The Lead Legacy:
An Updated Inventory of Important Metal and Gangue Mining Sites in the Peak District

John Barnatt, Kieron Huston, Dave Mallon, Rebekah Newman, Rebecca Penny and Richard Shaw

Metal Mining in the Peak District

Introduction: Assessing the Resource

Survival and Loss

The physical remains of metal mining in the Peak District, particularly for lead, but to the west, focussed at Ecton and Mixon, also for copper, have over modern decades been one of the conservation assets most a risk in the region. Year-on-year the surface hillocks and associated structures have been removed by the modern minerals industry and as part of agricultural 'improvement'.

From Roman times until the 19th century, lead mining was the most important traditional industry in the Peak, second only to agriculture as the main livelihood of the people here. At Ecton copper was mined in the Bronze Age and in the 18th century Deep Ecton Mine was the deepest mine in Britain.

The lead mines were once common across the central limestone plateau of the region (Figure 1) and after the collapse of the industry in the late 19th century there were many waste hillocks and mining structures scattered across the landscape. However, the waste hillocks contain gangue minerals, now of economic value, and these have been extensively removed over the last century. The hillocks have also commonly been levelled or ploughed-down by farmers and other land managers.

Analysis of the orefield as a whole, using aerial photographs, has shown that only about a quarter of the mining hillocks and associated features that were present in the late 19th century survive today in reasonable condition (Barnatt 2000) (Figure 2).

There are still many significant surviving mining sites that tell us much of this once important industry (Plates 1, 2), and the hillocks are often also of great value for the diverse and rare ecological habitats they provide. Similarly, there are important geological and mineralogical features within the mines at surface and underground. However, losses have reached a critical point where action to conserve vital key sites, that represent now rare aspects of the diverse archaeological resource, is essential now. These represent over 2000 years of changing and diverse mining practice, and irreplaceable examples are at risk of being lost forever. Similarly, the hillocks have a rich mosaic of ecological communities that are at risk and with ongoing losses of access to underground workings and infilling of open-cuts the opportunities to study the geology is diminishing.

Hence, the Peak District National Park Authority set up the Lead Rakes Project in the mid-1990s to identify lead mining sites and landscapes of high conservation value, and to co-ordinate opportunities for conservation of the lead mining resource in the Peak District and identify and implement ways to achieve this.

Mine Conservation in the Twentieth Century

One of the aims of the Peak District Mines Historical Society from its formation over 50 years ago has been the conservation of the lead mining resource in the Peak District. Much assessment, negotiation and physical work has been done by members over the decades. Particular mention should be made of its Preservation Officers, now retitled Conservation Officers in line with current thinking on appropriate terminology. Jim Rieuwerts drew up early unpublished inventories of important mines and features of interest that were worthy of conservation. Similarly, both Jim Rieuwerts and Lynn Willies provided information to English Heritage with regard to proposed scheduling. There have been high-profile successes, such as the work over decades at Magpie Mine (Plate 3) and underground recording at Old Millclose Mine, but often conservation has been quietly achieved behind the scenes by persuading site owners and mineral operators to leave particular places undisturbed. The High Rake project was part of this tradition of conservation, but a new departure in that a site which had effectively disappeared from view has been resurrected.

Both Staffordshire & Derbyshire Wildlife Trusts have played a part in the conservation of important mining remains. Nature reserves owned or managed by the Trusts include Gang Mine, Rose End Meadows, Thorswood and Priestcliffe Lees. These sites are also used for educational purposes and raising awareness amongst members and the public of the conservation importance of mining remains.

Designation and Voluntary Conservation

Building upon what has gone before, latterly the Peak District National Park Authority, English Heritage and Natural England, have become more involved in conservation initiatives at Peak District mine sites. Selected sites are now designated as Scheduled Monuments, Listed Buildings, Special Areas of Conservation and Sites of Special Scientific Interest. The geological interest is often also included in the non-statutory Regional Important Geomorphological and Geological Sites (RIGGS). Conservation has been achieved at many non-designated sites through voluntary agri-environment agreements, usually for fixed terms of 10 years, with options to renew.

The Lead Rakes Project

The primary aims of the Lead Rakes Project, a partnership between the Peak District National Park Authority, English Heritage and Natural England, has included undertaking

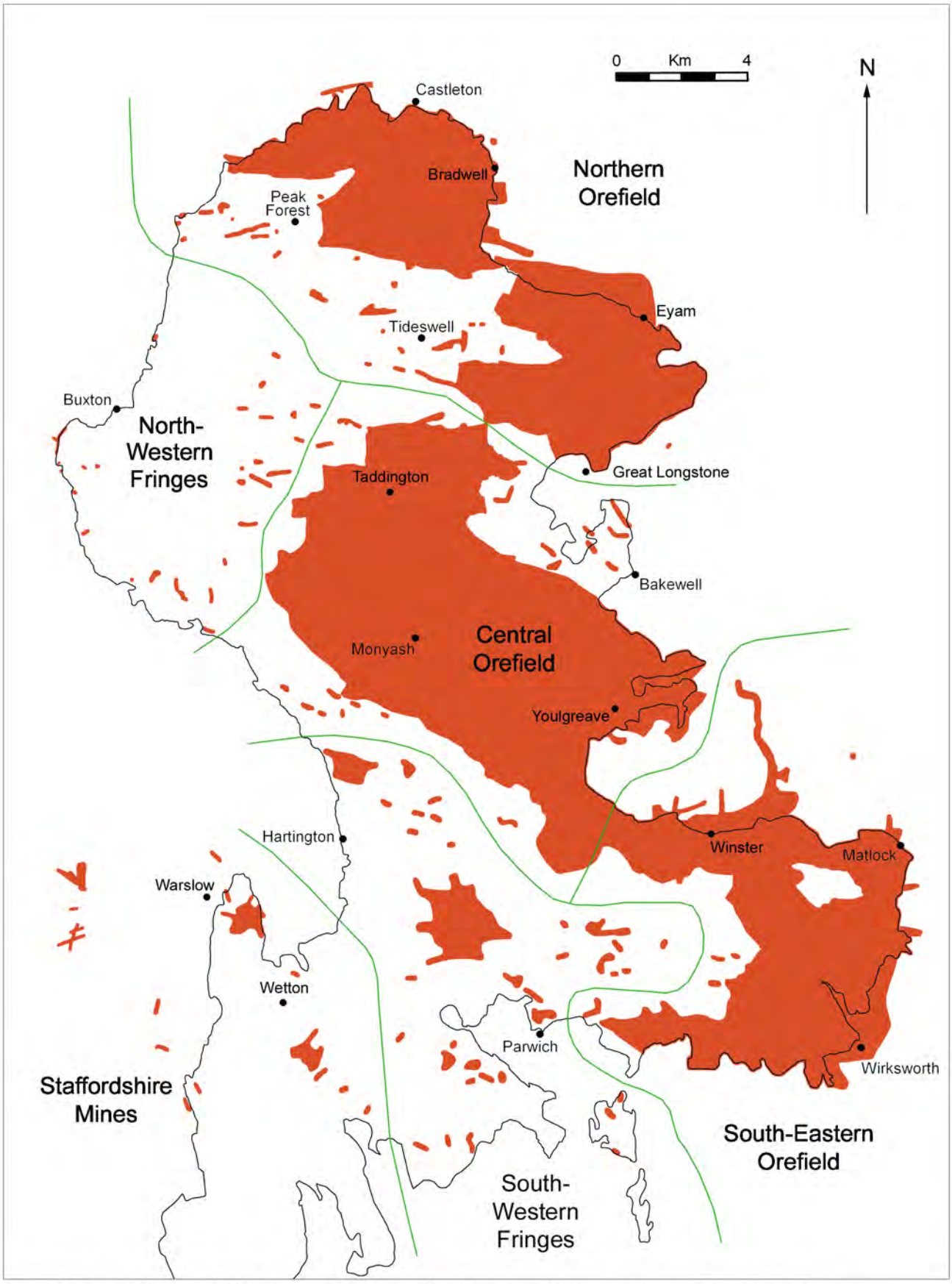


Figure 1: The Peak District Metal Mining Orefield (mining areas – red, limestone plateau edge – black line).

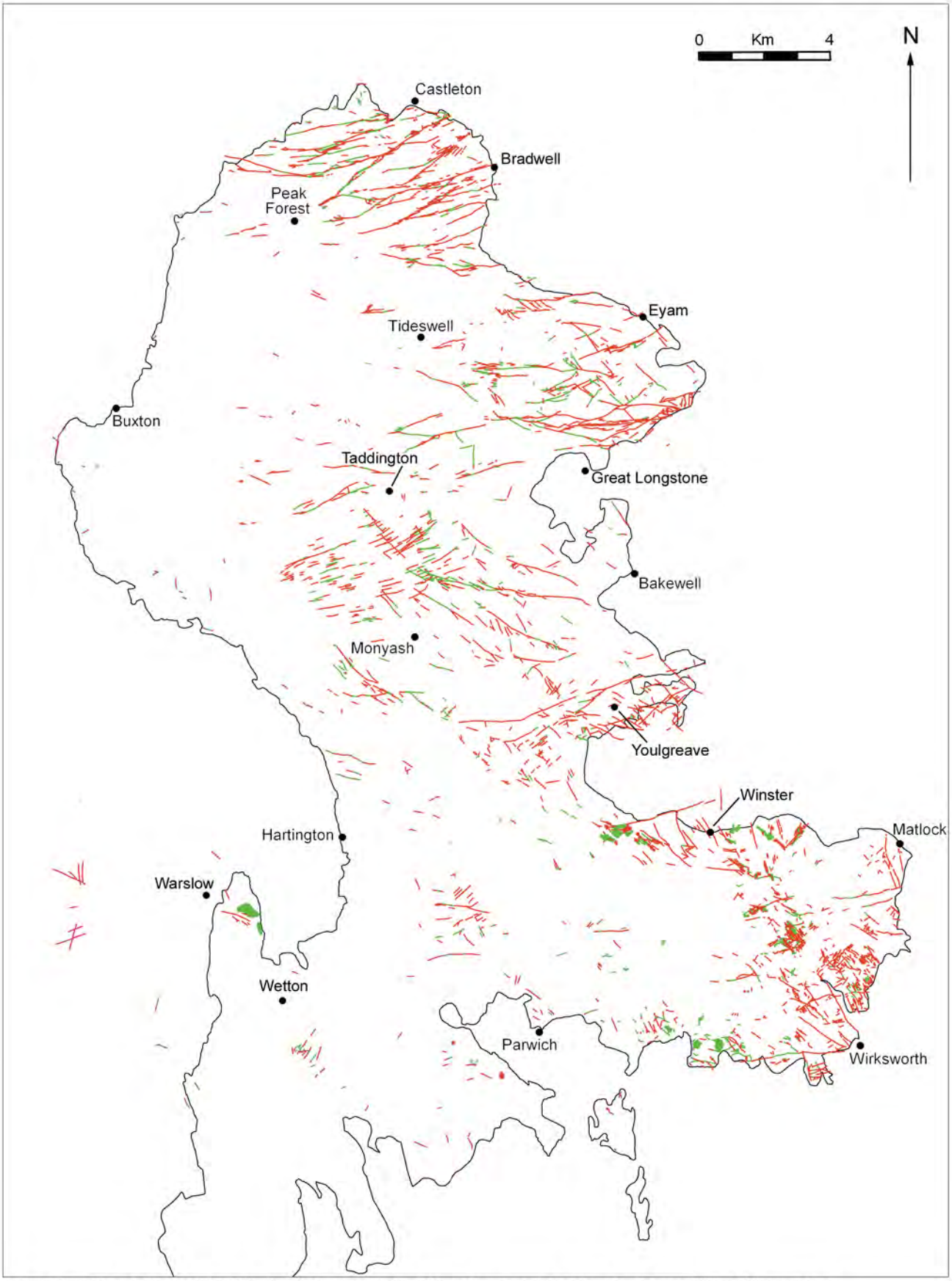


Figure 2: The distribution of metal mining surface remains, showing those surviving in reasonable condition (green) and those removed or badly damaged over the last hundred years (red).

Plate 1: The ruined pumping engine house at Watt's Engine (Site 199) is one of the little visited gems that remain from the Peak District's historic lead mining industry.

Plate 2: Site 256: The surviving hillocks around Nickalum Mine (Site 256) are a valuable heritage feature. They are particularly complex and lie over a swarm of small veins. However, an engine house and a coe in the triangular area at their heart were removed several years ago (Image: National Monuments Record, English Heritage).

Plate 3: Site 129: One of the crab winches at Magpie Mine (Site 129), with the dressing engine house behind, both at the heart of the Scheduled Monument and cared for by the Peak District Mines Historical Society for several generations.

research and fieldwork to find out more about the conservation value of metal mine sites and landscapes, set priorities, and focus conservation initiatives.

A discussion of challenges and opportunities for conservation was first presented publically in 2004 in The Lead Legacy, a report which reviewed the state of the resource, the variety of conservation interests present, and presented inventories of sites and landscapes (Barnatt and Penny 2004).

Other work of the Lead Rakes Project has included:

- Raising awareness amongst local communities and the general public of the important contribution lead mining remains make to the historic landscape and its biodiversity.
- Forging partnerships with national and local organisations and others, to promote conservation of lead mining sites.
- Safeguarding important sites by negotiating conservation agreements with farmers and landowners.
- Carrying out appropriate assessments of sites in relation to planning and development proposals.

The Lead Legacy report reviewed a series of conservation challenges and opportunities; this is not the purpose of the present report and these matters are not included here. Many of the basic issues remain the same although change has also taken place. In recent years the modern mineral extraction industry in the Peak has gone into the doldrums but it is not known to what extent this will continue long term. Some of the details of the legislative framework, planning guidelines and agri-environment schemes have changed.

Late in 2012 English Heritage reviewed the importance of several mine sites on the back of recommendations made by the Lead Rakes Project, designating 12 of these as new or enlarged Scheduled Monuments. Currently they are using the Peak District as a pilot area to investigate issues of designation at underground remains. Agri-environment agreements are constantly being reached with landowners and tenant farmers, which while of great positive value, are usually agreed on a 10 year basis and are not always renewed at the end of their term.

Inventories of Sites and Landscapes

After a long period of gestation (Jim Rieuwerts and Lynn Willies unpublished conservation lists of surface and underground sites; Barnatt with Rieuwerts 1995; Barnatt with Rieuwerts and Roberts 1996; Barnatt with Stroud 1996; Buckingham and Penny 1997; 2000a-b; 2001a-c; Barnatt 2000; Barnatt and Penny 2004; Barnatt 2004) an 'Inventory of Regionally and Nationally Important Lead Mining Sites in the Peak District' was published in 2004 (Barnatt and Penny 2004). Further detailed work and review has taken place subsequently (Barnatt 2005a; 2009; Dixon and Mallon 2010; Dixon, Mallon and Soames 2010; Mallon 2006; 2008a/b; 2010a/b; Penny 2009).

It was recognised at the time that the Inventory was first presented in 2004 that while a mature assessment of sites that were known had been made, it was not definitive. While an overview of the archaeological interest for the whole orefield had been achieved, only about half the region's mine sites had been assessed in detail for their ecological interest. Geological interests had yet to be incorporated.

A significant milestone has now been reached in that initial fieldwork assessments of geology, archaeology and ecology have been completed and the resulting inventory of sites is presented in this volume for the first time. The Inventory now includes all metal mining sites, including ores of not only lead but a small number of mines where copper, zinc and iron were extracted (with the exclusion of those at sedimentary iron deposits), and also metal mines where the gangue minerals, fluorspar, barytes and calcite have been worked.

There are now 338 sites in the Inventory. This has been compiled with the primary aim of raising awareness of the multitude of interesting aspects to the sites that have remains today, and indirectly to foster support for conservation initiatives. The sites in the revised inventory have been renumbered and a concordance is given in Appendix 1. In summary the numbers of sites in the Inventory with particular types of value are:

	Numbers of Sites		
	Main Sites (Surface Interest, with 60 also including Underground Interest)	*Underground Interest Only*	*Totals*
Geology	18	10	**28**
Archaeology	162	42	**204**
Ecology	232	0	**232**
All	**296**	**42**	**338**

Not surprisingly the geological interest is often best seen underground. Conversely the ecologically important sites are at surface; while bats are present in small numbers in Peak mines, some of which are used for hibernation, their distribution and the importance or otherwise of this habitat is currently not well understood and this is not included. Not all ecological sites with good botanical interest are also of great value for their archaeology, for plant communities can sometimes continue to thrive, if in modified composition, after hillocks have been disturbed.

It should be noted that only sites of regional and national importance are listed; there are many others where remains exist that are of local interest.

A second inventory was also presented in 2004, listing Regionally and Nationally Important Lead Mining Landscapes. This was based on the visual impact of mining hillocks and other surface features on landscape character rather than on specific geological, archaeological or ecological criteria. This remains much as it did in 2004 and The Lead Legacy report should be consulted for details.

Understanding Peak District Metal Mining Sites: A Resource with Many Interests

Lead mining was for centuries a key social and economic factor in the development of the Peak District and its landscape. Lead vied with iron for second place as Britain's major export behind wool. Britain was Europe's main producer of lead until resources elsewhere in the world were discovered in the 19th century; the Peak District orefield was one of the main sources. Thus, lead mining was vital for both the Peak District and the national economy. For several decades in the second half of the 18th century the copper mines at Ecton were of national importance, becoming the deepest mines of any kind in Britain, only matched later at metal and coal mines in the 19th century.

Metal mining has only taken place in a small number of areas of Britain, often in upland contexts, and the surviving remains are thus a nationally-rare conservation resource. The lead mining sites in the Peak are particularly important because of their exceptionally extensive surface remains of archaeological and ecological value. This results from the unusual mineralisation here, commonly present at surface, where there is a multitude of outcropping veins. Thus, there are high numbers of surface hillocks, mostly derived from over 25,000 shafts that once dropped to underground workings. Other orefields have different but important characteristics, as for example in Cornwall which is well known for its 19th and 20th century engine houses, now viewed as icons within the county, or the Northern Pennines where there is a variety of impressive but very different 19th century mine complexes. In contrast, lead production in the Derbyshire orefield peaked at an earlier date and thus there is a wide variety of important features that are relatively uncommon elsewhere.

The lead mining sites in the Peak support rare metallophyte-rich (calaminarian) grasslands, with metal-tolerant species, that are of international importance, designated as Special Areas of Conservation (SAC), a European designation. At Gang Mine the calaminarian grasslands are the primary reason for SAC designation whilst within the Peak District Dales they are a qualifying feature but not a primary reason for site selection. Sites of archaeological, biological and geological interest are designated as nationally important Scheduled Monuments, Listed Buildings and Sites of Special Scientific Interest. Within Derbyshire and Staffordshire, outside the national park, a number of sites have also been designated as Local Wildlife Sites. Within the national park the most valued sites where we are targeting pro-active conservation action are also provisionally being called Wildlife Sites.

In many cases individual sites have multiple interests which make them particularly valuable assets (Plate 4). These are listed in Appendix 1.

