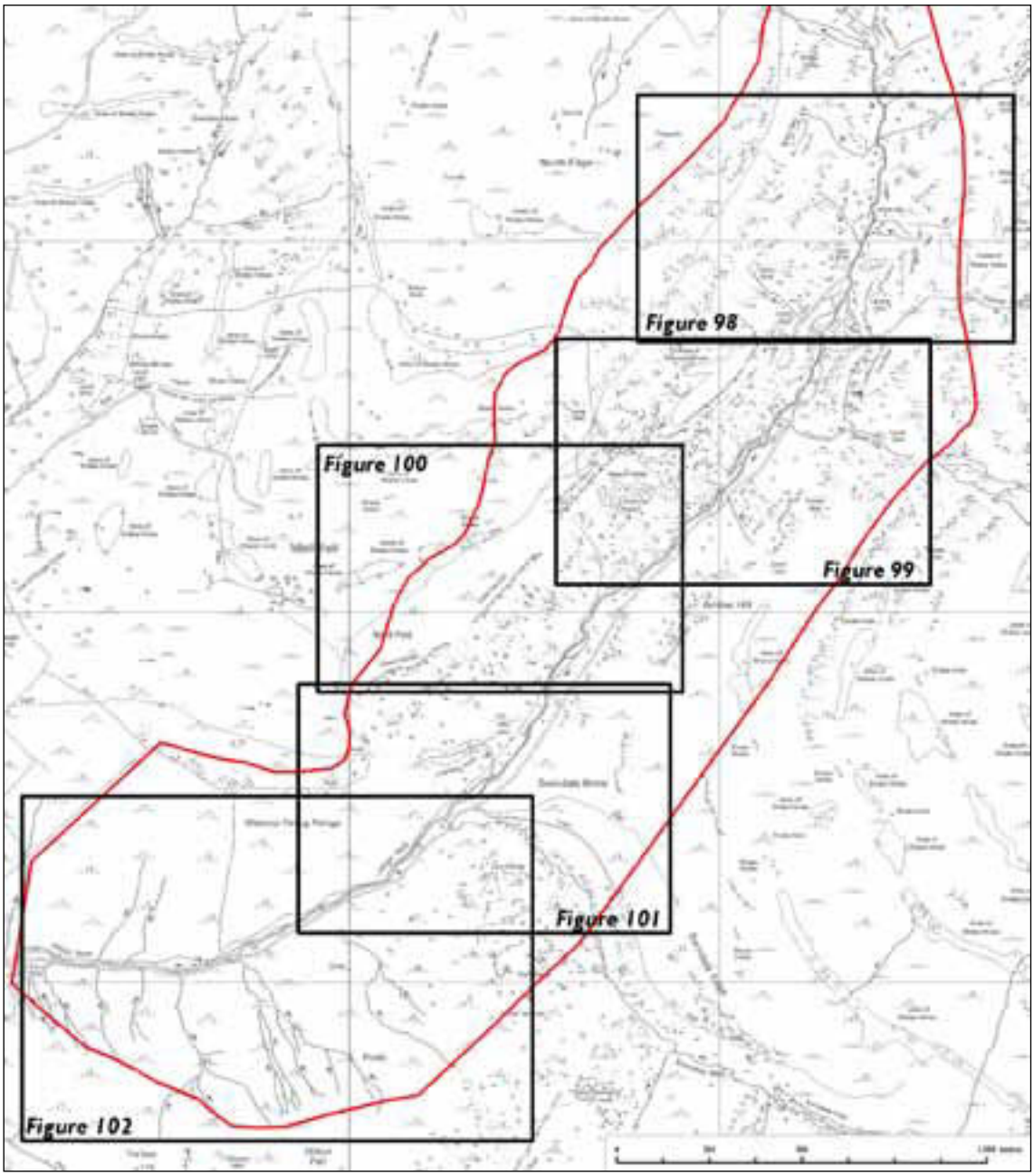
Elsewhere in Scordale, a number of features are at risk from threats that are not related to fluvial erosion. For example, the section of revetment walling (538) in the middle of split spoil heap 537 is at risk of collapse, in part due to the weight of retained spoil and the rough construction of the wall (which, when built, must have been perceived as a pragmatic short-term solution). However, this 'embedded' risk is exacerbated by the continued use of the track, which the revetment once protected, as a public footpath. A number of features built on a scree surface on the steep slopes just below High Shop are also at risk of collapse. These comprise of the fragmentary remains of a pair of ore bins (379), stone stanchions (378) and a length of drystone wall (376). Here, although a long-term risk has been embedded from the outset due to the location and the construction technique employed, fluvial erosion is again a contributory factor; leats and hush channels above this area (807, 809 and 811) potentially direct water to these features, particularly at times of heavy precipitation, washing material down the slope and causing erosion.