Mining History

The origins of lead mining date back at least 2000 years to the Roman era and possibly before. Lead ore was being worked in Anglo-Saxon times from at least the 8th century and throughout the medieval period. Output from the mines reached a peak during the 17th and 18th centuries. At this time production was often on an industrial scale, the ore removed from deep underground with the aid of engines, and using pumps and drainage levels to dewater the mines. Alongside this, mining was also commonly undertaken by miner/farmers across the orefield, who continued using simple methods to produce small quantities of ore to supplement other income. At Ecton copper was worked in the Bronze Age and interest in this metal revived in the 17th century AD. Very large quantities of copper were extracted from c. 1750 to 1790 until the richest deposit failed at depth, although mining ventures continued here until the late 19th century. After about 1860 there was a rapid decline in the numbers of people employed in lead mining in the region as a result of foreign competition and the last large lead mine closed in 1939 (Barnatt 1999a; Barnatt and Smith 2004; Ford and Rieuwerts 2000; Great Hucklow 2009; Kiernan 1989; Porter and Robey 2000; Rieuwerts 1998a; 2007a; 2008a;; 2010a; 2012a Willies 1986; 1999; Willies and Parker 1999; Wood

Plate 4: The multiple veins at the Linacre and Slitherstone mines (Site 8), looking south-west, are a classic example of lead mining features which have multiple interest. The hillocks in this area are within a Scheduled Monument and ecological and geological SSSI's (Image: National Monuments Record, English Heritage).

1999). In modern times fluorspar and barytes have been the main commodities mined at the traditional lead mining sites, although lead ore is still recovered as a by-product.

Early Mining - Lead has been used in very small quantities for ornaments and ritual objects since Bronze Age times. Copper, one of the main constituents of bronze, was certainly mined at Ecton near Warslow, Staffordshire in the Bronze Age, sometime between 2000 and 1500 BC, as indicated by the discovery of bone and antler mining tools there which have been radio-carbon dated (Barnatt and Thomas 1998; Timberlake in press).

The main direct evidence for Roman mining is the discovery of several inscribed lead ingots, known as pigs, found locally and as far away as Normandy. We know from documentary sources that the Roman administration for the orefield was based at Lutodarum and this name appears on the pigs. However, it is not clear whether this was a specific place, a name applied to the orefield as a whole, or even the name of a company who were in charge of production. Archaeologists have searched for Lutodarum without conclusive success, although a site now flooded by Carsington Reservoir is one strong candidate.

One of the main interests in lead for the Romans (and for people in later times), as with lead ores wherever they occurred across the Roman Empire, was that they were the main source of silver. This is often a small but significant component of the ore and the presence of rich metal sources in Britain was probably one of their main incentives for Roman occupation. In the Peak orefield they may have been disappointed, for the ores produced in post-medieval times at least were usually particularly poor in silver. However, there were exceptions, as at the Ball Eye Mines in the Via Gellia west of Cromford. It is also documented that late Anglo-Saxon mines in the region were producing silver and it may be that silver-rich ores were targeted and largely worked out at an early date.

Documentary evidence for mining in Anglo-Saxon and Medieval times is sparse, as it is for industry anywhere, but enough is known to indicate lead mining was widespread and well established in the Peak. From at least the early 8th century through to the late 9th century mines around Wirksworth were controlled by the important Mercian abbey at Repton in the Trent Valley. In 714 they sent a leaden coffin, for the remains of St Guthlac, to Crowland Abbey in Lincolnshire. After the collapse of the Danelaw in the early 10th century, many of the mines in the Peak were controlled by the English kings who owned large

Plate 5: All that stands today on the large hillock of the once important Ladywash Mine (Site 47) is the chimney of a 19th century lead mining engine house, with more modern buildings used when the shaft was used to bring fluorspar to surface in the 20th century. The fenced shaft top is in the foreground. Archaeological remains at disused gangue mines are rare and while more modern are just as important.

estates here. Domesday Book of 1086 recorded significant lead production based at royal manors at Ashford, Bakewell, Matlock, Wirksworth and Crich, with a mention of further pre-conquest production at Hope. Later medieval documentation gives a similar picture. Lead was in great demand in the 11th to 13th centuries to provide roofs and plumbing for the many cathedrals and abbeys built throughout England at this time; a significant proportion came from the Peak District.

From the medieval period onwards, and probably at earlier dates, much small-scale mining was carried out by miner/farmers, while larger ventures were probably worked by full-time miners. In medieval times all lead mines were probably either surface opencasts cut into vein outcrops and/or underground workings that were rarely more than 30-50m deep, dug using simple methods and tools. In exceptional circumstances, as at the easily worked pipe and atypical vein deposits on Masson Hill at Matlock Bath, extensive underground mines existed and these are some of the largest identified metal mines of this date in Britain (Barnatt and Rieuwerts 1998; Barnatt and Worthington 2009).

Post-Medieval Mining - By the end of the medieval period most workable rich deposits were becoming exhausted above the water table. From the 17th century onwards, deeper and much larger mines were developed. This required investment capital for drainage and haulage and thus such mines were often controlled by the landed gentry and an emerging group of wealthy industrialists. Alongside the larger ventures, miner/farmers continued to supplement their income from agriculture by mining smaller veins at slack times in the farming year. Such mining continued to use the simplest of extraction techniques and underground workings were usually relatively shallow, entered by small shafts. Because easily won deposits were becoming rare there was increasing use of firesetting in the 16th and 17th centuries, using coal to burn the limestone within which thin veins with lead occurred, in order to follow these lesser deposits. Miners often had smallholdings to supplement income from mining.

By the 17th century, larger mines had become so deep that flooding of workings was a severe problem and drainage levels known as soughs began to be driven to lower local water tables (Rieuwerts 1987). In a few instances waterwheels, both at surface and underground, were also employed for pumping. Another approach adopted at large mines in the 18th and 19th centuries was the installation of steam-powered pumping engines. Similar but less powerful engines were also used for winding ore up engine shafts at the largest and deepest mines from the late 18th century onwards. More commonly, mines used less expensive horse-powered engines, which had been employed from the 17th century. Engines were essential at all mines where shafts were over 50-75m deep; hand winding became increasingly difficult to the point of being impossible with depth because of the weight of the rope needed.

One technological advance, which was eventually adopted by mines of all sizes, was the use of gunpowder for blasting. In the Peak District this was first used in the 1660s (Barnatt et al. 1997; Rieuwerts 1998c), and had become common by the mid-18th century at latest. The use of gunpowder allowed ore to be extracted far more efficiently, and shafts and levels to be driven through hard limestone far more easily. This allowed many new workings to be created, following mineralisation that previously had been effectively inaccessible.

These developments led to a great increase in lead output in the 17th and 18th centuries in the Peak District orefield. This was also linked to improvements in smelting technology and changes in attitudes towards industrialisation that went hand in hand with a demand for the mined product. However, in the 19th century remaining sources of ore to be obtained at a profit became scarce and competition from other orefields such as in the Northern Pennines led to a decline in the importance of the Peak District mines. All mines in Britain found it increasingly difficult to compete in the second half of the 19th century as rich reserves were exploited elsewhere in the world, flooding the market and lowering the price that local lead could be sold for.

Extracting Gangue Minerals - Lead mining in the Peak went into terminal decline in the late 19th century, with the exception of the rich Millclose Mine at Darley Bridge, which worked until 1939 (Willies 1986; Barnatt 2012). From the early-20th century to the present, lead mining sites have been extensively reworked for gangue minerals (Plate 5). Those of economic worth are primarily fluorspar, barytes and calcite, while lead is still a valuable by-product.

These minerals are known to have also been worked in the 18th and 19th century, sometimes with these being the primary resource rather than by-products at specific mines. Barytes was used for example in paint manufacture and fluorspar as a flux for smelting, but currently little is published on the history of the exploitation of these resources.

Miners and Society - The formal organisation of the lead mining industry included a complex series of mining laws and customs, which directed how mining was to be carried out (Ford and Rieuwerts 2000). As with any industry, many local traditional terms evolved associated with Peak District mining, its geology, the methods used and tools employed (Hooson 1747; Rieuwerts 1998a). These include such strange terms, picked here at random, as bing (high grade ore), bouse (undressed ore), cackle mackle (inferior ore), foudenheads (small picks), knocking (breaking ore) and woughs (the walls of a vein).

The laws and customs for Derbyshire were first codified and set down on paper in the Quo Warrento of 1288 (Rieuwerts 1978). By this date they were obviously ancient and may well have evolved in late Anglo-Saxon times if not before. The region was divided into areas of mining activity known as Liberties, largely based on traditional Royal estate and private manorial boundaries (often the present parish boundaries). On royal estates, which were extensive, the Crown held the lead mining rights and royalties, called the Queensfield or Kingsfield of the High Peak and Low Peak (also known as the Soke and Wapentake of Wirksworth); this has now been the case for over a thousand years. Over recent centuries these royalties due to the Crown have often been leased out. Outside these areas there were a number of private Liberties, with prominent owners including the Dukes of Devonshire and Rutland, and here somewhat different mining customs often applied. The mineral rights for Staffordshire were all in private hands in post-medieval times and traditional miners' law had ceased to operate.

Traditionally lead miners have been allowed to mine anywhere without hindrance from landowners except under churchyards, gardens, orchards and highways. Payments were made of 'lot' (a fraction of the dressed ore paid to the owner of the mineral rights) and 'cope' (a price per load of lead, collected from lead merchants who purchased the ore from the miners and paid to the Crown or the lessee in lieu for them having the first right of purchase). In addition tithe was often paid to the church on the basis of the traditional belief that lead was alive in the sense that it grew again in old workings. The majority of income was retained by the individual miners or the companies for which they worked, although any profit was often negated by the costs of non ore-producing development work and purchase of equipment and materials necessary to continue mining.

Lead mining in Derbyshire has traditionally been overseen by the miners' Barmote Courts, each with its steward, a barmaster appointed by the Crown or Liberty owners, deputies and jurymen. These courts met regularly and frequent inspections of mines were made to execute routine court business. They commonly presided over ore measurement, the collection of lot and cope, and the freeing of newly found or unworked veins. When necessary they gave verdicts on deaths in mines, disputes over title, payment of mineral debt and forfeiture of shares.

In smaller mines, the miners usually worked for themselves, often part-time, frequently in small groups or 'companies'. In many cases there were also non-working partners, often comprising local lead merchants and smelters, or local landowners, shopkeepers and tradesmen, who contributed the investment necessary for materials and tools to make the mining possible. At larger mines in post-medieval times, companies of mining 'adventurers' were formed to provide the high levels of capital to develop deep mining. Here, miners were employees in all but name, although they frequently moved from mine to mine depending upon where the most money was likely to be made, or in harder times where work was on offer. They commonly worked in small gangs and pre-arranged bargains were struck, either as a price for the amount of dressed ore produced or for a specific non-ore producing task, each lasting a period of several weeks. Other members of the workforce, carrying out labouring tasks such as pumping and ore winding, were sometimes paid wages. Prior to the 19th century the investors in mine companies were usually people in the lead trade or local landowners, who were well placed to calculate the risks involved. However, in the 19th century several speculative ventures were set up that relied on advertising for shareholders, many of whom lost their money as these mines never had any realistic chance of success. It was generally the lead merchants who bought, transported and smelted the ore who made the most money, for they did not take the risk that a mine would prove poor in ore. While fortunes of individual mines often fluctuated wildly, there were normally sufficient mines in work to provide a regular supply of ore.

At all mining ventures there was a social hierarchy. At the top were owners or lessees of the mineral rights, followed by mine owners and lead merchants together with the Barmote steward, the barmaster and his deputies. Miners were held in relatively high regard and the more experienced and successful often served as jurymen at the Barmote Courts. Bottom of the list were the general labourers underground and the surface workforce. At larger mines, the hierarchy was more complex, with overseers, agents and managers, as well as technical experts, including the engineers who installed engines, steam-engine operators, and surveyors, often referred to as plumbers and diallers. These people were mostly regarded as of greater importance than the underground workforce.

Normally it was men who worked down the mines carrying out the heavy work, with boys carrying out lighter tasks. Mining of the ores, using hand tools, firesetting and gunpowder, was undertaken either by small companies of working miners for themselves, or at larger mines often by 'cope bargains'. Here a gang of copers undertook to mine, raise and dress ore ready for sale and received an agreed proportion of the money received for the ore. Similarly, in the 19th century, tutmen drove levels and worked the veins above and/or below them. The men who extracted ore were more generally called miners, pickmen and hewers. A second type of work in larger mines, where tasks were separated between different men, was known as 'bargain work'. This included a wide variety of tasks where no direct profit could be made from the ore, such as driving levels, sinking shafts, filling kibbles and drawing then up shafts to be unloaded, installing platforms and ladderways and operating hand pumps. Some jobs were seen as specialist tasks, such as the driving of drainage levels undertaken by soughers, and operating mechanical pumps and winding engines by engine men. Boys working underground had several common jobs. As bearers or carriers they moved ore and waste from the

forefield along levels to shaft bases or to stacking areas. They also operated ventilation bellows and helped with underground ore-dressing and shaft work.

At many mines woman and children did much of the surface dressing work, under a variety of names that describe the tasks. Swillers gave the ore from underground an initial washing. Pickers sorted the ore into different grades. Knockers and chippers removed adherent gangue from good quality lead ore with a hammer and broke-down other ore for further processing. Servers kept the sieve full of ore during the dressing process and carried away the processed ore. Cavers, often old women, searched and reworked hillocks for discarded ore. Men sometimes carried out the heavier work at surface. Drawers wound the ore from underground, while others helped sieve the ore and emptied buddles. By the 19th century there were fewer women at mines; it is thought they had opted for more attractive employment in the industrial mills that had been established in the area!

Mining has always been a hazardous industry and it was inevitable that fatalities occurred. For example, men falling, drowning and being buried by roof falls were recorded in the Peak Forest Liberty where, perhaps surprisingly, only 7 deaths were recorded between 1752 and 1856 (Heathcote 2001).

Lead Production - In 1700 Britain was Europe's largest lead producer and the Peak District orefield made a significant contribution (Burt 1984; Willies 1986; 1999). At the end of the 18th century the price of British lead started to fall and by the 1830s there was a nadir with little mining taking place. In the Peak District the industry never recovered, and although there were short-term recoveries in fortunes, local mines found it hard to compete as rich ore sources were developed in other parts of the world, with British prices falling to disastrously low levels in the 1870s-90s.

The fortunes of any lead miner or mine owner were very dependent upon the world price of lead which fluctuated significantly over the decades, metal mining having always been notorious in this respect. In some years the mines wouldn't make a penny. If the miners were lucky and rich ore deposits were found, large sums of money could be made quickly. However, this was very much the exception. It was the chance of making a fortune that prompted continued work and investment. However, if all investment and labour is accounted for over the last 500 years, including the costly failures as well as the occasional notable success, it is debatable whether the Peak District orefield made an overall profit.

Many small-scale mines existed, often worked only spasmodically as a supplementary income to farming. It appears that by the 19th century small-scale mining was commonly little more than an informal form of poor relief, or a way of supplementing income to provide beer money or small sums to purchase other inessentials. Full-time miners also supplemented their income with smallholdings; when working on cope bargains sometimes little was earned and a fallback position was essential. In the parishes of Elton, Winster and Bonsall, which had many mines, this farming connection is still clear, for many of the small fields surrounding the mines contain ruined smallholding field barns built for the shelter of stock and the storage of hay.

Whilst the last large lead mine closed in 1939, the Barmote Courts still meet annually to administer any lead production as a by-product of the mining of gangue minerals, although currently they have little formal business.

Geology and Minerals

The South Pennine Orefield, as it is formally known, is one of several similar orefields in the UK that are hosted in rocks of Lower Carboniferous age. In all of these orefields the Carboniferous (Dinantian) limestones are the principal host rocks for the predominantly lead/zinc, and less frequently copper, mineralisation. The gangue minerals, which comprise the majority of the mineralisation present in the veins, consist of varying proportions of fluorite, barite, calcite and, sometimes, dolomite, ankerite and quartz. The other orefields are the North Pennine Orefield, which comprises two separate areas, the Alston and Askrigg Blocks separated by the Stainmore Trough, the Mendip Orefield and the North Wales (Halkyn and Minera) Orefields. There are several 'outliers' to these main orefields including The Great Orme, Staunton Harold and Middleton Tyas. The style of mineralisation in all of these orefields is similar but each has their own specific characteristics which are in part controlled by differences in the geology of the host rocks. It is beyond the scope of this paper to describe these orefields in detail but the interested reader is referred, for example, to Dunham (1990), Dunham and Wilson (1985), Earp (1958), Ineson and Ford (1982) and Jones *et al.* (1994) for further information.

The majority of the lead-bearing mineralisation is confined to the Carboniferous Limestone at the centre of the Peak District (Aitkenhead *et al*. 1985; Chisholm *et al.* 1988; Cope 1998; Ford *et al.* 1993; Ford and Rieuwerts 2000; Ford 2002a; Quirk 1993; Stevenson and Gaunt 1971). These beds form a high undulating plateau dissected by many dry valleys and the cliff-lined gorges of the rivers Derwent, Wye, Lathkill, Bradford, Dove, Manifold and Hamps. These valleys had a significant impact on mining in that they naturally lowered the water table so that ore-deposits could sometimes be followed downwards to a significant depth without the workings flooding. This situation is made more complex by intermittent beds of volcanic basalt, usually known to miners as toadstone, and by thin beds of volcanic clays known as wayboards. These often created perched water tables which hampered mining. On three sides (north, east and west) the plateau is surrounded by overlying shales cut by major valleys and by high gritstone uplands. To the south the shales overlying the limestone are largely obscured by the overlying Triassic strata which unconformably rest on the Carboniferous succession. The northern and eastern parts of the plateau have particularly rich mineralisation, and here deposits were sometimes followed by miners under the overlying beds. This is the case at some of the orefield's richest mines including Millclose Mine, Odin Mine, the mines beneath Hucklow Edge and some around Matlock.

The primary mineralisation, deposited from mineral-rich hydrothermal waters passing through weaknesses in the bedrock, is most commonly found in veins following faults in the rock. These usually cut the rocks near-vertically and run in lines across the landscape, often tending to be roughly east/west in orientation. The larger veins are often a few kilometres long and sometimes several metres wide. These were known by lead miners as 'rakes'. Smaller veins are common, often branching from rakes. These were known as 'scrins' and are often short and only a few centimetres wide. Between the two extremes there were no hard and fast rules as to which term was applied.

Mineralisation is also found in a range of other morphological styles of deposition. One relatively-common morphologically-similar type of deposit, but with a variety of geological explanation, was collectively known by miners as 'pipes'. These tend to run irregularly through the rock. They are often formed following ancient cave passages. Here, the passages are in some cases lined (or sometimes filled) with layers of solid mineral. In other cases there are irregular deposits where the mineral is widely inseminated into the host rock from lines of weakness. Another type of mineralisation deposit was identified by miners and known as 'flats'. Here the mineralisation followed the near-horizontal bedding of the limestone. In some cases miners encountered veins, pipes and flats together, with complex ore bodies that were difficult to categorise simplistically.

The primary mineralisation has been re-worked by a number of processes to form secondary mineral deposits. Here the original mineralisation has been eroded and redeposited in sands and

Plate 6: (Top Left) Townhead Vein, Magpie Sough. The vein is about 1 m wide consisting almost entirely of white calcite with traces of galena.

Plate 7: (Top Right) A small vein typical of those worked in parts of the Via Gellia in the roof of Goodluck Mine. The vein is approximately 25cm wide and comprises mainly calcite and barite, some fluorite and minor galena adjacent to the limestone walls.