Given the quantity of features classed as being at low or medium risk, it is not practical to comment on individual features. However, as has previously been witnessed in Scordale, the valley is susceptible to rapid changes brought about by extreme weather episodes and fluctuating water levels, therefore, those features at medium risk could quickly change to high or immediate risk in the event of an extreme rainfall event. Monitoring of those features within the medium risk category would therefore be beneficial, particularly in the aftermath of severe weather conditions.

Clearly, many of the immediate risks facing features on the valley bottom are created by the fluctuations of the Scordale Beck. These fluctuations, whilst linked to precipitation episodes are also related to the lead mining and processing activity in the valley, both through the movement and re-deposition of waste material and the extensive water management systems constructed during the lifetime of the mines. The workings underground, with their capacity to act as reservoirs and conduits will doubtless also have played a part, but analysis of this is outside the scope of the present research.

APPENDIX 3 EXTRACTS FROM THE PROJECT GIS

The following figures (98-102) are taken from the project GIS, illustrating the position and number of the majority of features recorded during the course of the field survey, with the orthophotograph of Scordale as a background image. The survey area has been divided up into five sections to allow reproduction at a legible scale. The individual figures correlate with the areas shown on the map below.



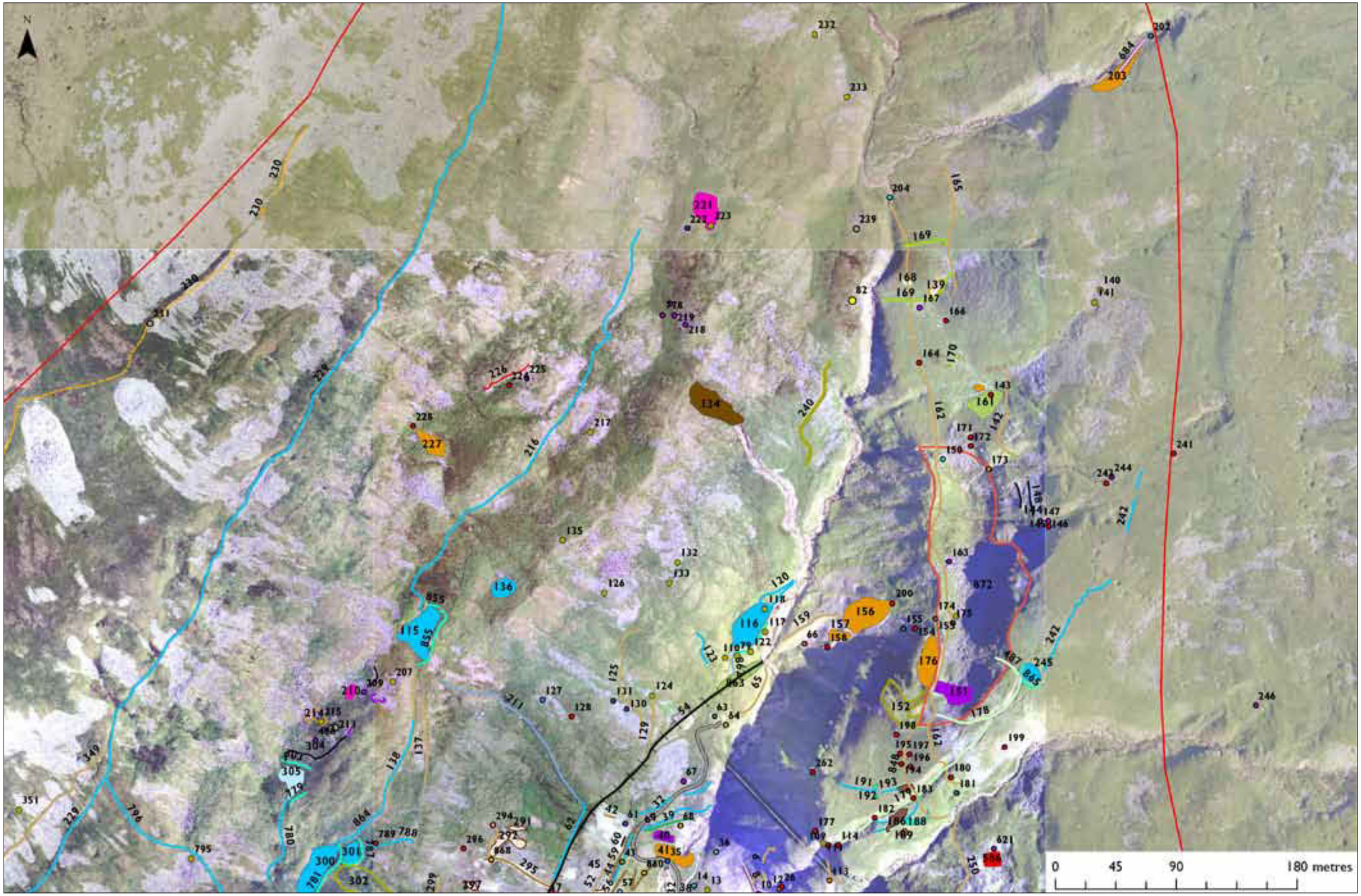


Figure 98 Extract from the Scordale project GIS showing the northern part of the survey area, with the orthophotograph as a background

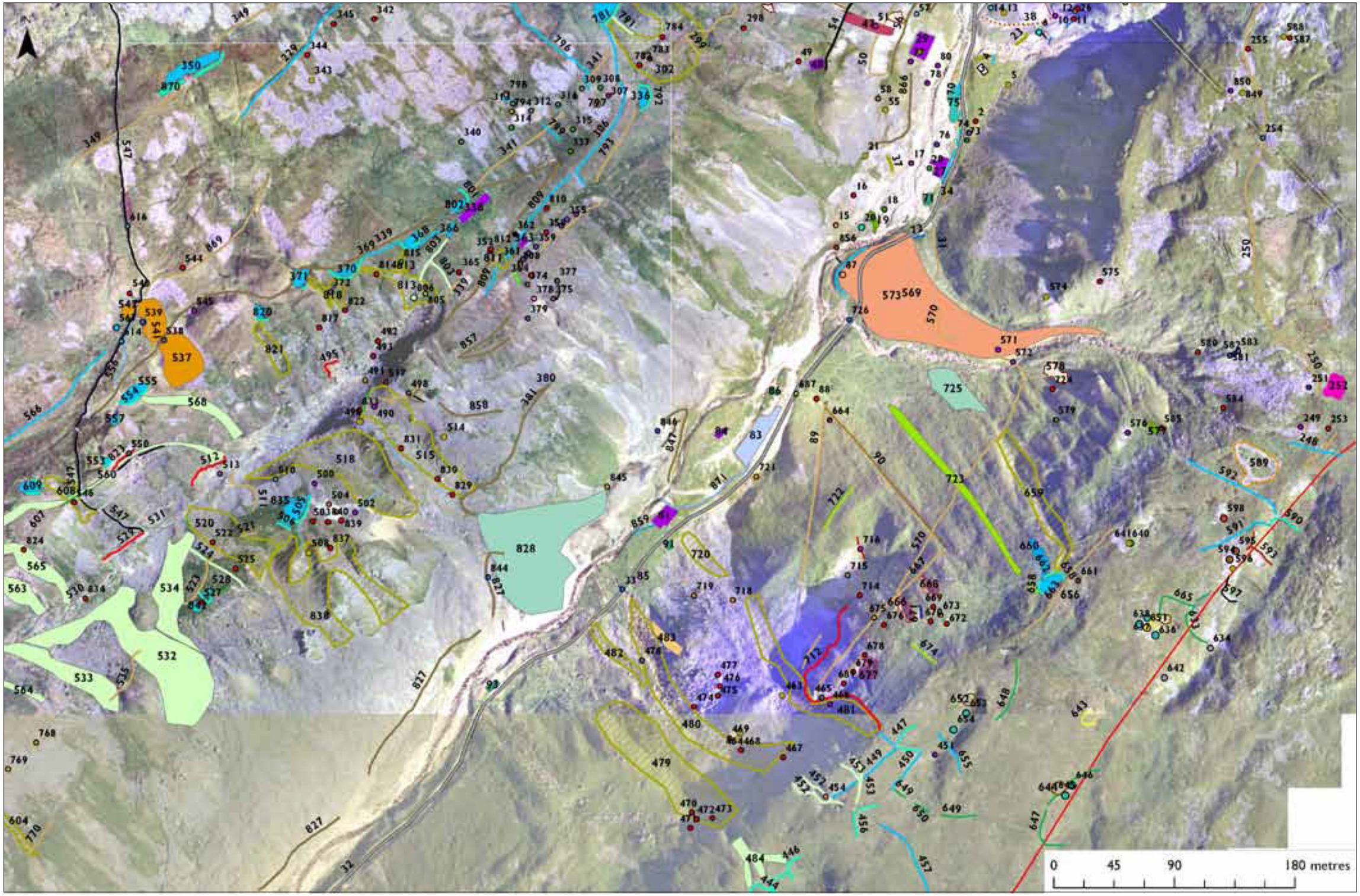


Figure 99 Extract from the Scordale project GIS showing Mason Holes, Stow Gill and Amber Hill, with the orthophotograph as a background