Plate 8: (Bottom Right) The base of a pipe associated with New Rake accessible from the Boulder Piles in Speedwell Cavern. The pipe consists of galena and barite at the base overlaid by a thick layer of coarsely crystalline calcite. Field of view approximately 30 cm.

Plate 9: A flat vein near Dale Shaft in Masson Mine. Comprising mainly fluorite, with calcite, barite and galena (Photo Dave Webb).

Plate 10: Lumps of detrital galena from Speedwell Cavern. The larger pieces are typical pieces of barite/galena ore. These are probably representative of lead ore found in some of the easily worked sedimentary deposits containing derived galena that have been worked in most parts of the Peak District and led to short term high outputs. 1p coin for scale.

gravels which may be associated with mineralised veins and pipes and in later active cave systems. These deposits were sometimes lead-rich, were easy to mine and sometimes known as 'gravel ore'.

The commonest lead ore found in the Peak District is galena, lead sulphide. In some veins this was altered to cerussite (a lead carbonate), and other secondary lead minerals such as pyromorphite (lead phosphate), as a result of near surface weathering processes. Other metal ores are present, usually in smaller quantities, include ores of zinc (commonly sphalerite and as secondary smithsonite), copper (commonly chalcopyrite and as brightly-coloured secondary coatings of malachite, azurite and aurichalcite) and iron (commonly as earthy deposits of ochre). Nickeliferous pyrite (bravoite) and chalcopyrite are often present, commonly as small inclusions in the other primary vein minerals.

The metal ores typically form only a small percentage of the vein, pipe or flat. Lead miners would consider themselves lucky if these ores reached 5% of the total and commonly the ore was only intermittently rich in any given working. The majority of veins, pipes and flats were largely filled with non-metallic minerals known to miners as gangue. Three minerals are particularly common - fluorspar or fluorite (calcium fluoride), barytes or barite (barium sulphate) and calcite (calcium carbonate), all of which have been commercially produced from the orefield. Many other minerals have been identified in small quantities that have normally not been mined in their own right.

There is significant variation across the orefield in the detailed character of the mineralisation and the mining response to this. This has been reviewed in some detail (Ford 2000; 2001; 2002b; 2004, 2005; 2008; 2010; 2012) and the selection of sites of geological importance in the Inventory reflects this.

Historic Landscape Character

The surface remains left by lead miners are a key element in the Peak District's historic landscape character that we have inherited from past generations (Barnatt 1999b; 2003b). While much has been lost and some areas now have only local survivals, there are still parts of the region's limestone plateau where swathes of prominent hillocks add significantly to its character at a landscape scale (Plate 11). Here one can still walk and see the evidence of past mining running as far as the eye can see. In some places there are distinctive discrete lines of hillocks following veins running across the land, in others field after field has hollows and hillocks in profusion where there are swarms of veins and pipes.

The hillocks amongst the walled fields give this limestone landscape a unique character that tell us of the many generations of farmers and miners who gained a livelihood from these two major traditional sources of income in this upland region. The Peak District is far more than a place of pretty scenery for visitors to enjoy: it is also a place of great time-depth, imbued with physical remains that tell the story of how our forebears shaped and used this land. It is much the richer, with the potential for deeper understanding and appreciation, as the result of these features surviving in the landscape.

The physical remains of the lead mining industry, in the form of the surface hillocks and the features associated with them such as engine houses, gin circles, and coes, provide a valued link with the past for many of today's inhabitants of the Peak District. Some of the remains were created by forbears of local families who were miners. These are a tangible asset that reminds them, and us, of the hardships and dangers the miners endured to scrape a living from this often inhospitable landscape into which they delved.

An inventory of the best of these mining landscapes has been presented elsewhere (Barnatt and Penny 2004).

Archaeology

The most common and readily-visible surface remains of lead mining comprise hillocks of waste material brought to the surface with the ore (Plate 12). These hillocks are associated with features such as mine shafts, open-cuts, coes, gin circles,

engine houses, crushing circles, ponds and buddles which tell us much about the history of the mining and the processes used (Willies 1975; 1979; 1991; Willies *et al*. 1977; Palmer and Neaverson 1989; 1992; Barnatt with Rieuwerts 1995; Ford and Rieuwerts 2000; Rieuwerts 1996; 1998a; Barnatt 2004). Inevitably, any description of mining features includes many technical terms: explanations are given here in a glossary. Representative examples of the 165 types of surviving archaeological features that require conservation have been identified. What follows is a brief overview of the most important.

The production of lead was a complex process that involved mining the ore-bearing veins, pipes and flats, getting the mineralised material to the surface and then dressing it. This included washing, breaking it down and sorting to retrieve the lead ore from the gangue minerals with which it was mixed, before the concentrate was sent to the smelters. All stages of this work involved episodically improving methods (Barnatt 2002b; Barnatt with Rieuwerts 1995; Ford and Rieuwerts 2000; Rieuwerts 1998a; Willies 1979, 1991). For example, early miners used only picks and firesetting to break away the minerals from the surrounding limestone, while later they used gunpowder (Barnatt and Worthington 2006; 2007; 2009). Similarly, various types of hand-pumps to dewater the workings were first used, while from the 17th century miners drove drainage soughs and used pumps driven by waterwheels. Later still they erected large steam-driven pumping engines that allowed still deeper mines to be developed.

Plate 11: Site 11: Oxlow Rake (Site 11) looking south-west, with part of Cop Rake and the Starvehouse Mines (Site 19) to the left are a good example of veins with remaining hillocks that run for long distances across the limestone upland and have an impact at a landscape scale (Image: National Monuments Record, English Heritage).

Plate 12: Waste hillocks can form prominent features in the landscape, as here at the Fiddler's Shaft hillocks at Hubbadale Pipe (Site 119), with other shaft hillocks to left and right, and seen from Field Head Vein (Site 118).

Surface Features - The most common surface evidence for lead mining comprises open-cuts, shaft tops and waste hillocks often situated along large rake veins that run for long distances across the landscape (Plate 13). Smaller veins, known locally as scrins, also have similar but less massive remains. Elsewhere shafts drop to pipe and flat workings, and also to veins that do not outcrop at surface which were found deep under overlying shales.

The waste hillocks are important archaeological features in their own right. They hold valuable evidence for significant changes in mining practice, having been reworked several times over recent centuries. This reworking resulted from advances in smelting technology that allowed poorer grades of ore to be processed long after they had first been discarded. The hillocks are also likely

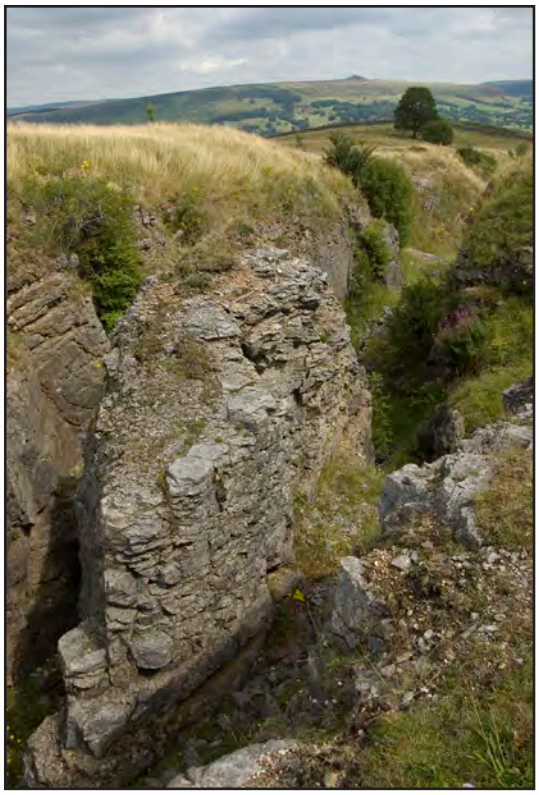
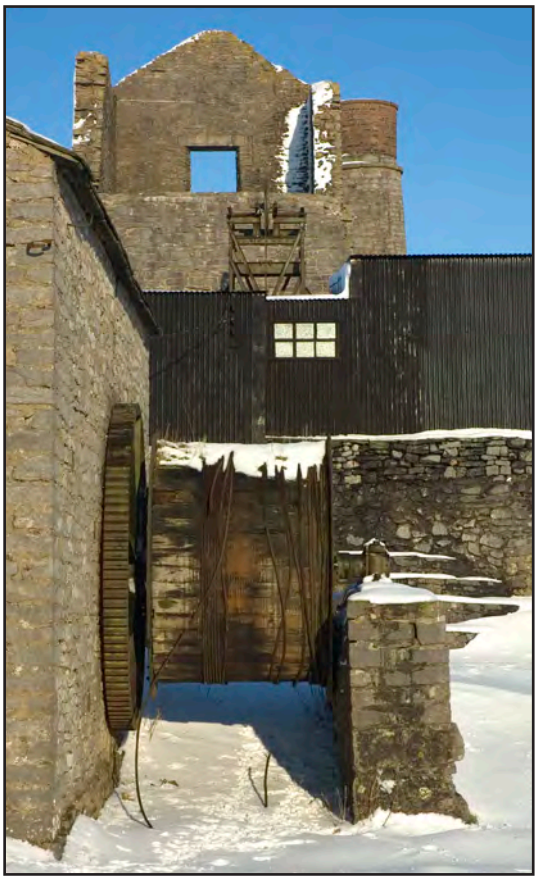


Plate 13: (Top Left) The open-cuts at Dirtlow Rake (Site 12) were first worked many centuries ago and form prominent gashes in the landscape.

Plate 14: (Top Right) Magpie Mine (Site 129) is the most iconic mining site in the Peak, with headframe surrounded by standing engine houses dating from 1869 to the 1950s.

Plate 15: (Bottom Left) The 1869 winding drum powered by a horizontal steam engine at Magpie Mine (Site 129), with the 1950s diesel engine winding house and headframe over the main shaft behind, and the massive vertical-cylindered 'Cornish-type' 1869 pumping house at the back.

Plate 16: (Bottom Right) Not all steam engines were in stone buildings. The late 19th century engine mounting bed at Great Greensward Mine (Site 141) was once perhaps in a timber-framed shed. The main shaft with retaining wall on three sides is in the hillock behind.



to bury evidence of the earlier phases of mining; open-cuts from surface were worked first; with later spoil from depth burying the signs of previous activity left to either side of the vein.

The mining has left a legacy of fascinating archaeological features amongst the hillocks and open-cuts, which illustrate how the various mining tasks and dressing processes were carried out and how these changed over the centuries.

Above ground, the many shaft tops for access, winding and pumping, as well as rare engine houses and other large mine buildings, are the most easily recognised features to be found (Plate 14). However, some of the commonest surviving remains, such as coes, gin circles and water management features, are not as obvious to the uninitiated eye.

Early ways of removing the ore from the mine included simply carrying it underground in a wooden basket, known as a wisket, or dragging it on a sled, known as a corve. Some later mines used tramways with wagons (also known as corves), often of narrow gauge. Most ore was brought up drawing-shafts in a kibble. Shallow examples of these shafts had hand-wound stowce where one or more men turned the wooden windlass. At many larger mines there are both small-diameter climbing shafts for human access and deep and relatively large-diameter engine-shafts used for winding or pumping and sometimes both. Climbing shafts are often relatively shallow, and to achieve depth a descending series of these was sunk, with short cross-cuts from the bottom of one to the top of the next. Engine shafts normally went to the full depth of the mine in one drop. At some mines, particularly where sited on steep slopes, there were access and haulage levels, a few of which are still open.

From the early 18th century onwards, large beam-arm and horizontal engines were installed at larger mines where finances allowed (Plates

Plate 17: This reckoning house at Little Pasture Mine (Site 50) had an office with fireplace upstairs and workshop/storage space on the ground floor; it has survived because it later made a good field barn.

Plate 18: The Mandale Mine sough goit (Site 152), where the water issues from underground close to the River Lathkill.

Plate 19: A fine but now removed example of a horse-drawn ore crusher at Ashton's Mine on Dirtlow Rake (Site 12), with crushing stone and crushing bed, surrounded by sloping paving for placing ore before being fed under the wheel. While some examples survive today, others have been removed as hillocks have been reworked. In the foreground is an ore washing pond with a flight of steps leading down to the water.

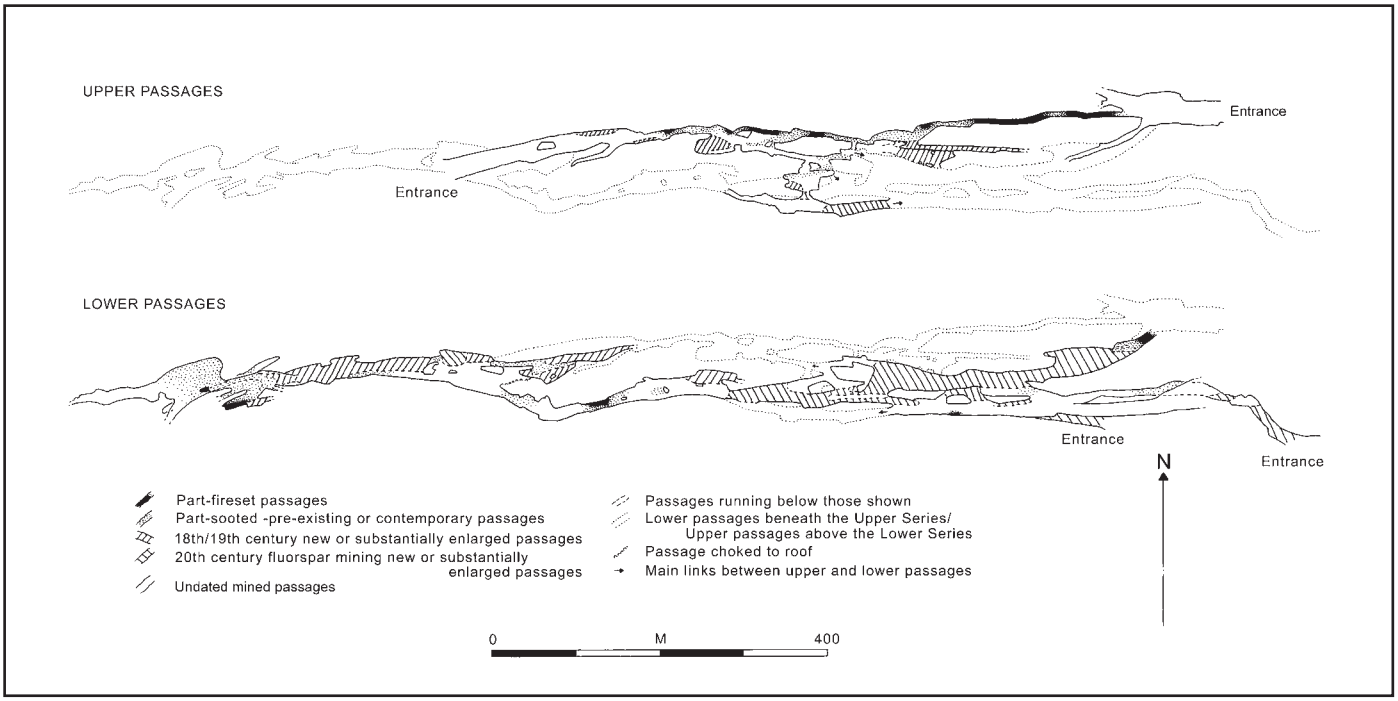


Figure 3: Harrybecca, Evans Gin and Bacon's Mines (Site 90). Analysis of the underground workings shows they have evolved over a long period and include early fireset workings, those later enlarged by lead miners in the 18th/19th centuries, and others when this was a 20th century fluorspar mine.

15, 16). These pumped water out of the mine to keep it dry, and wound ore to surface. Several ruined engine houses still exist, together with boiler houses, chimneys and reservoirs.

At large mines, which were relatively uncommon, there were further buildings, such as reckoning houses, offices, ore-coes, smithies, overseers' and agents' dwellings and powder houses. Several examples survive (Plate 17).

Coes were small sheds, often built around or adjacent to a shaft, to provide shelter and a 'lock up' for the miners' tools and ore. Often they were the only building at smaller mines. All that remains today of most coes are their stone footings and ruined walls.

A horse gin was commonly used for bringing out ore and water at deeper shafts. This was a form of winding engine of 17th to 19th century date. It normally comprised a large wooden drum for the shaft winding rope, set horizontally, adjacent to the shaft and headgear. This drum was turned by a horse, or horses in larger examples, the animal walking in a circle and pulling the drum around. Gin circles, where a horse walked while turning the gin, can still be found at some mines today. The gins themselves and the wooden headgear have long since gone, removed to other shafts, salvaged for other uses, or rotted away.

Another distinctive and once-common feature in the Peak District was the mine drainage sough and these were driven from the 17th century onwards. Some entrances, normally away from the mines themselves at the bases of nearby valleys, are still open (Plate 18). In some cases the sough tails were not designed for entry after completion and all that can be seen is a low bolt issuing water. When being driven, getting good air to the forefield was often problematic and ventilation shafts from surface were sunk along the sough, the hillocks of which sometimes survive.

Dressing of ore was usually carried out at the mine before the resulting concentrate was removed to smelters. Some dressing was done underground as this meant less haulage to surface, as well as initial sorting of what broken veinstuff contained ore, sometimes sieving and buddling was also undertaken; this was particularly the case where water used for the process was relatively abundant at depth. At surface, water was normally scarce and thus a valuable commodity as it was essential for washing and dressing the ore. Special provision had to be made and storage ponds, leats and dressing pits are found at many mines. Surface dressing floors are common, usually sited by the shaft top with waste hillocks of broken and crushed material nearby. Much initial ore-dressing was traditionally done by hand-breakage with hammers and simple processes such as sieving and buddling were also normally employed once large pieces of ore had been hand-picked. Sieves for mineral broken down to coarse gravel, and buddles for finer material, were used to wash the crushed gangue and rock away from the ore, which was heavier and thus could be separated. Dressing pits and stone-lined buddle troughs can still be found on some sites. Buddle dams are relatively common and comprise flat-topped hillocks where water with fines, known as smitham, was slowly run across the top; the heavy ore was deposited first and recovered for reprocessing. In the 19th century, at some mines in the northern part of the orefield, the mineral brought to surface was broken down with the aid of a horse-drawn ore crushing stone which was pulled round a circular crushing bed (Plate 19). These stones and their beds are still to be seen at several sites.

Lead smelting was normally carried out away from the mines, often in the Hope and Derwent valleys, on the flanking gritstone moorlands, or in the foothills east of the region. These important sites are not considered in this report.

Underground Features - When venturing underground today, historic extraction techniques become evident; pick marks and gunpowder shotholes are the most common features, found in vein stopes, pipeworkings, levels and shafts. In a few mines there is evidence for early firesetting. Often waste material, known as deads, was stacked and retained by drystone walling at passage sides, or in worked out cavities above, where it was placed on stone or wooden stemples. A noteworthy feature found underground is the coffin level, often with fine sweeping pickwork, illustrating the high levels of skill possessed by the

miners. Rare features included engine chambers, boat levels, workshops, pumps, sieving, buddling and hotching troughs, leats and miners' graffiti. In a few mines there are still tools, candle stumps, remains of clogs and clay pipes that can still be found where the miners left them. All these create a vivid picture of what it was like to work underground.

Many mines have been worked over several centuries and there is evidence that allows phases of medieval to modern work to be identified (Figure 3).