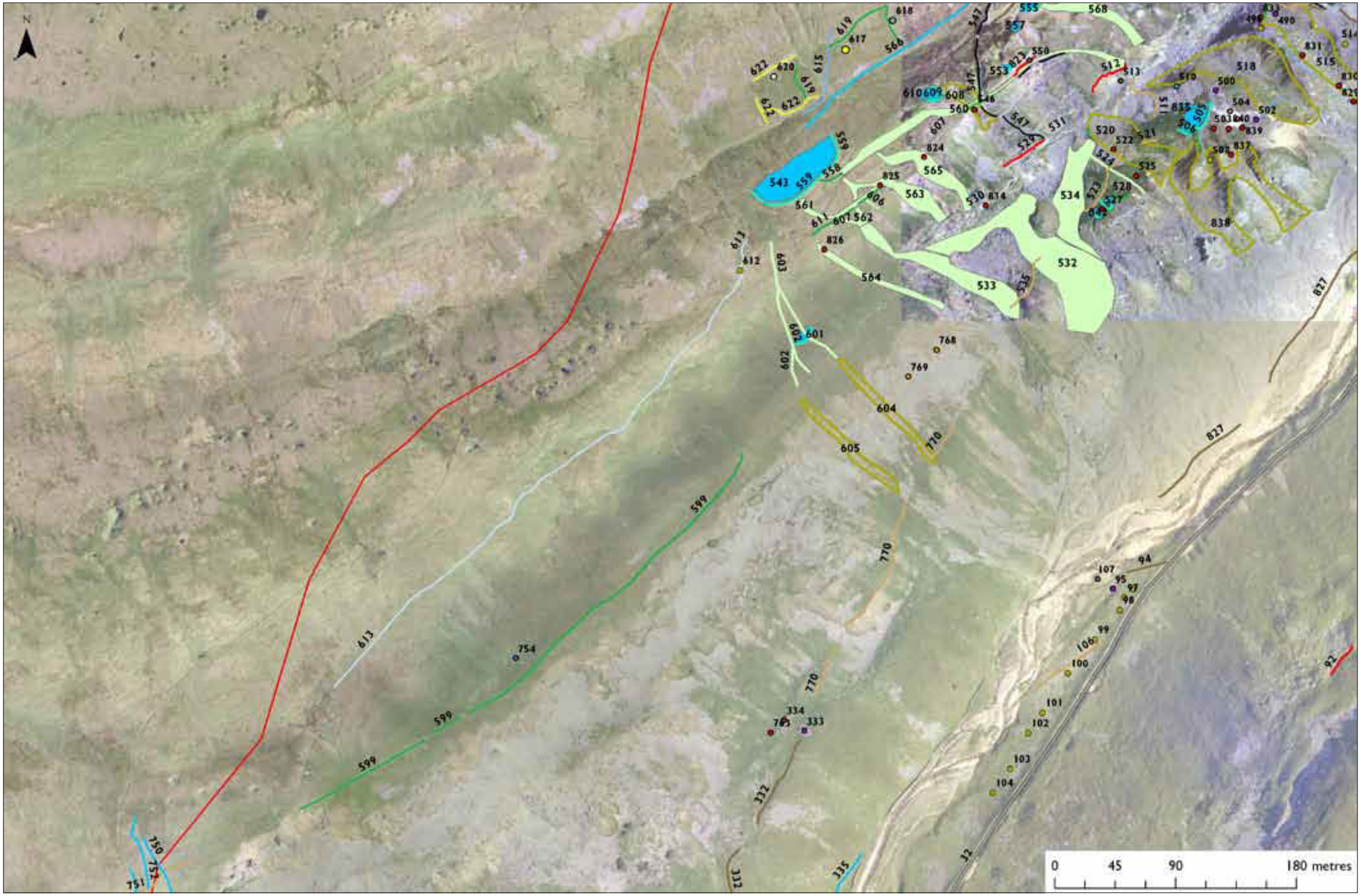


Figure 100 Extract from the Scordale project GIS showing the south-western part of Mason Holes, Little Carrath and Great Carrath, with the orthophotograph as a background