Underground workings are now of variable stability and underground exploration should only be attempted with specialist equipment and in the company of those with the experience to assess the safety (or otherwise) of the workings.

Biodiversity

Lead rakes and other metal mining remains are important for the plant communities that have become established since the mines were abandoned. They support complex mosaics of metalliferous (calaminarian), calcareous, neutral and acidic grasslands. Some contain rare 'heavy-metal tolerant' plants known as metallophytes that flourish because of their tolerance of heavy metal-polluted ground. There are also other important and locally rare plant species and highly specialised lichen communities found on lead rakes.

The hillocks and hollows also provide a refuge for many once-common Peak District wild flowers and some rare or declining mammals, birds and invertebrates. In recent years modern farming practices have led to the loss of many unimproved grasslands and traditional hay meadows. The lead hillocks with their rich plant communities have suffered less agricultural intensification and are therefore an important resource for biodiversity. In spring and summer there is a rich mixture of colours and textures, the wild flowers transforming the hillocks into places of great beauty.

Sometimes the hillocks are made up of rock, principally limestone but occasionally shale. More often it is a varied mix of fluorspar, calcite, barytes and clay, all materials that were of no use to the lead miners or were by-products of the ore processing, such as buddling, and thus cast aside as waste. Lead mining sites also have a wide topographic range and individual hillocks have different aspects. As a result of all this variation, many different species with contrasting environmental requirements grow in close proximity to each other, making lead rakes ecologically very exciting.

On Hucklow and Eyam Edges shafts have been driven through the shales into the underlying limestone and the mineral veins. The ecology of these sites is consequently influenced by the preponderance of shale material and the calcareous influence commonly associated with lead mining sites is consequently diluted or absent.

In the Winster and Elton area the abundance of buddle dams, principally made up of fine clay, and the presence of shale in the hillocks, affects the vegetation type resulting in more neutral grassland. Consequently the occurrence of metallophytes and calaminarian grassland is rare in these areas.

Calaminarian Grasslands (OV) - Habitats characteristic of lead rakes in the Peak District include specialised metallophyte (metal tolerant) vegetation, due to the toxic nature of some of the hillocks, where there are residual quantities of galena and other metalliferous ores. These calaminarian grasslands are of very restricted occurrence throughout Europe and are considered to be of international conservation importance, listed in The European Union Habitats and Species Directive 1992 and the Habitats Regulations 1994, as well as notified as SSSIs under national legislation. In the UK they are most commonly found in the limestone uplands of the Mendips, the dales of Derbyshire and Yorkshire, and the north Pennines. In many ways it is this grassland community which makes lead rakes unique in nature-conservation terms. Only small areas of this grassland were identified during survey, which highlights its rarity and importance. Indeed, a recent survey concentrating on this habitat has estimated that less than 15ha of this internationally important type of habitat still remain in the Peak District, one of its UK strongholds. Although it is difficult to compare survey records over time owing to different survey methodologies, it appears as if calaminarian grassland communities are still declining. At some sites calaminarian grasslands were recorded as significant in the 1990s, noted as limited in the early years of the 21st century but are now largely absent, restricted to small patches of spring sandwort (locally known as leadwort) within a calcareous grassland sward. Recent survey work also highlights the importance of disturbance in keeping the communities open, so maintaining the competitive advantage of species such as spring sandwort which in a closed sward can easily be lost. Trampling by people and grazing by cattle and sheep in addition to erosion on steep slopes are all recognised as important elements in maintaining the community type in addition to the inherent toxicity of the soils.

Four calaminarian grassland communities have been recorded in the Peak District. They are classified using the National Vegetation Classification (NVC) (Rodwell 2000; Cooper 1997) for Open Vegetation (hence OV):

- **OV37a** is the typical open metallophyte vegetation commonly found on stony shaft hillocks and areas of heavy metal rich spoil, including old buddle or spoil heaps on and adjacent to crushing circles. Most of the ground will be open with odd patches of single plants of spring sandwort, alpine penny-cress, ribwort plantain, sheep's fescue, crested hair grass and lichens. Rarely and particularly in the Castleton area of the orefield, Pyrenean scurvy grass occurs. This community represents the earliest successional stage of the colonisation of toxic ground and in time the following communities will develop when toxicity is reduced, maybe taking centuries to succeed to a closed sward (herbs and grasses covering 100% of the substrate) of calcareous grassland.

- **OV37b** is a more closed vegetation type with a lower proportion of open ground and typically a greater cover and variety of calcicoles. This community represents the next successional stage and consists of a more closed sward but still very open with probably a 50 / 50 proportion of open ground to closed sward. More of the calcareous herbs to occur including kidney vetch, autumn gentian, fairy flax, limestone bedstraw and thyme. This mixture of vegetation cover and open ground is important for some invertebrates.

- **OV37c** supports a high cover of lichens, in the Peak District most commonly *Cladonia rangiformis*. Nationally this community type is found in wetter more upland locations and whilst we have recorded it here it is atypical being transitional to the other community types. It often appears to occur particularly where flats and pipes have been worked so potentially there is some link between the material in the spoil heaps and the vegetation.

- **'Closed sward with alpine penny-cress'**, is a community not represented in the National Vegetation Classification and appears to be a Peak District specialist. The sward is dominated by sheep's fescue and a few acid/neutral grassland species with occasional to locally frequent alpine penny-cress. Typically the associates are those species that are known to have heavy metal tolerant eco-types including mountain pansy, eyebright, harebell, thyme and crested hair grass. Spring sandwort, a species that is always present in OV37 communities doesn't occur here.

Other Lead Rake Grassland Communities - Assessment of lowland grassland interest in a national context by Natural Areas classifies the White Peak Natural Area as 'outstanding'.

A range of different communities can be found at lead rakes in the Peak District, in addition to the classic calaminarian grassland. Following the National Vegetation Classification (in brackets), these include:

Calcareous Grassland Communities (CG) - The lead rakes have been found to be an important refuge for calcareous communities and in particular:

- **Sheep's fescue/meadow oat grass (CG2d),** which is a classic daleside grassland. It was found that good calcareous grasslands of this type frequented the lead rakes but in many instances the community was true to CG2d in every aspect except it didn't contain meadow oat grass. To recognise the importance of these species rich communities they have been considered as CG2 but reference has been made to the fact that they do not include meadow oat grass. (The Unit of Comparative Plant Ecology at Sheffield University (Grime *et al*. 1998) found that meadow oat grass is confined to infertile and undisturbed sites. It is a slow growing grass with no persistent seed bank, low mobility and thus restricted to grasslands of some antiquity. Meadow oat grass may only be found where the lead rakes have not been disturbed since they were abandoned.)

  This is a beautiful, colourful and aromatic community with abundant herbs and fine leaved grasses, including thyme, rockrose, fairy flax, quaking grass, spring sedge, kidney vetch and salad burnet. Notable species confined to this community include frog orchid, fragrant orchid and carline thistle.

- **Sheep's fescue/mouse-ear hawkweed/thyme grassland (CG7)** which is often an early successional grassland on disturbed sites particularly those which have been left to naturally regenerate after being reworked for fluorspar and associated minerals. It is mostly found in the south and east of the country, being best developed where there is a continental type climate of long hot summers and low rainfall. On the lead rakes it does tend to occur on south facing well-drained sites. The community is characterised by an abundance of thyme and mouse-ear hawkweed forming a mat of plants, dominating other plant species. Other calcareous species found include kidney vetch, autumn gentian and eyebright, which occur occasionally with very small clumps of grasses such as crested hair grass and sheep's fescue.

- **Sheep's fescue/common bent/thyme grassland (CG10)** is typical of more upland sites especially in the Castleton and Peak Forest area in the far north of the ore field. This type of grassland represents a transition between true calcareous and acidic grassland. The sward is typically characterised by a mix of calcareous species such as thyme and limestone bedstraw and species indicative of acidic grassland such as heath bedstraw and tormentil. Grasses, particularly sweet vernal and common bent, are more prominent here whereas herbs and sedges tend to dominate the other calcareous community types. Nationally CG10 has a northern distribution and its presence on lead rakes here perhaps reflects the northerly location and relatively high altitude of this part of the orefield. The presence of CG10 is an important part of the character of this northern part of the orefield.

Plate 20: (Top) Example of OV37c with lichen dominated vegetation.

Plate 21: (Centre) An example of CG2d grassland with fragrant orchid.

Plate 22: (Bottom) An example of CG7 grassland with mouse-ear hawkweed, fairy flax and milkwort.

Spring sandwort is not solely associated with metalliferous spoil. It can be an important component of montane grasslands in the British Isles. In the Castleton and Peak Forest area of the orefield it occurs in over 50% of the examples of the closed CG10 community on the lead mining remains.

Species-Rich Neutral Grassland Communities (MG5) – These are also found on lead rakes which again provide an important refuge for this community. In the main, the following three sub-communities have been recorded:

- **Meadow vetchling sub community (MG5a)** – The sward tends to be dominated by grasses, crested dog's tail, rye grass, red fescue, cocks foot, yellow oat and sweet vernal grass with a high frequency of the commoner neutral grassland herbs such as, bulbous and meadow buttercup, common sorrel, red and white clover, pignut, common cats ear and ribwort plantain, but also including common knapweed, meadow vetchling and very often ox-eye daisy.

On lead rakes these grasslands tend to be relatively productive and often found on the hillock slopes adjacent to improved grassland. This is probably due to deeper soils or where the hillocks have been exposed to nutrient enrichment from farmyard manure or artificial fertilizer.

- **Lady's bedstraw sub-community (MG5b)** – This community tends to be rich and diverse in species. The sward is characterised by an abundance and often dominance of interesting species. These include quaking grass, hairy oat grass, yellow oat grass and the conspicuous herbs, lady's bedstraw, bird's-foot trefoil, common knapweed and field scabious. Species associated with lime rich soils, calcicoles, are also important components of the sward and include an abundance of salad burnet, cowslips, rough hawkbit, hoary plantain and fairy flax. This is an extremely attractive community especially where the land management allows a rest period and the flowers can be seen in all their glory like a mini hay meadow. This richness and diversity is becoming increasingly rare which emphasizes the need to conserve lead rakes as refuges for such species and communities. On lead rakes the boundaries between MG5b grassland and CG grassland are often indistinct. This fusion of communities often makes it difficult to survey but very attractive to the eye.

- **Heath grass community (MG5c)** - The heath grass sub community is confined to the more acidic end of the range of neutral soils. The sward tends to be dominated by common bent, sheep's fescue and sweet vernal grass with a range of herbs associated with both neutral and acidic soils including tormentil, devil's-bit scabious and heath bedstraw. This community is poorly represented on lead rakes.

The Acid Grasslands - On lead rakes these are most frequently found in the north of the ore-field and include:

- **Sheep's fescue/common bent grass/heath bedstraw grassland (U4)** – This acidic community is naturally poor in species characterised by an abundance of sheep's fescue, and mosses with occasional heath bedstraw, bent grass, harebell, common sorrel, lady's bedstraw, crested hair grass and tormentil. In the best examples of this community on lead rakes, mountain pansy is frequent.

Plate 23: (Top) An example of MG5b grassland with lady's bedstraw, rough hawkbit, salad burnet and field scabious.

Plate 24: (Centre) Blue mountain pansies in a U4 grassland with sheep's fescue and common bent.

Plate 25: (Bottom) Spring sandwort (Minuartia verna).

- **Wavy hair grass grassland (U2)** – Dominated by wavy hair grass with occasional common sorrel, tormentil and heath bedstraw. Occasionally bilberry will be found in the sward. This type of grassland has a direct link to the widespread heathlands of the past. Not surprisingly such grassland is very rare. It is an attractive sward when the wavy hair grass is flowering and rippling in the breeze and provides an important habitat for invertebrates.

- **Mat grass/heath bedstraw grassland (U5)** – This distinctive very poor acid grassland is like U2 in that it provides a direct link with once widespread heaths. It is normally dominated by mat grass with occasional bilberry, harebell, moss, and mountain pansy.

- In very rare cases, lead rakes also support patches of heath (H9/H12).

A relatively species-poor neutral/acid grassland community is found on some sites, dominated by species with lead tolerant ecotypes including harebell, common sorrel, sheep's fescue and common mouse-ear. This may well be a grassland community that develops from a calaminarian community in response to the toxic elements leaching out of the soil and/or a build-up of non-toxic material including humus/leaf litter.

Metallophytes - The classification of species colonizing metalliferous soils differentiates between "metallophytes" as species found only on metal contaminated soils and "pseudo-metallophytes" those species found on both contaminated and uncontaminated soil within the same region. (Lambinon & Auquier 1964 and Baumbach 2012). For the purposes of this report the term "metallophyte" will be applied to three of the colonizing plant species - spring sandwort, alpine penny-cress and Pyrenean scurvy grass. These three species are nearly always restricted in Peak District orefield to heavy metal mining remains.

- **Spring sandwort** is a low-growing cushion-forming species with an abundance of small white flowers in the summer. Locally known as leadwort, the species has the capacity to uptake and store quite high concentrations of heavy metals without any severe impairment of growth (it has been shown to absorb as much as 7500ppm zinc and 500ppm of lead). In the Peak District, spring sandwort is restricted to spoil heaps of lead workings. The plant is threatened nationally with a restricted distribution and with the Peak District supporting a significant part of the national population. As a result of the demand for fluorspar there has been a significant decline in the national population of this species. It is a poor competitor and is normally only present where the stresses of its environment prevent the establishment of, or retard the growth of, more robust herbs and grasses. Many of the sites where spring sandwort occurs are also characteristically rich in calcareous species such as kidney vetch, fairy flax, limestone bedstraw and thyme. This abundance of calcicoles is indicative that the substrate is lime rich, which over time may sometimes ameliorate the effects of the toxic soil.

- **Alpine penny-cress** is a perennial, rosette-forming plant, with clusters of white to pink flowers. It is a nationally scarce plant, being found in less than 100 one-kilometre squares in the country. Though this plant also occurs in the mountains of Europe, the British population represents

Plate 26: (Top) Alpine penny-cress (Thlaspi alpestre).

Plate 27: (Centre) Alpine penny-cress (Thlaspi alpestre) in close up.

Plate 28: (Bottom) Pyrenean scurvy-grass (Cochlearia pyrenaica).

the north-western limit of its geographical range. In Britain it is generally confined to spoil heaps of mine workings, being tolerant of heavy metals such as lead and zinc which it absorbs and stores in its leaves. Within the Peak District it is mainly found in the south-eastern part of the ore field, in a circle of about ten kilometres in diameter centred on Matlock. It is largely absent from other parts of the ore field, with only one known site near Eyam where it is locally abundant. Reproduction is largely by seed, but these are heavy and tend to remain close to the parent plant. They also are not able to survive in the soil for long periods. Thus, once lost from a site, it is unlikely to return.

- **Pyrenean scurvy grass**, an uncommon metallophyte in the Peak District, here confined to the grassland on spoil heaps that maintain a high heavy metal content. It is particularly noteworthy in the Castleton area (recorded on only six sites). Nationally, it is a variety of scurvy grass only found in the uplands at normally damp and open locations, including cliffs, wet gullies, bryophyte-dominated flushes and spoil heaps by old lead and zinc mines.

- There is also a group of species present on lead rakes that scientific research and our observations suggest have genetic or ecological adaptations to metalliferous sites but are not constrained to them (pseudo-metallophytes). This includes mountain pansy, maiden pink, harebell, common sorrel, field mouse-ear, dark mullein and sheep's fescue. Mountain pansy is particularly of interest as there does exist sub species (Zinc pansy) in the Netherlands that have been proved resistant to heavy metals. To date no research has been done in the UK to identify whether or not mountain pansy is a metallophyte genotype or sub-species.

Other Important Plant Species – In addition to the species described and listed above there are other important and locally-rare species found on lead rakes which provide refuges where these sometimes rare and fascinating plants can survive modern agricultural practices. These include frog orchid, fragrant orchid, kidney vetch, moonwort, autumn gentian, grass of Parnassus, carline thistle, stemless thistle, mossy saxifrage, heather, bilberry and restharrow. Nationally, the range and size of populations of many of these species has declined in recent decades.

Species and Significance

***Nationally threatened*:**	Maiden pink
	Frog orchid (National Biodiversity Action Plan species)
	Spring sandwort
	Mossy saxifrage
Nationally scarce:	Alpine penny-cress
Derbyshire Red Data Book:	Dark mullein
	Green spleenwort
Edge of Range species:	Limestone bedstraw
	Mountain pansy
	Pyrenean scurvygrass
	Hoary whitlowgrass

Other Wildlife Interest - Lead rakes are also significant for a range of other wildlife associated with flower rich grasslands. The profusion of different plant species provides a wealth of nectar for insects and seed for birds and small mammals. The sparsely vegetated areas of spoil are important for lichens and provide 'hot spots' for invertebrates; these aspects of the resource need further assessment and may be of greater importance than currently recognized as specialist lead rake species are present.

Plate 29: (Top) Dark mullein (Verbascum nigrum).

Plate 30: (Bottom) Frog orchid (Coeloglossum viride)

Plate 31: Geoglossum umbratile - one of many types of fungi that thrive on heavy metal mining remains (Photo: Barry Soames).

In addition, features such as old mine shafts can provide roosts for bats and the stony waste heaps offer hibernation sites for amphibians. Where we have specific information/records for invertebrates and other interest this has been included in the inventory descriptions but coverage is far from complete and a lack of information does not necessarily imply that the interest isn't present.

Complexity and the Problems of Restoration - Each lead rake site is unique, a complex amalgam of mineralogical, environmental, historical and management factors. The ecological interest of lead rakes has often developed over the many decades since individual mine workings were abandoned and the hillocks were left to be recolonised by the plants that surrounded them.

In recent decades attempts have been made to restore lead rake habitats after minerals have been removed. However, survey during the Lead Rakes Project has shown that the ecological interest here is dependent on complex factors such as its chemistry, substrate, topography, aspect, age and proximity to seed source. Thus, it is considered that once a lead rake is lost, its unique complexity, inherent interest and importance as a resource for recolonisation of adjacent areas, will be lost forever. The best that can be hoped for is partial restoration, leaving suitable minerals on site and recreating sufficient variation in aspect and slope, in the hope that the intricacies of the plant communities will develop in the long term.

Plate 32: A wealth of insects utilize the nectar source to be found on lead rakes, especially where they survive amongst a green desert of improved grassland.

Visiting the Mining Sites

Inclusion in this inventory does not mean that there is public access to a site. Here we list some of the principle sites where access is encouraged, or where they are on public land or Open Access land. Please remain within the boundaries of Open Access land and respect access arrangements at such places as nature reserves. Much of the land that the mines survive on has been sympathetically managed by farmers. We are very grateful to all the farmers and land owners who have allowed us access to survey, please respect their business and livelihood by not trespassing.

In the list given below, the site names are followed by the Inventory number and relevant web-links.

Sites owned/managed by public bodies and charities where access is encouraged

High Rake (35)
Peak District National Park Authority

Silence, Old Grove and New Grove Mines (39)
http://www.hucklow.org/shs/

Derbyshire Dales National Nature Reserve - Arbourseats Veins and Sough, Wardlow Sough, Nay Green Mine and Washing Floors, White Rake and Wardlow Hey Mines (72, 73, 76, 77)
http://www.naturalengland.org.uk/ourwork/conservation/designations/nnr/1006046.aspx

Priestcliffe Lees Nature Reserve – Maury Mine, and Lees and Dove Rakes (97, 99 & 100)
http://www.derbyshirewildlifetrust.org.uk/reserves/priestcliffe-lees

Deep Dale Nature Reserve – Whale Sough, Shake Rope and Sun Veins, and Fieldgrove Vein (part) (124, 125 & 127)
http://www.plantlife.org.uk/nature_reserves/deep_dale

Hard and Glead Rakes, with the High Low Mines (126)
Peak District National Park Authority

Magpie and Dirty Redsoil Mines (129)
http://www.pdmhs.com/MagpieMine.asp

Derbyshire Dales National Nature Reserve - Mandale and Lathkill Dale Mines (152)
http://www.naturalengland.org.uk/ourwork/conservation/designations/nnr/1006046.aspx

Winster Ore House (197)
Peak District National Park Authority

Via Gellia Mines - Rose End Meadows (233)
http://www.derbyshirewildlifetrust.org.uk/reserves/rose-end-meadows

Gang Mine (243)
http://www.derbyshirewildlifetrust.org.uk/reserves/gang-mine

Dale Mine (292)
Peak District National Park Authority

Thorswood Mine (296)
http://www.staffs-wildlife.org.uk/reserves/thorswood

Sites open to the public as show mines

Blue John Cavern (1)
Treak Cliff Cavern (1)
Speedwell Mine (U2)
The Heights of Abraham - Nestus Pipes (Great Masson Cavern and Rutland Cavern) (U27).
The Peak District Mining Museum – Temple Mine (U29)

Sites with significant Open Access areas.

Odin Mine (1)
Burning Drake, Portaway Mine, Jowle Grove, Watts Grove (8)
Oxlow & Daisy Rake (Old Moor Mine) (11)
Dirtlow Rake and Pindale Side (12)
Cop Rake and Starvehouse Mines (19)
Moss Rake West End (21)
Tideslow Rake (35)
Cackle Mackle Mine (78)
Hassop Common - Brightside, Middle Engine, Evans Gin, Harrybecca, Bacon's and White Coe Mines (90)
Ecton Mines (293)

An Inventory of Regionally and Nationally Important Metal Mining Sites

Aims and Objectives – Because the conservation of metal mining hillocks can impact on the minerals industry and on agricultural income, it is vital that conservation efforts are carefully focussed on those mining sites and landscapes that are of the greatest importance. It is unrealistic to attempt to conserve all remaining surface and underground metal mining sites: fossilisation of the landscape is not a desirable option. With this in mind, a primary objective of the Lead Rakes Project has been to compile a detailed audit of the resource and use this to prioritise conservation effort.

If action is not taken to conserve all sites in the Inventory, then important parts of the metal mining resource and the historic landscape character of the Peak District will be gone forever. Therefore every effort should be made to ensure sustained conservation of all the 338 'Regionally and Nationally Important Metal Ore Mining Sites' in the current list.

Scope - The Inventory of Regionally and Nationally Important Metal Mining Sites includes all currently-known sites in the Peak District orefield of significant geological, archaeological and ecological importance. This report concentrates on the archaeological interest at these sites.

Between them, all the sites in the Inventory of Sites cover a broad range of geological features, types of mining remains and ecological habitats. Each specific type of identified interest and habitat is often only represented in small numbers. Thus, the removal of any site would be a significant loss.

Compilation of Archaeological and Ecological Data - At an early stage, in 1996, the Lead Rakes Project compiled a provisional working list of over 50 important sites within the National Park based on readily available pre-existing databases and knowledge based on then-known surface remains of archaeological and/or ecological importance. Because of conservation concerns, it was decided to survey systematically the whole of the orefield. By 2000, a significant number of further sites had been identified as the result of fieldwork and consultation (Barnatt 2000). After further intensive fieldwork, a formal Inventory was produced and made public (Barnatt and Penny 2004). However, at that date ecological survey was far from complete and geological assessment had not yet been attempted. Significant progress in these respects has now been achieved, and the archaeological list has been refined, leading to the publication of the current volume. There are now 338 sites in the Inventory.

The Peak District Mines Historical Society, founded in the late 1950s, has a large and enthusiastic membership who over the years have documented many sites in the region, both at surface and underground, and promoted their conservation wherever possible. Specific mining sites have been extensively reported in the Bulletin of the Peak District Mines Historical Society and latterly in its renamed journal, now Mining History. Detailed accounts have been supplemented by overviews and summaries (Willies *et al*. 1977; Rieuwerts 1987; Palmer and Neaverson 1989; 1992; Gill and Beck 1991; Ford and Rieuwerts 2000; Heathcote 2001a; 2002; 2007b; 2008; 2010; 2012; Porter and Robey 2000; Rieuwerts 1996; Barnatt 1999a; Willies and Parker 1999; Webb 2001; Barnatt and Worthington 2006; 2007; 2009; Rieuwerts 2007a; 2008a; 2010a; 2012a; Barker and Beck 2010) and by unpublished reports on specific areas of the orefield, many commissioned for by Lead Rakes Project (Rieuwerts 1992a-b 1993a-c; 1997; 1998b; 1999a-b; 2000b; 2001; 2003; 2004; 2005; 2007b-c; 2008b; 2009; 2010b; 2011a-b; 2012b-c; n.d. (a-e)). Published site-specific texts are given below in the Inventory. However, often information has also been derived from general texts and short notes in the PDMHS Newsletter; here these are too numerous to acknowledge individually in site entries. Similarly the notes are not placed in the bibliography; apologies to the authors of these for this omission. A large amount of further unpublished field assessment has been undertaken by the authors of this volume. Particular thanks go to Jim Rieuwerts, Chris Heathcote, Phil Shaw and Terry Worthington for their support and hard work since the Inventory was first mooted through to today.

At the beginning of the Lead Rakes Project it was obvious that we needed to urgently survey those areas that from previous observations contained mining remains with high ecological interest and encourage land managers to conserve them (as well as those identified for the archaeological remains) by entering an agri-environment scheme. At that time the tributers were very busy providing Laportes material from existing surface remains to be processed at Cavendish Mill, principally for fluorspar. A project officer was appointed with joint funding from Natural England and the PDNPA to ecologically survey one parish at a time and negotiate conservation agreements with the land managers. The partnership approach continued with help from Derbyshire Wildlife Trust, The National Trust (for the Monyash area), English Heritage, Natural England and from the SITA Trust to complete the survey in 2012.

Ecological information has been compiled from a wide range of different surveys carried out over a lengthy time period (1998-2011). The details provided need to be treated with caution because changes in the management regime on sites may well have caused changes in the vegetation. In addition survey methodology has changed over time and community interpretation varies between surveyors. This means that whilst the site descriptions give a 'flavour' of the site, accurate comparisons between sites based on these descriptions would potentially be flawed.

The Geological Assessment – Sites of particular geological importance are included for the first time in the revised inventory presented here. The geological details provided in this report are not intended to replace or otherwise alter any RIGGS designations, however, where they are coincident they may provide additional information. These descriptions are necessarily brief and are not intended to be exhaustive and have only been provided for site where particularly good examples of mineralisation may be examined, that are sometimes also unusual or unique in the Peak District Orefield. They are based on information available to the author (Richard Shaw), where possible from personal examination over nearly 40 years of underground exploration in the Peak District Mines, and discussions with other authorities on the topic, in particular Trevor Ford.

Sites may or may not be currently accessible and in some cases, Millclose Mine and the deeper parts of the Ecton Mines, have been flooded for over 70 years and 120 years respectively. New exploration in the future will inevitably locate sites worthy of inclusion in this summary. Sites of interest from a mineralisation point of view exposed in quarries or other surface exposures not related to mining are not included.

The inclusion in the Inventory of modern mines at Milldam Mine and Middleton Stone Mine is because fresh exposures of mineralisation are sometimes particularly instructive; their inclusion here should not be used to argue that extraction should cease on conservation grounds.

Underlying Criteria - While the Inventory includes 338 sites, each is necessary, as many important features are only found at a small number of cases. The surviving mining resource in total has features:

- At very different types of mineralisation, with concomitant contrasting responses to extraction.
- With strong differences resulting from topography and the presence or absence of different rocks overlying the mineralisation.

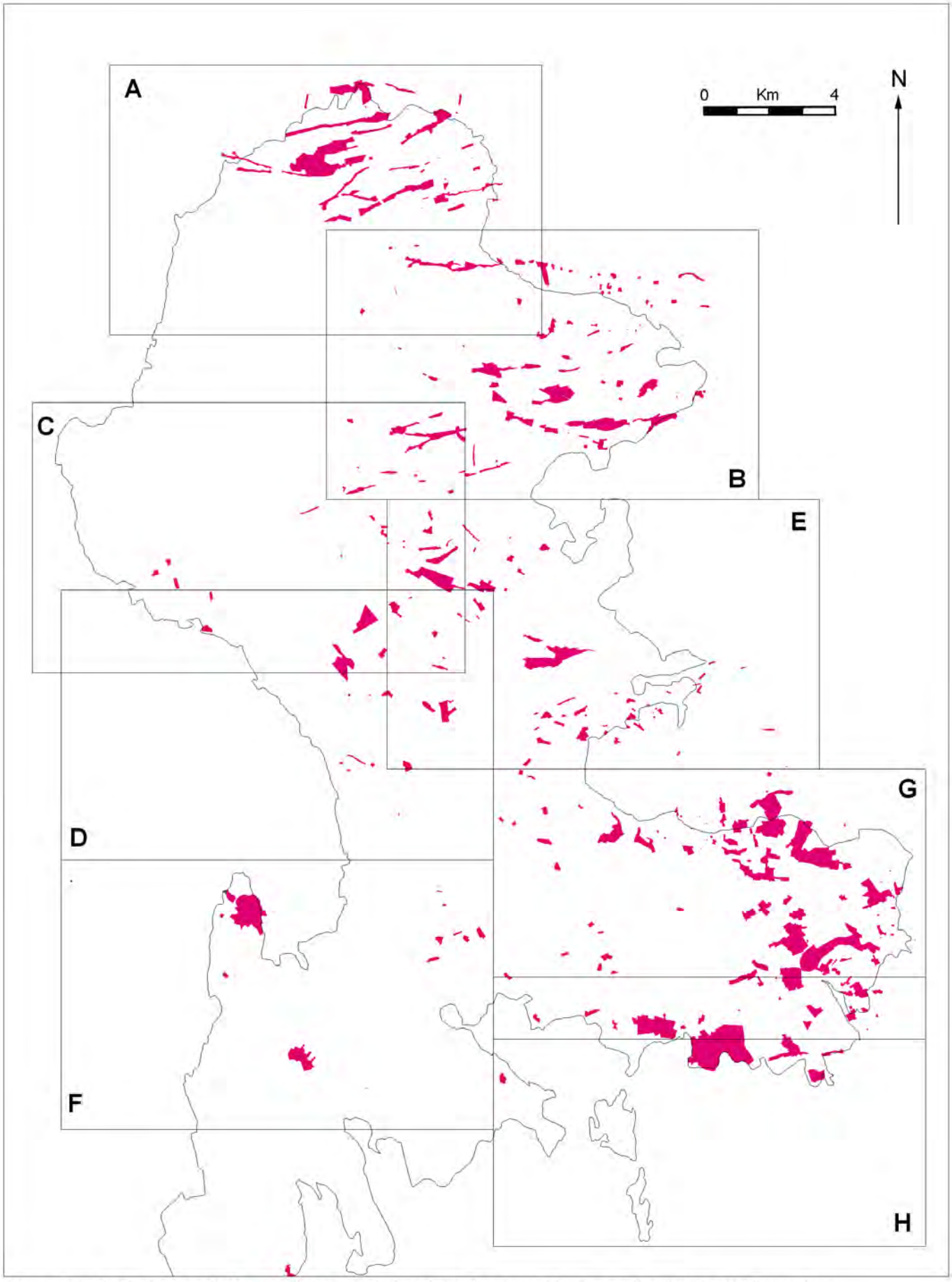


Figure 4: A key to location maps A-H showing the sites in the Inventory of Regionally and Nationally Important Metal Mining Sites in the Peak District (main sites – red; underground interest only – green).

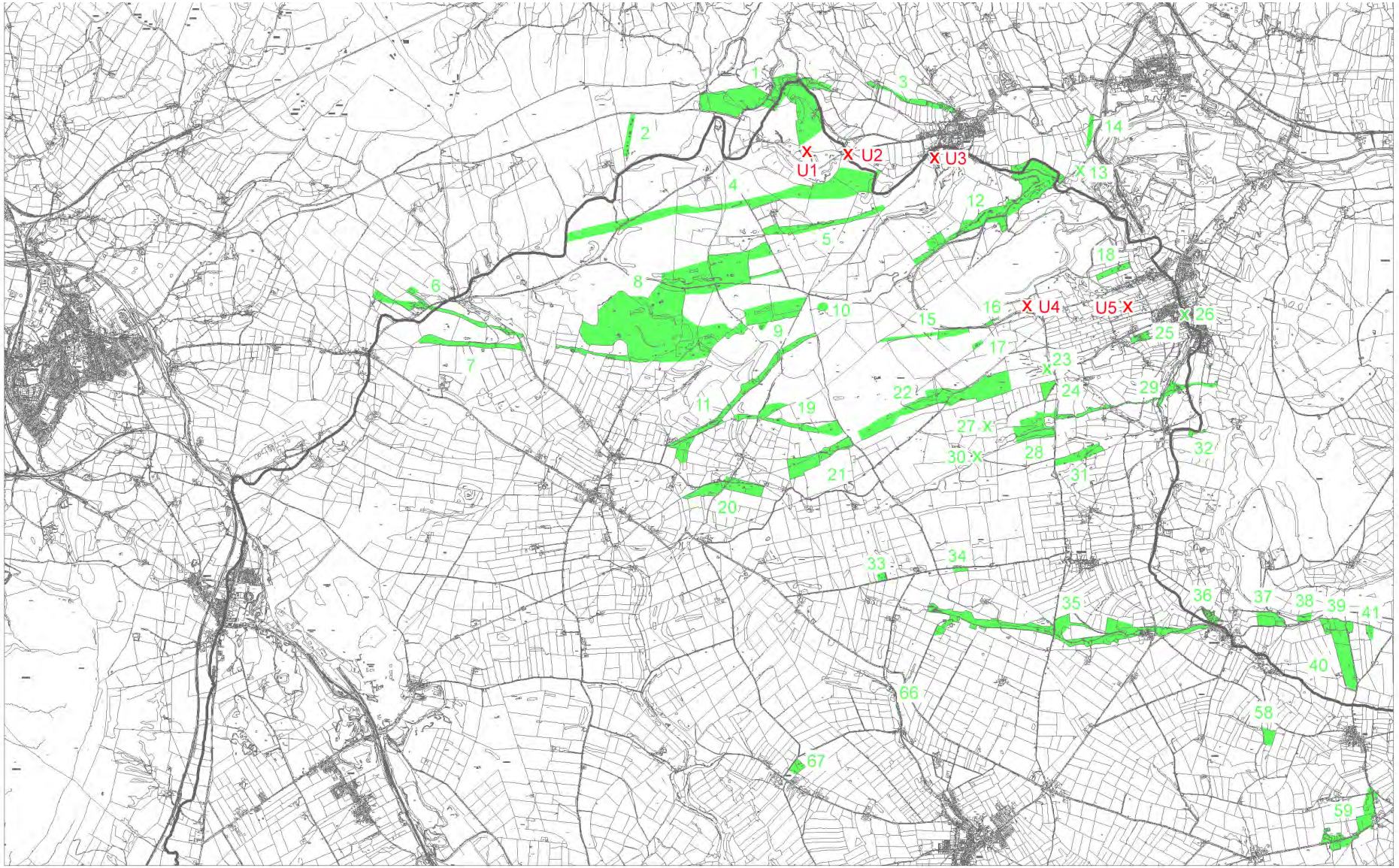


Figure 5: Map A: The location of Regionally and Nationally Important Metal Mining Sites in the northern part of the orefield around Castleton, Peak Forest and Bradwell (main sites – red; underground interest only – green).

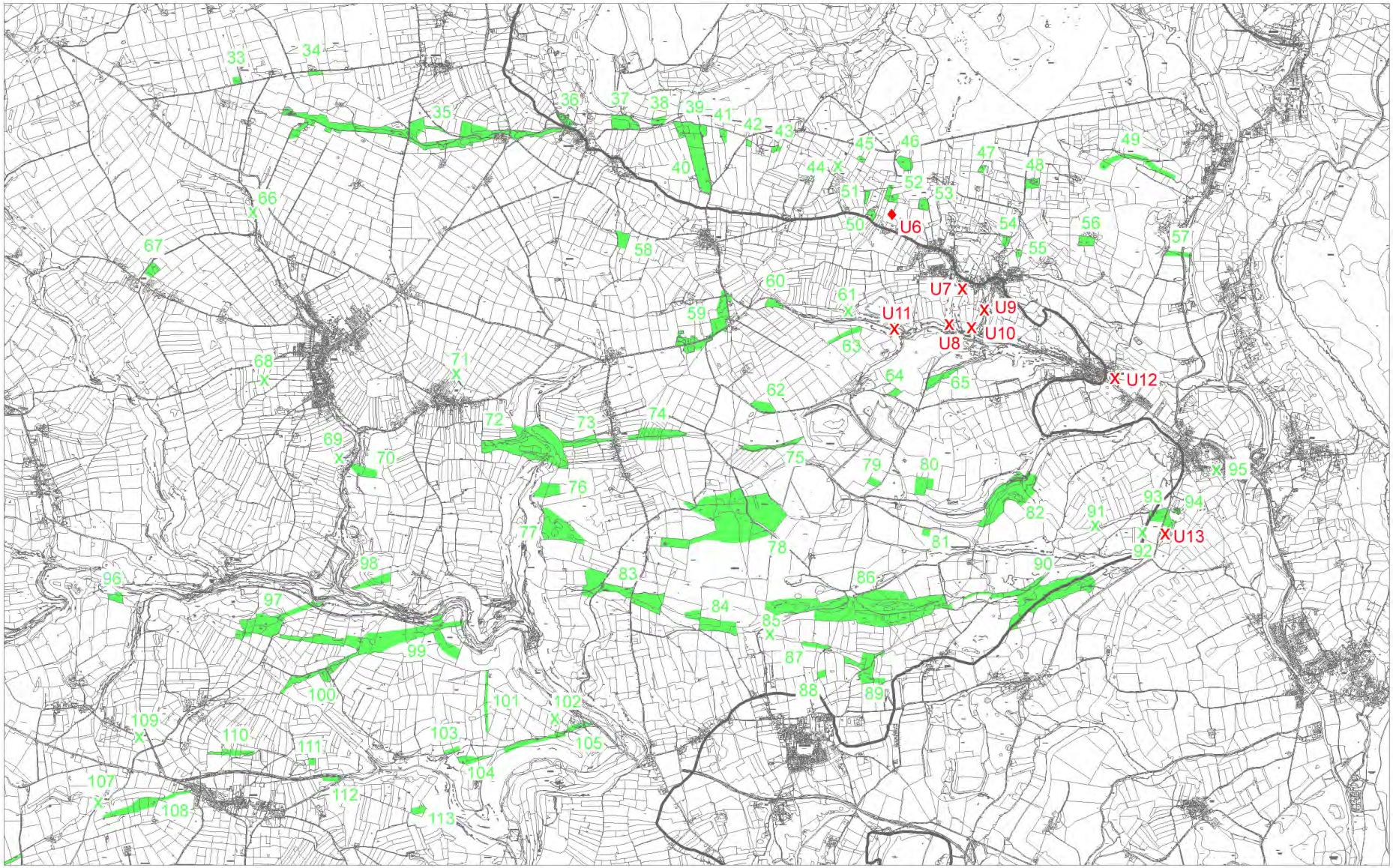


Figure 6: Map B: The location of Regionally and Nationally Important Metal Mining Sites in the northern part of the orefield around Eyam and Longstone (main sites – red; underground interest only – green).