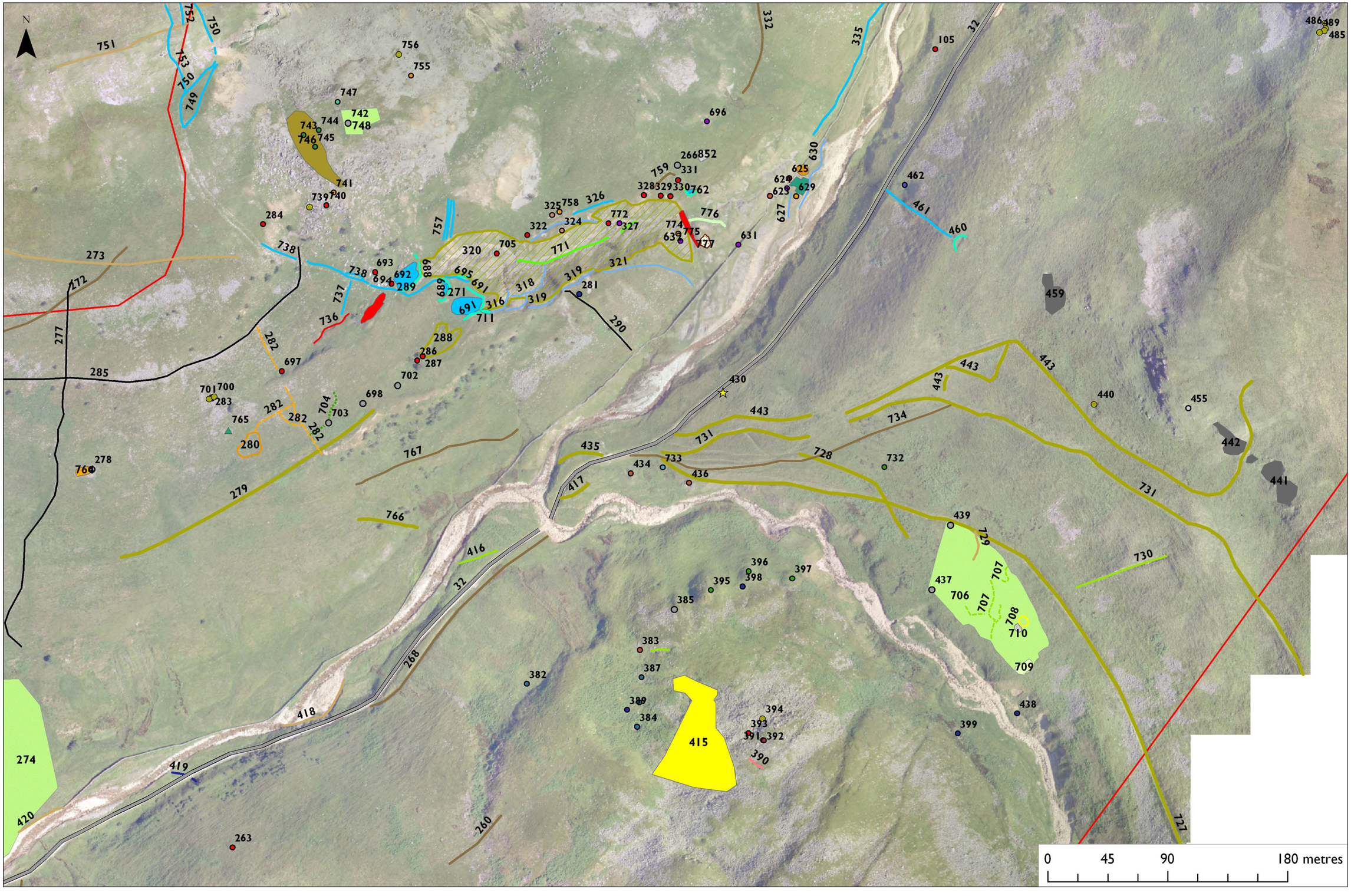


Figure 101 Extract from the Scordale project GIS showing Lowfield Hush, Low Hause and the confluence of the Swindale and Scordale Becks, with the orthophotograph as a background