Figure 7: Map C: The location of Regionally and Nationally Important Metal Mining Sites at the north-western fringe and central parts of the orefield around Buxton and Taddington (main sites – red; underground interest only – green).

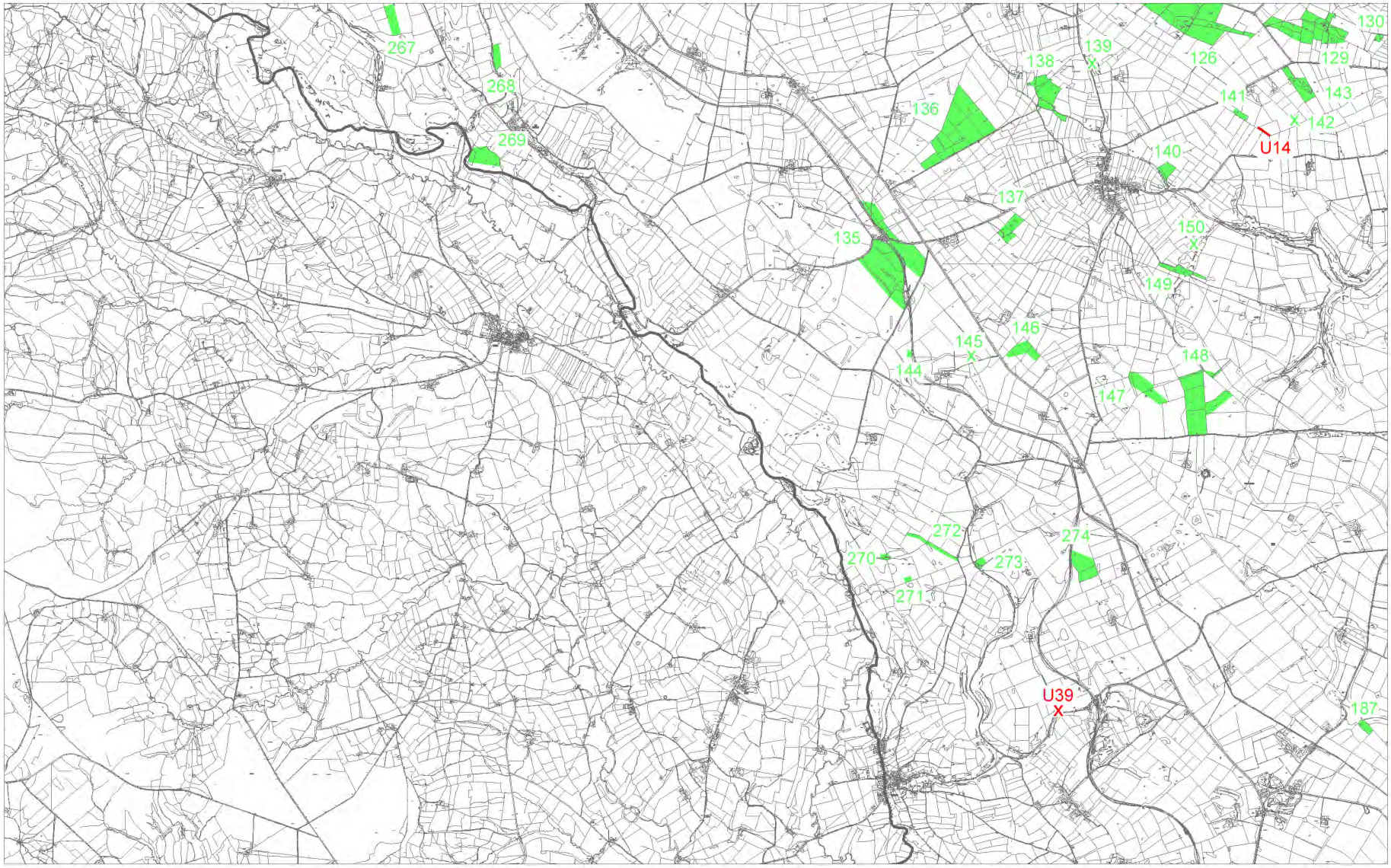


Figure 8: Map D: The location of Regionally and Nationally Important Metal Mining Sites at the south-western fringe and central parts of the orefield north of Hartington and around Monyash (main sites – red; underground interest only – green).

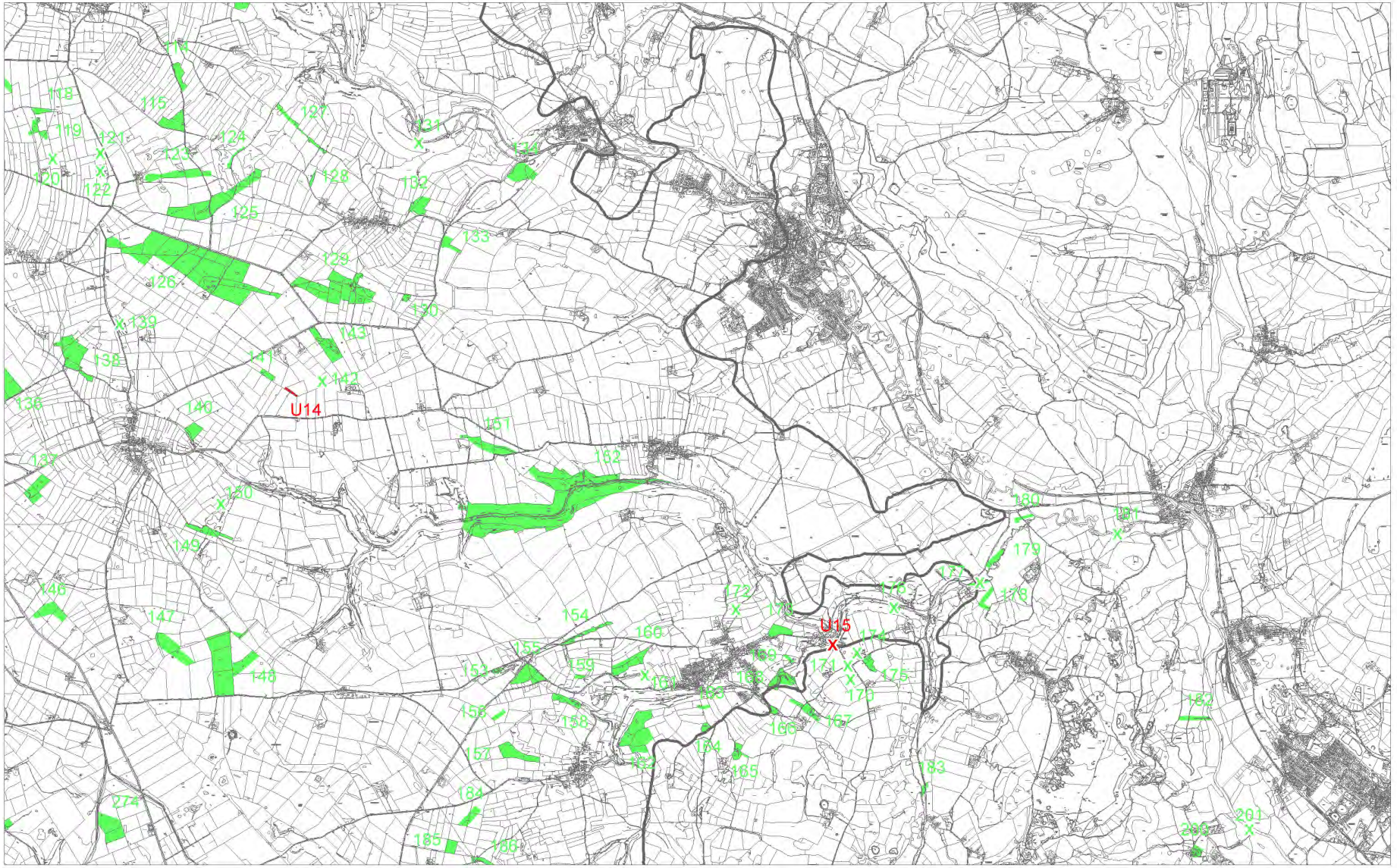


Figure 9: Map E: The location of Regionally and Nationally Important Metal Mining Sites in the central part of the orefield around Bakewell and Youlgreave (main sites – red; underground interest only – green).

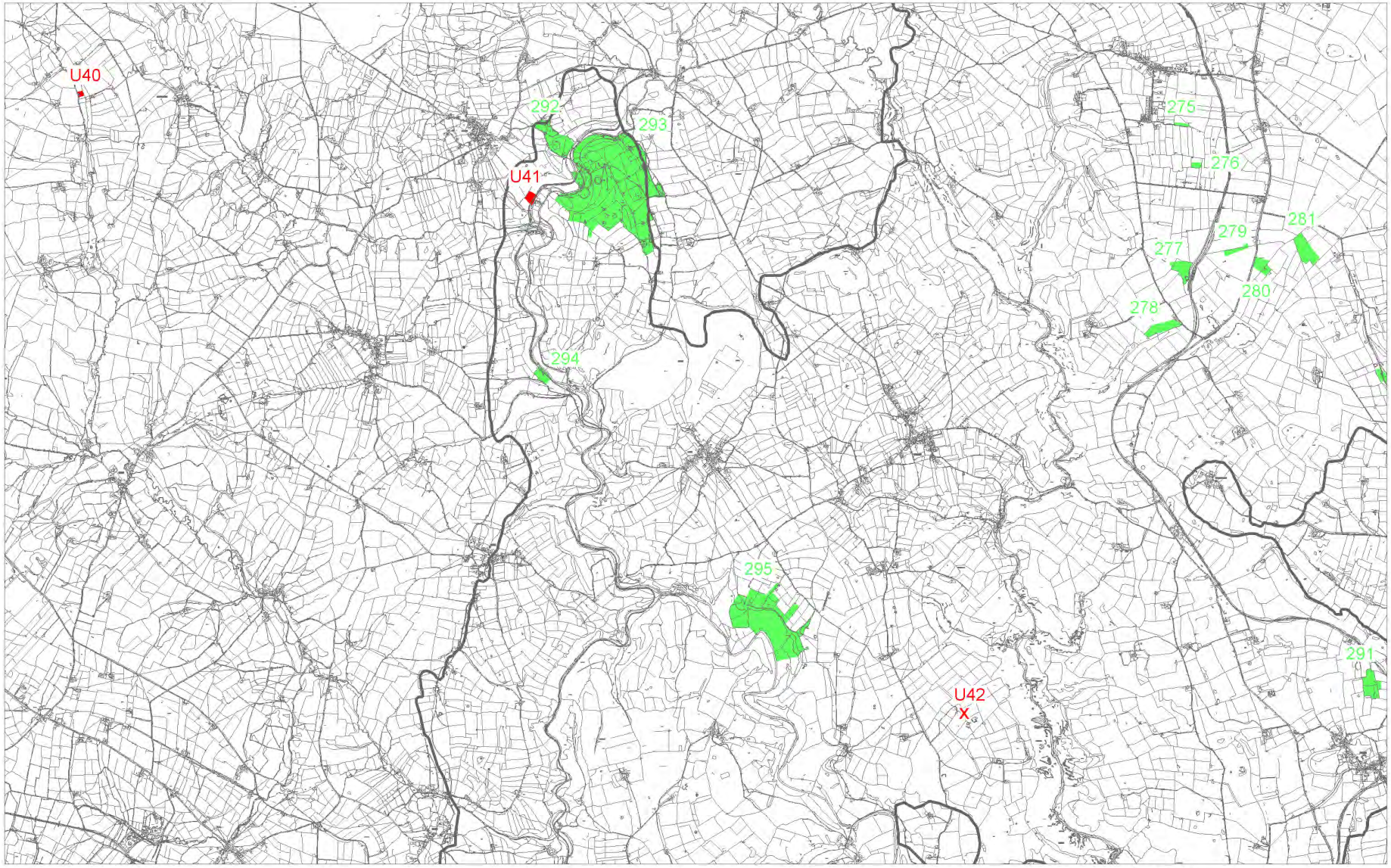


Figure 10: Map F: The location of Regionally and Nationally Important Metal Mining Sites in the Staffordshire and south-western fringe parts of the orefield around Warslow and Wetton (main sites – red; underground interest only – green).

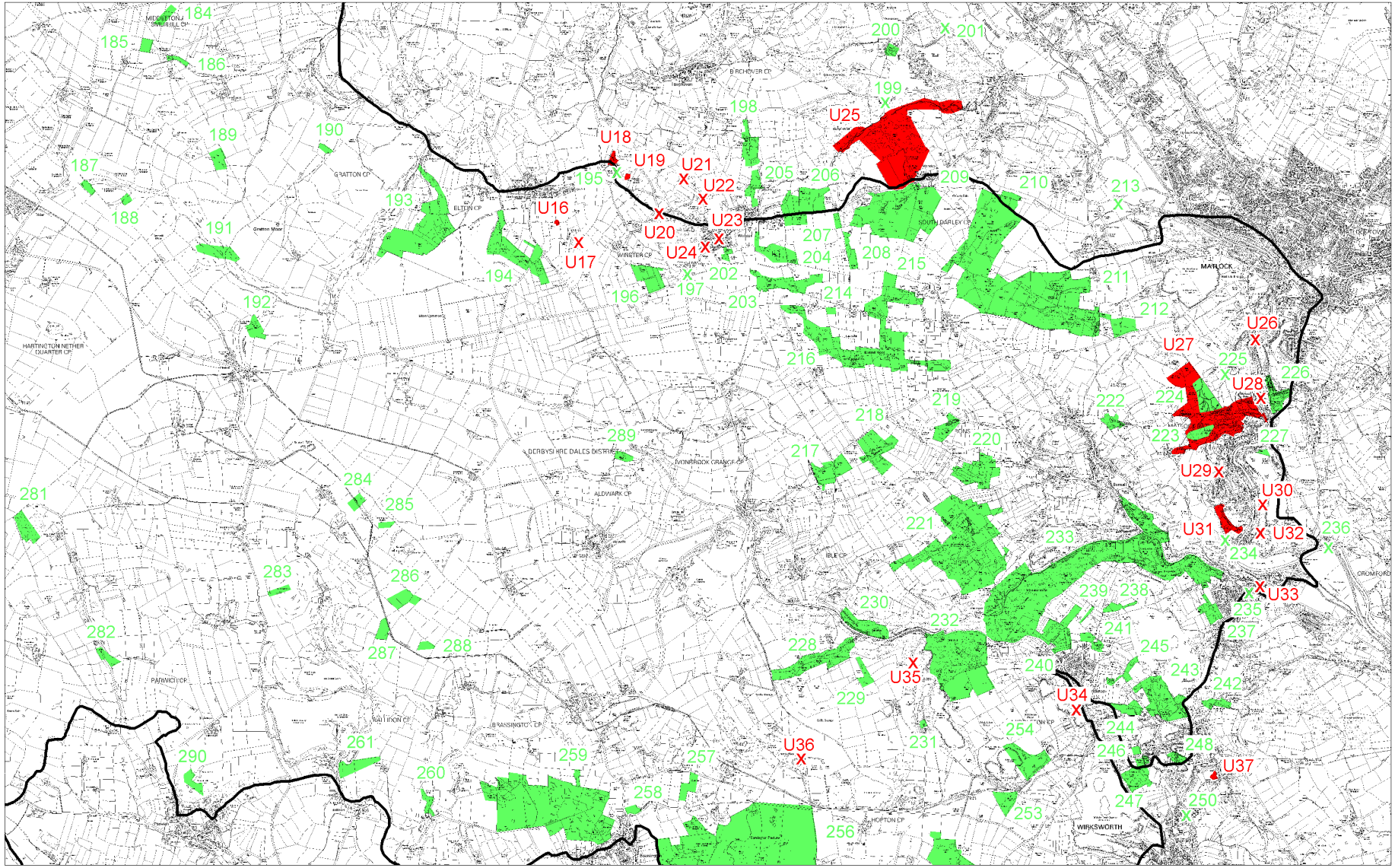


Figure 11: Map G: The location of Regionally and Nationally Important Metal Mining Sites at the south-eastern fringe and south-eastern parts of the orefield, located north of Parwich and around Winster and Matlock (main sites – red; underground interest only – green).

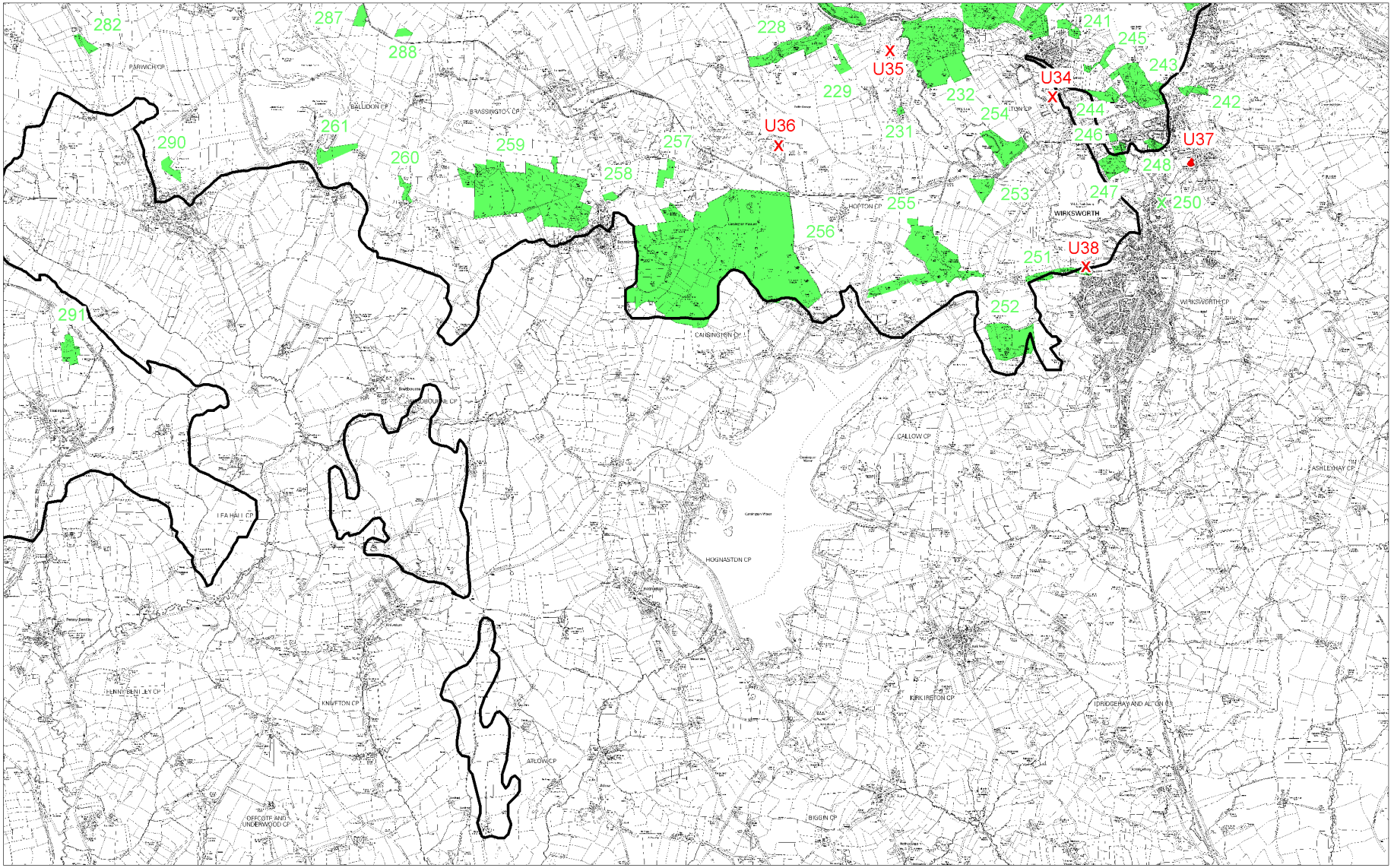


Figure 12: Map H: The location of Regionally and Nationally Important Metal Mining Sites in the south-eastern fringe and south-eastern parts of the orefield, between Parwich and Wirksworth (main sites – red; underground interest only – green).