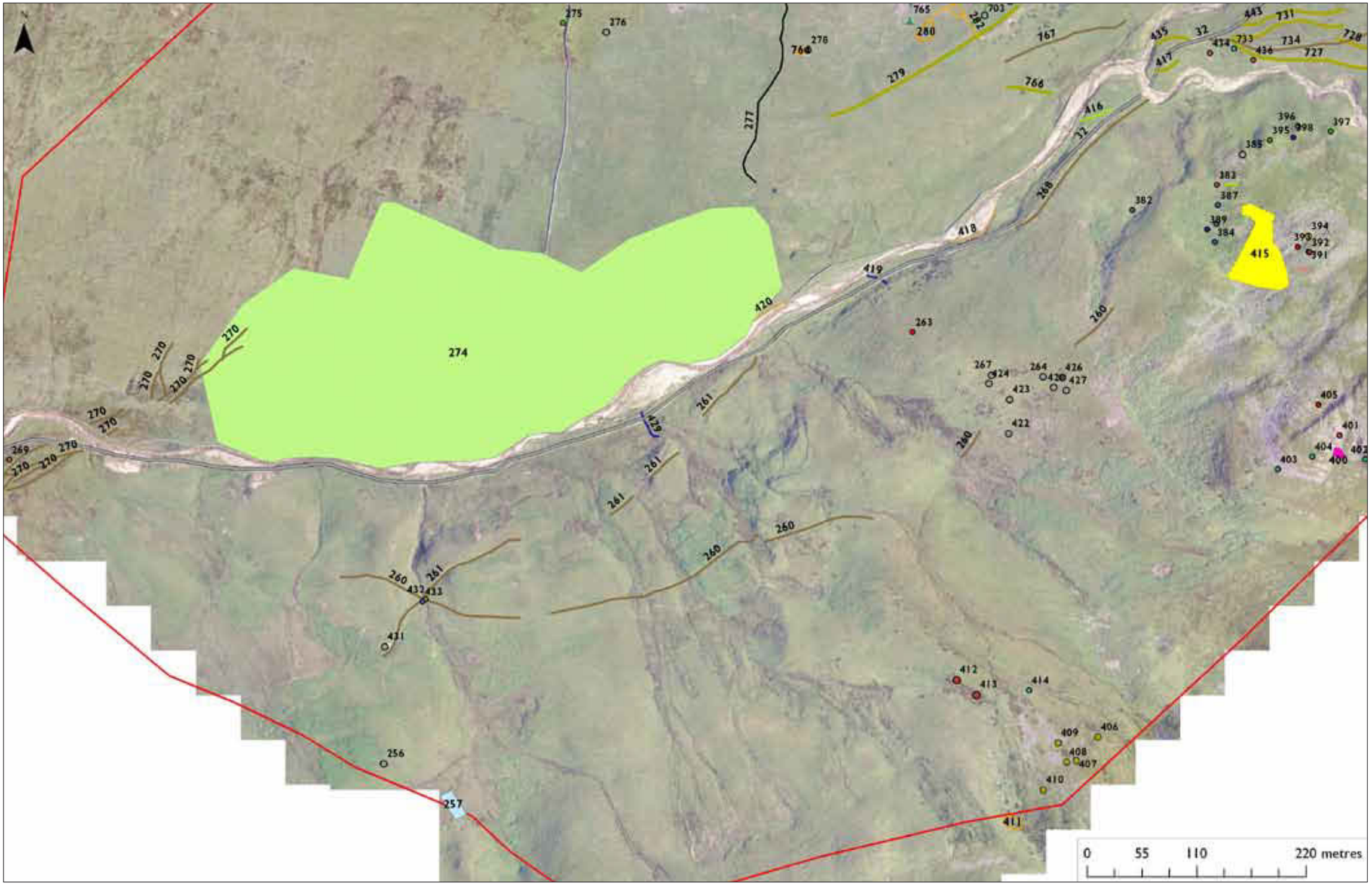


Figure 102 Extract from the Scordale project GIS showing the south-western part of the survey area, with the orthophotograph as a background



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