- Of a wide variety of dates.
- Of significantly different scales of extraction and investment.
- From extraction at different depths, with surface features built where necessary to overcome having to raise ore from great depths and drainage problems here.
- With a wide range of rare or special mining features related to different stages of ore extraction and processing.
- With a significant variety of ecological communities on the surviving hillocks.

Listing Categories – The Inventory has two lists of sites. The Main List includes all those sites with surface hillocks and/or a variety of significant features; these can also have underground interest. The other list has sites with primary interest underground rather than at surface (prefixed in the Inventory catalogue by 'U', with the surface access point mapped). The defined extent at surface of sites in the underground list is usually small, confined to the usually-used entrance, although the workings below this can be extensive. There are three exceptions, at the Nestus and Longtor Mines (U27), Wapping Mine and Cumberland Cavern (U31) and Old Millclose Mine and Sough (U25) there are extensive interlinked workings with several entrances and each been brought together under one entry that covers a broader area at surface.

Site Boundaries: In many sites where the interest is both archaeological and ecological, it is the distribution of surviving or damaged hillocks (and in some cases specific archaeological features) which has been used to define site boundaries. The approach has been relatively broad-brush, choosing boundaries to sites that can readily be recognised in the field using obvious features such as field boundaries, while at the same time, with large parcels in particular, excluding broad areas where there is no mining conservation interest. Thus, in many situations the ecological interest is variable across the site (particularly on the extensive sites). Therefore individual sites do not necessarily have a coherent ecological identity. Thus, where practical, areas of particular ecological interest have been indicated. Similarly, there are some parts of sites where the interest is largely ecological, while the archaeological interest is low; these instances are noted.

Site Names: Wherever possible original miners' names for sites have been used; where these are not known, too specific or particularly problematic, names based on currently used place-names are given but placed in parenthesis. Often the miners' names are well established but in a small number of cases they are open to question or only cover parts. Conversely, mine names can change through time and with large sites in particular there can be many relevant names; we have attempted to simplify and use those names that are most commonly known to mining historians and/or cover much of a site. Inevitably, especially with an interdisciplinary assessment, there are many alternative names used by specialists and on modern maps that again we could not use without having such a plethora of site names that this would lead to confusion amongst the readers; specialists wanting to cross-correlate should start with the location and mapping of sites (details of which are available upon request).

Numbering Conventions: Because many sites have been added since 2004 and the number system used listed sites from north to south, all have now been re-numbered; a concordance between old and new numbers in given in Appendix 1. In the site entries below for geology and ecology only those sites considered to have features of regional and/or national importance are listed. Where possible traditional mine names have been used for sites; however in a minority of cases this was not possible or inconvenient; here the names are given as '….'.

Using the Inventory: The descriptions given below should be used in conjunction with Figures 4-12 and the table in Appendix 1. Sites vary greatly in the areas they cover, and the table gives the area (in hectares), as well as data such as the designation status not given in the text. The orefield is divided into seven zones as an aid to finding sites, with the main zones to the north, centre and south-east given first, followed by mines to the east and west in peripheral areas, ending with the Staffordshire mines to the south-west.

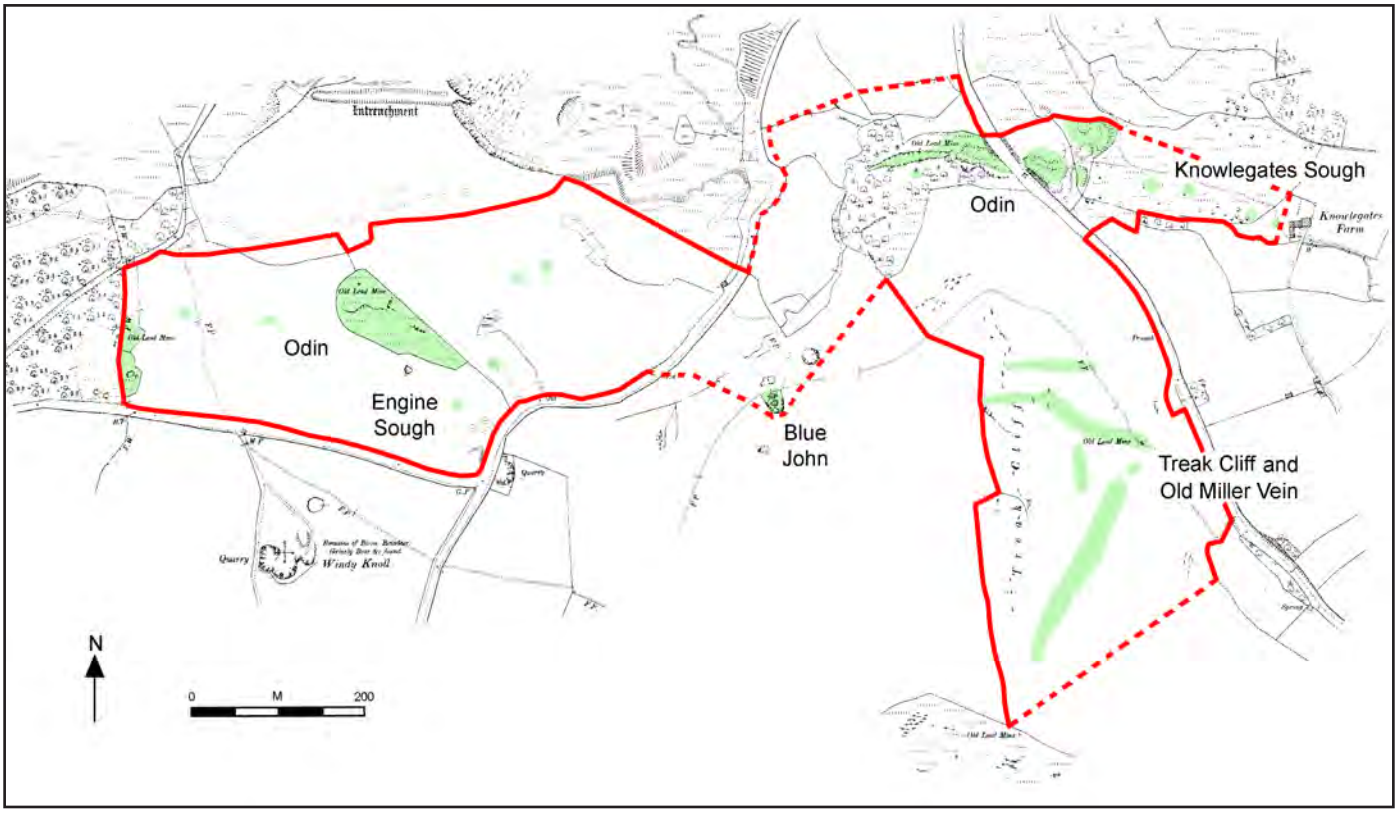


Figure 13: Site 1: Odin Mine, Knowlegates and Engine Soughs, Blue John and Treak Cliff Mines, and Old Miller Vein (site boundary – red; surface mining features - green).

MAIN SITES

The Northern Orefield – Castleton, Peak Forest, Bradwell, Eyam and Longstone.

1: Odin Mine, Knowlegates and Engine Soughs, Blue John and Treak Cliff Mines/Caverns, and Old Miller Vein, SK 131833

Geology: Treak Cliff Cavern is noted for the occurrence of a decorative variety of fluorite known as Blue John. The mineralisation consists of banded dark blue, yellow and white fluorite that has crystallised in the cavities between boulders in the fore-reef boulder bed of Treak Cliff which occurs immediately beneath the Edale Shale. Vugs in the Blue John pipe mineralisation sometimes contain calcite crystals and, rarely, barite rosettes. The 'black' fluorite takes its colour from abundant pyrite inclusions. The site is within a geological SSSI.

The Blue John from Treak Cliff was worked as steel smelting flux during and just after the First World War. Small quantities of ornamental Blue John are still produced. Treak Cliff Cavern is also noted for the fine stalactite caverns discovered during the later phase of fluorspar working.

The Blue John Caverns are a series of natural caves within which there are a number of veins and pipes of Blue John fluorite. These are geologically similar to the Blue John veins in Treak Cliff Cavern, being situated immediately beneath the overlying shale. Small quantities of ornamental Blue John are again still produced.

Archaeology: Surface features at this large and historically important mine include, to the east, a fine crushing circle/wheel with rare iron track and 'tyre', a gin circle with associated run-in/filled shafts, a possible knockstone and a disturbed belland yard wall, all at a disturbed dressing floor and an associated large area of hillocks. Nearby there is the Knowlegates Sough bolt with a line of sough shaft hillocks between it and the mine. West of the road is an impressive deep open-cut running into the hillside, with a small entrance to a side vein to the north side, with a diverted stream in a leat running above and to the side of the main open-cut. The open-cut gives access to large, extensive, underground stopes, a slab-roofed level and a drystone-arched/slab-roofed cartgate; there have been recent collapses.

Further west, at surface, there are spaced shafts (run-in or capped) and associated hillocks that were sunk to workings under the shale. At one shaft mineral was brought to surface but these large hillocks have now been largely removed and there is a 20th century tramway bed associated with this latter activity. The other shaft hillocks include two or possibly three mounds along the early Engine Sough and a probable small shaft mound on another shale gate or trial. One shaft has a leat and this may perhaps have been used for a water blast. Downslope of the shafts there is a possible mine road.

Odin Mine is documented as active in the second half of the 13th century and had a long and complex history (Ford and Rieuwerts 1976). The Blue John Mine and Treak Cliff Cavern (currently show caves) contain shafts and adits sunk to natural caverns and historically important Blue John pipe deposits, first found within lead mines, with the decorative banded fluorspar worked from the 18th century onwards. Treak Cliff Cavern also has opencast workings on the steep slope above.

Ecology: The eastern area of Odin Mine is Unit 26 of Castleton SSSI, notified both for its Earth Heritage and Biological interest, where the main interest feature is the calaminarian grassland which is associated with the crushing and gin circles, belland yard and hillocks. These include both open skeletal vegetation (OV37a) over bare spoil and a more closed vegetation (OV37b) both with a high cover of spring sandwort. Associated species include thyme, bird's-foot trefoil and harebell although the open vegetation tends to be species-poor. Locally species typical of more calcareous soils including fairy flax, limestone bedstraw and mouse-ear hawkweed are present. Un-grazed and otherwise un-managed, the vegetation grades into tall relatively species-poor neutral grassland (MG1) away from areas of toxicity. However the calaminarian areas appear fairly stable, maintained by the substrate toxicity and locally by visitor trampling pressure.

At the large disturbed hillocks with tramway bed to the west (SK127832) associated with Winnats Head Farm (outside the SSSI) there is extensive calaminarian vegetation along the eastern edge of the field, with frequent spring sandwort and occasional eyebright, of the typical open sub-community. Most of the rest of the area consists of rather species-poor acidic grassland with rare to occasional harebell and heath bedstraw.

2: Peakshill Sough, SK 117829

Archaeology: Rare example of 12 or 13 closely-spaced ventilation shaft hillocks along the line of a sough or shale gate. Pairs of hillocks near the tail indicate an undocumented re-driving.

3: Oden Sough, SK 145832

Archaeology: An open low bolt to an historically important sough, with four surviving large, well-spaced, ventilation-shaft mounds allowing its course across relatively flat ground to be traced.

4: Faucet, Slack Hole and Longcliff Rakes, with Rowter, Oxlow and Maskill Mines, SK 127821

Archaeology: Well preserved and in places impressive hillocks at larger veins, with open-cuts at a good example of a smaller mine working. Features include a gin circle set into the hillside at Rowter Mine and another probable gin site on a hillock at Longcliff Rake. The section of Faucet Rake west of Maskhill Mine has shallow surface workings with a distinctive series of spaced shaft mounds just off the surface line (presumably down to the hading vein). Here there are capped shafts, ruined coes and five small ore storage bins.

Underground there are shafts and large stopes (some natural opens) still accessible at Oxlow, Maskhill and Rowter Mines, with underground dressing floors.

Ecology: The mounds centred on SK120821 west of Maskhill Mine support a few tiny patches of calaminarian vegetation with spring sandwort and rare mountain pansy. The rest is rather species-poor acid (U4) and neutral (MG6) grassland.

5: New Rake, SK 137820

Archaeology: The hillocks are well preserved and there are several capped shafts. Surface features include a small ore storage bin adjacent to a small dressing floor with a small rectangular hollow that may be an ore-dressing pit. Nearby there are possible ponds. This section of the vein lies within a belland yard.

Underground a shaft at what is now erroneously known as James Hall Over Engine gives access to extensive stopes, internal shafts, a miners' workshop and underground dressing floor, and an impressive natural vertical cavern with miners' ladderway stemples which leads down to the Speedwell Cavern (see site U2) (Nixon and Warriner 1997).

Ecology: The central part of the rake forms Unit 28 of the SSSI where the main interest feature is the calaminarian grassland. This forms pockets within more extensive herb rich calcareous grassland which covers the steeper slopes of the hillocks particularly in the west. The calaminarian grassland is characterised by a thin scatter of spring sandwort in a more or less closed sward with constant sheep's fescue, crested hair grass and spring sedge and a diverse array of wildflowers including thyme, eyebright, bird's-foot trefoil and fairy flax. Of note is the crested dog's tail spreading in from the surrounding vegetation. This coupled with the scarcity of bare spoil and only scattered

spring sandwort, suggests that succession may be happening to a less toxic vegetation type. The surrounding calcareous grassland is very herb-rich (around 90% cover) and locally supports small scabious and autumn gentian.

6: Coalpithole Rake, SK 099811
Archaeology: The surface interest to the east includes extensive hillocks, a long open-cut, several small dressing floors, two probable gin circles, a set of slime ponds and a probable large water storage pond (or dew pond). Near the eastern end of the vein is a manager's house which is still occupied. The central section of the vein lies within a belland yard. Underground interest includes several deep shafts (rarely entered) that give access to unstable stopes.

West of the road there are two particularly impressive lined engine shafts sunk through shale, with damaged hillocks. At 'shaft 8', adjacent to the road, there are slight traces of the horizontal engine house and/or associated buildings, including large gritstone blocks with securing bolts. Nearby is a large dam and leat which may be the reservoir for 18th century waterwheel pumps, or was constructed as a flood-control measure in the 1860s. At 'shaft 10' (the westernmost) there are traces of the brick foundations and paving of an engine house or boiler house, together with a brick-built flue running up the hillside to a chimney base.

A detailed history of the mine has been written (Heathcote 2007).

7: Gautries Rake, SK 102808
Archaeology: Surface interest within a long belland yard plantation includes undisturbed hillocks, several capped shafts, open-cuts, water storage and ore-dressing ponds, two buddle dams, dressing floors and traces of small buildings. Three foci at relatively small mine complexes can be identified. Rarer features include the only known stone-lined buddle in the northern part of the orefield, a 19th century mine road, and a retained tramway with a loading bay at the top end probably associated with relatively early hillock reworking and removal.

8: Linacre, Slitherstones, Eldon Bent, Burning Drake, Wrangling Rake, Portaway Mine, Eldon Vein, Jowle Grove, Watts Grove, Smiler, White Rakes and Hurdlow End Mines, SK 120811
Archaeology: This area has many small and medium-sized veins with well-preserved hillocks and open-cuts, together with natural dolines (surface collapses above cave passages) along the veins, which together form a classic example of mine complexes at different scales, with workings crossing the upper part of the limestone plateau on a landscape scale.

At the Linacre/Slitherstone Mines there are a large number of capped shafts as well as good examples of small open-cuts, small belland yards and dressing floors, coes, water storage and ore-dressing ponds, and buddle dams. Underground interest includes several deep shafts that give access to unstable stopes.

On Eldon Hill there are several small veins. Interest here includes a fine belland yard with crushing circle and wheel, ruined coes, a shaft and ore-dressing ponds and pits on the hilltop at Burning Drake Mine. On the north-east side of Eldon Hill, on Eldon Bent Vein, there is a small gin circle on a low mound, with a large hollow at a run-in shaft. Nearby to the west there is a ruined small belland yard. There is a ruined coe with a small ore storage bin on Wrangling Rake, with other ruined coes and/or walled shafts nearby, while further west there is a possible coe with what may be a small ore storage bin. Still further west along this vein there is a ruined small belland yard with a possible pond and a flat area that may once have been the site of a gin or less probably a crushing circle. At the western end there is a further belland yard with a ruined coe around a shaft.

On the large veins to the south, at the easternmost part, at Portaway Mine, nearly everything within the belland yard has been removed. There is a small belland yard and capped shafts on the small Eldon Vein to the north. There is a crushing circle and part of the wheel, a ruined coe, a small possible part of a gin

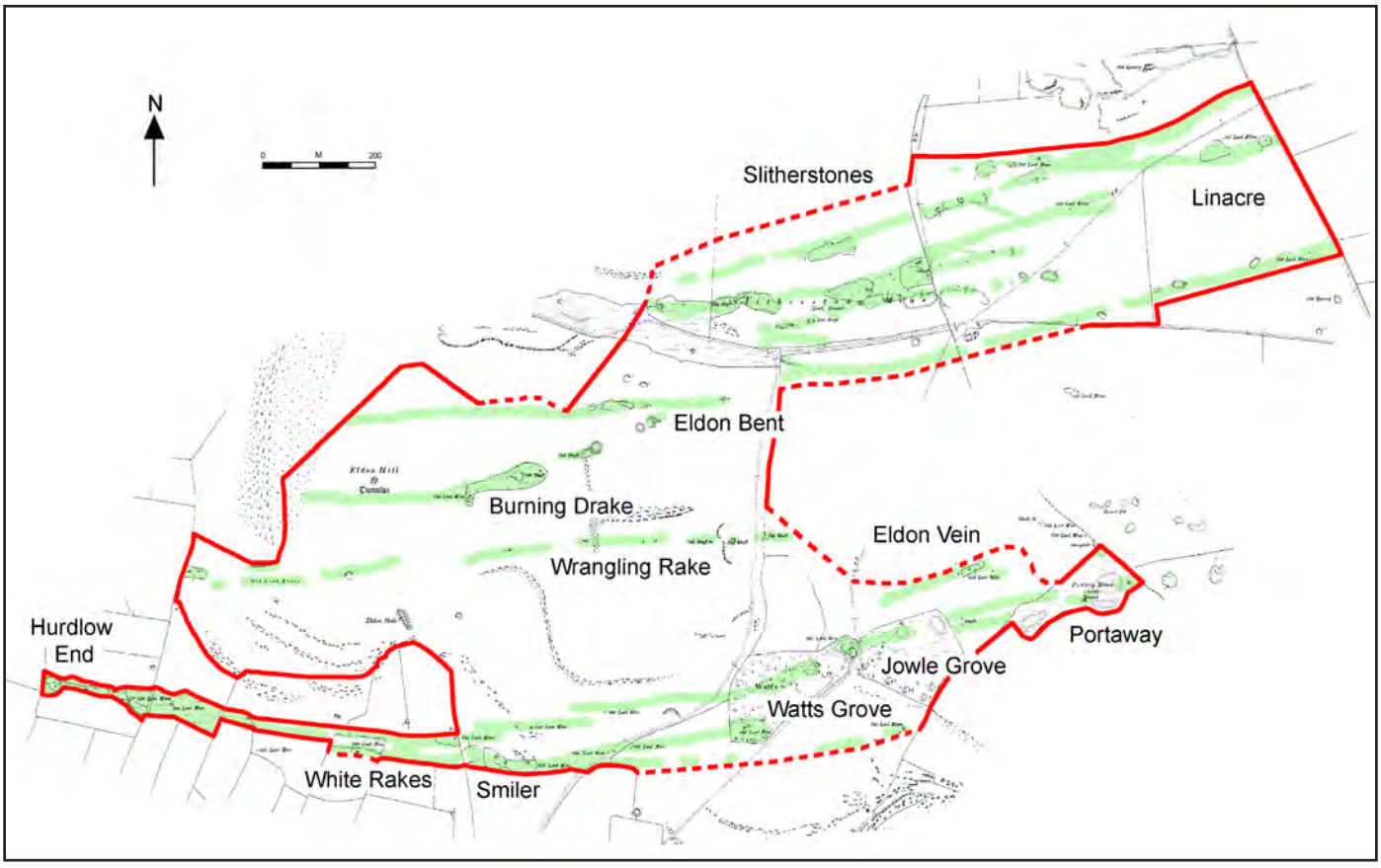


Figure 14: Site 8: Linacre, Slitherstones, Eldon Bent, Burning Drake, Wrangling Rake, Portaway, Eldon Vein, Jowle Grove, Watts Grove, Smiler, White Rakes and Hurdlow End Mines (site boundary – red; surface mining features - green).

circle and a grilled engine shaft at otherwise disturbed ground within the belland yard at Jowle Grove. Well north of the vein there is the dam of a large water storage pond. Immediately further west along the vein within the same belland yard as Jowle Grove, at Watts Grove, the hillocks are better preserved and there are various grilled/capped shafts, a ruined coe or shaft wall, a water storage pond and a gin circle. The grilled shafts allow easy inspection of ginged engine shafts.

Going west, to the veins known as White Rakes, there is a belland yard around Smiler Mine with capped adjacent engine and climbing shafts, open-cuts, a fine example of walling supporting deads in the vein, water storage/ore-dressing ponds and pits and a probable buddle dam. Further belland yards along White Rakes, now planted with trees, have shafts, a ruined coe, possible ponds and a probable gin circle. Nearby is a probable mine road. Open-cuts are associated with early hillock reworking, possibly in the 19th century.

There is a fine gin circle at Hurdlow End in a belland yard and further east there are reworked high hillocks at a second mine within a further belland yard.

Ecology: The northern and western sections of this site lie within Castleton SSSI notified both for its Earth Heritage and Biological interest.

Slitherstones Mine in the north-east of the site forms Unit 23 of the SSSI where the main interest feature is the calaminarian grassland found on steep hillock slopes. Except in the east there is little bare spoil, the grassland supports a high cover of grasses and includes some neutral grassland herbs. Spring sandwort is generally scarce although it is more frequent in the east whilst thyme is constant with smaller amounts of eyebright, fairy flax and harebell. A short neutral/calcareous sward covers much of the spoil heaps and surrounds the small pockets of calaminarian grassland. Widespread herbs include thyme, bird's-foot trefoil and ribwort plantain with rough hawkbit and occasional autumn gentian.

Elsewhere on Slitherstones Mine a line of hillocks (SK123814) supports five very small patches of calaminarian grassland with spring sandwort. The rest is shared equally between calcareous (CG2) and species-poor neutral (MG6) grassland. There is a small patch of autumn gentian. Mountain pansy and crested hair grass are occasional.

The top of Eldon Hill (Unit 24 of the SSSI) has several lines of hillocks, hollows and open-cuts. These support a very species-rich mosaic of different calcareous [CG2, CG7, CG10] and acidic communities. Small patches of calaminarian grassland with spring sandwort are also scattered throughout. Notable species include wall whitlow grass (nationally scarce), hairy rock cress (rare), primrose, common dog violet, meadow oat grass, sheep's fescue, crested hair grass, limestone bedstraw, carline thistle and early purple orchid, with kidney vetch (rare), rock rose, carline thistle and autumn gentian. Acidic vegetation includes tormentil, wavy hair grass, mat grass, heath bedstraw, bitter vetch, mountain pansy, and bilberry (rare). Adder's tongue fern also occurs.

At Portaway Mine (SK127808) hillocks support up to about 5% calaminarian grassland with spring sandwort. Another small area supports acid grassland (U4) with tormentil and mountain pansy, and a larger area of calcareous grassland with limestone bedstraw, glaucous sedge, spring sedge and mouse-ear hawkweed.

Jewelknoll Plantation west of Jowle Grove (at approx. SK124808) has two tiny patches of calaminarian grassland with spring sandwort on the hillocks.

At Watts Grove (SK121807) hillocks and hollows support patches of calaminarian grassland with spring sandwort and eyebright. Autumn gentian occurs in one place.

9: Wham and Wrangling Rakes, with Penny Mine, SK 132811
Archaeology: Some surviving large hillocks and hollows, others completely removed, and also ruined belland yards. At Penny Mine there is a walled flat circular area at the south side that may be a small gin circle.

Ecology: The surviving large hillocks and hollows support moderately species-rich calcareous and neutral grassland with a small patch of calaminarian vegetation to the north-east.

10: Hazard Mine, SK 137812
Archaeology: Mostly removed, but a walled gin circle, a deep, grilled, engine shaft and a small part of the belland yard wall are extant and there are a few remaining adjacent hillocks (Chatburn 1962).

Ecology: There are three very small patches of calaminarian grassland on the hillocks with spring sandwort and eyebright. Glaucous sedge and common dog violet are locally frequent.

11: Oxlow and Daisy Rakes, SK 130804
Archaeology: Here there are fine examples of large hillocks and open-cuts on a particularly large rake. Some of the hillocks are flat-topped and have been used as dressing floors; adjacent hillocks often comprise dressing waste. The whole is walled out by five large linear belland yards.

A series of mines can be identified from the distribution of larger hillocks within the yards. Few shafts and associated features remain visible, with only two or three capped examples of shafts surviving. There are several examples of ruined coes including a large one that may have been part of a larger complex of structures. Associated with the identified mines are water leats, storage and ore-dressing ponds (sometimes clustered together in integral arrangements), and buddle dams including one fine semi-circular example. Rarer features include a fine bouse teem at Nether Oxlow, a circular structure of unknown purpose and slime pond relatively nearby, and footings of a possible small engine house at Oxlow End (recently damaged). There is a crushing circle, mostly buried, at Daisy Rake (Old Moor Mine).

Many of the hillocks between those of the larger mines have been disturbed, and these provide clear examples of early reworking, most probably of 16th or 18th century date.

Ecology: The north-eastern section of this site forms Oxlow Rake SSSI. The steep slopes of the lead spoil heaps are mainly covered in a species-rich calcareous grassland community. This is diverse and herb-rich with up to 90% herbs including limestone bedstraw and autumn gentian and the very occasional plants of spring sandwort. A taller acid grassland community is present at the margins of the spoil heaps over deeper soil. This is fairly herb rich including mountain pansy but quickly grades to a poorer more grassy neutral/acid grassland over level ground. Calaminarian grassland is restricted to Unit 2 (in the south) where both the open (OV37a) and closed (OV37b) sub-communities are found. Spring sandwort is present throughout but always very sparse. Thyme, eyebright, sheep's fescue and crested hair grass are constant and many of the calcareous grassland species are present at a low frequency. Disturbance from stock is keeping the sward open and has also created areas of broken vegetation that lack metallophytes.

There is no lead rake ecological interest at the south-western section of the site.

12: Dirtlow Rake, Pindale Side and Red Seats Veins, with How Grove and Siggate Head Mines, SK 155820
Geology: Dirtlow Rake is a strong vein largely comprised of fluorite, calcite and barite with galena. In common with many of the veins in the orefield the galena is usually present close to the vein walls and sometimes in the centre of the vein. The vein exhibits classic 'crustiform' banding demonstrating that it was deposited from multiple phases of mineralising fluids and

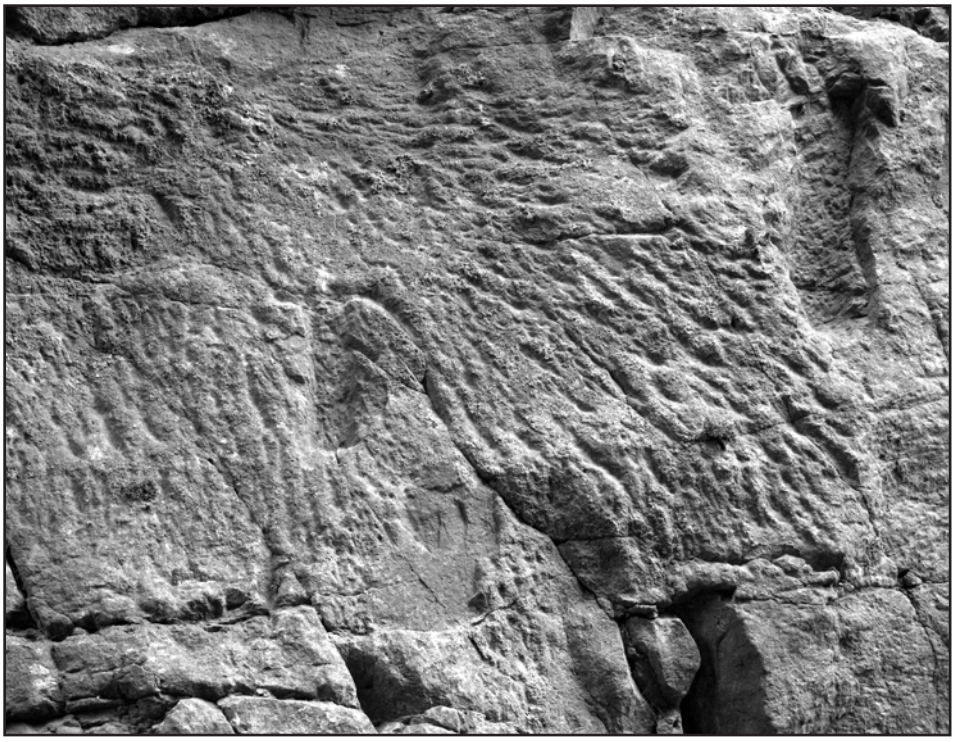


Plate 33: Site 12: Detail of the extensive ancient pickwork on the walls of the deep open-cut at Dirtlow Rake, long exposed to the weather, here cut in two places by slots for horizontal stemples placed across the vein and most probably for working platforms or as ladder supports.

fault movement as the vein was forming. The vein has several 'horses' of host rock limestone enclosed between branches of the vein. Crystalline fluorite, often purple or with a purple tinge, is common in parts of the vein.

As well as the vein mineralisation there are extensive deposits of fluorite where the limestone adjacent to the vein and in some of the horses has been replaced by fluorite. Apart from some un-replaced limestone, occasional chert nodules and silicified fossils, these deposits are almost exclusively comprised of fluorite and are the main reason that the rake has been worked for fluorspar.

In recent opencast fluorspar workings on Dirtlow Rake solutional collapse structures were exposed which contained residual fluorite and fluorite mineralization in the voids.

Archaeology: Surface interest includes deep open-cuts with fine pickwork of early date on Pindale Side and Dirtlow Rake, mostly within large belland yards. At Dirtlow Rake, which historically was an important rake working, in 'restored' ground there are several grilled shafts and stopes that allow easy inspection.

At How Grove there is a fine excavated small mine complex, with dressing floor, coe, crushing circle and wheel (Barnatt 2002b). There are also two atypical buddles, one circular the other D-shaped, leats and a water storage dam which provide a rare example of a small late-19th or early-20th century mining venture. There is a further complex at Siggate Head Mine above Pindale with surviving dressing floor, robbed crushing circle and pond (Chatburn 1962). At Nether Dirtlow Mine on Dirtlow Rake only part of the gin circle survives; a crushing circle and wheel here were moved several years ago from Rush Mine at Eldon Hill.

On Red Seats Vein there are hillocks and a shallow open-cut. It has been suggested that an adjacent 'field barn' was built for calamine processing, but there is currently no positive confirmation of this.

An accessible climbing shaft near to the bottom of Pindale, at Pindale End Mine, has a fine example of stone climbing steps in its ginging.

The mines at Dirtlow Head are documented as active in 1538 but may well have much earlier origins.

Ecology: The levelled spoil at Dirtlow Rake is covered in a mosaic of calaminarian vegetation with frequent spring sandwort, and species-rich calcareous patches including maiden pink, fragrant orchid, several species of marsh orchids, autumn gentian and green spleenwort, both in the open-cut and the surrounding levelled hillocks. There is a small amount of Pyrenean scurvy grass also in the open-cut. Shepherd's cress, a very rare plant locally, has been recorded in the past, but has not seen for several years.

Pindale Side is a very important site containing a significant area of calaminarian grassland in a Peak District context estimated at over half a hectare (The total area of the habitat in the Peak District is less than 15ha.). This is an excellent example of this habitat type (OV37a) and supports frequent spring sandwort and occasional Pyrenean scurvy grass. Species-rich calcareous patches exist around the margins and support autumn gentian, thyme, and rock rose. Dingy skipper, wall brown, and dark green fritillary butterflies all occur on the site, as does the cistus forester moth.

13: Ashton's Mine, SK 163826
Archaeology: Well-preserved two-storey horizontal engine house and chimney (Chatburn 1962); little remains of the boiler house. The shaft down to rake vein workings has been sealed but the surrounding hillock remains with retaining walls in parts. A powder house is set behind to the east.

14: Pindale Sough, SK 163829
Archaeology: A low damaged sough bolt by Peakshole Water from where the sough runs southwards, probably at first as a cut and cover feature, to higher ground where there are 3 surviving sough shaft mounds. A fourth mound, nearer Ashton's Mine, has now been destroyed.

15: New Venture Mine West End, SK 147809
Archaeology: Good example of a small-sized vein with hillocks and open-cuts. In the eastern part there are three identifiable small mines, each with a ruined coe. Two have surviving shafts. One has a ruined belland yard with two dressing floor compartments, one presumably for washing and sieving, the other perhaps for buddling.

Ecology: Hillocks support patches of moderately species-rich neutral and calcareous vegetation.

16: New Venture Mine, SK 154810
Archaeology: A length of damaged hillocks in two adjoining belland yards, with conserved open-cuts and grilled shafts. There is also a fine wall of deads across the vein, together with a dressing floor, a possible ore storage bin (restored), water storage and ore-dressing ponds, and a natural pothole on the vein. Shafts and open-cuts give access to underground stopes that reach a depth of about 70m; recent blasting in the quarry nearby may have added significantly to instability and the workings should not be entered.

Ecology: Small patches of calcareous and neutral grassland occur on the hillocks.

17: Long Rake Founder and Shack Pit, SK 153808
Archaeology: Hillocks mostly removed but still with ecological interest. The lidded founder shaft, in a disturbed hillock, gives access to deep and extensive stopes and natural caverns, which reach a total depth of 150m. Shack Pit, about 30m along the vein to the south-west and now more commonly known as Batham Pot, is an impressive natural 15m deep pothole with mining at one end, once much deeper but used by miners to dump deads.

Ecology: The vegetation associated with the hillocks is mainly neutral grassland with a small proportion that is more acidic in nature.

18: 'Smalldale Mines', SK 166815
Ecology: Three isolated hillocks in a largely reworked area support relatively species-poor neutral vegetation.

19: Cop Rake and Starvehouse Mines, SK 132800
Archaeology: At Cop Rake there are fine examples of open-cuts with associated shafts and unusual drystone walling across the cut, with early reworked hillocks, a retained causeway across the vein, a possible water storage or ore-dressing pond, a possible gin circle and ruined coes. The Cop Rake mines are documented as active in the first half of the 13th century.

At Starvehouse Mines there are several good undisturbed examples of hillocks and hollows following relatively small veins as well as the main rake. Parts lie within belland yards.

Ecology: The steeper western slope at Starvehouse Mine contains small patches of calaminarian grassland with spring sandwort, acid grassland (U4) with wavy hair grass and mountain pansy, and calcareous vegetation (CG2) with limestone bedstraw and thyme (both locally frequent), crested hair grass, fairy flax and mouse-ear hawkweed.

Cop Rake also supports small patches of calaminarian grassland with spring sandwort. There is also an excellent species-rich mosaic of calcareous (CG2, CG7) and acidic (U4) communities in a less species-rich neutral matrix. Mountain pansy is locally frequent, and thyme, mouse-ear hawkweed and glaucous sedge are locally abundant.

20: Boggart Hole Vein, Hills Venture and Royal Oak Mines, SK 127794
Archaeology: The hillocks, belland yards, dressing floors, ruined coes, part-collapsed beehive caps, and shafts at Boggart Hole Vein and Hills Venture Mine remain. In contrast, much of Royal Oak Mine within the ruined belland yard wall has been reworked. Interest includes a crushing circle and wheel at Boggart Hole Vein, a water storage (or dew) pond at Hills Venture, and a small part of the gin circle and a re-erected crushing wheel at Royal Oak Mine.

Ecology: The grassland is mainly neutral in character but contains species-rich calcareous patches with grass of Parnassus, early purple orchid and small areas of acid vegetation with localised mountain pansy. Of note here is the occurrence of butterwort, an insectivorous plant, found on the edge of one of the hillocks above a small quarry.

21: Moss Rake West End, SK 136796
Archaeology: Fine examples of hillocks (with partial fluorspar reworking in the central stretch) and open-cuts, with shafts and water storage and/or ore-dressing ponds, together with a fine slime pond, a robbed crushing circle and a ruined building, presumably a coe. Most of these lie at a mine focus where various rake workings come together. The eastern part of the site lies within two belland yards.

Ecology: Along the southern edge of the site is a narrow band of hillocks with patches of acidic (U4) vegetation containing mat grass, tormentil, mountain pansy and harebell. Elsewhere there are areas of calcareous grassland (both CG2 and CG7) with autumn gentian, thyme, fairy flax, glaucous sedge, eyebright, and crested hair grass.

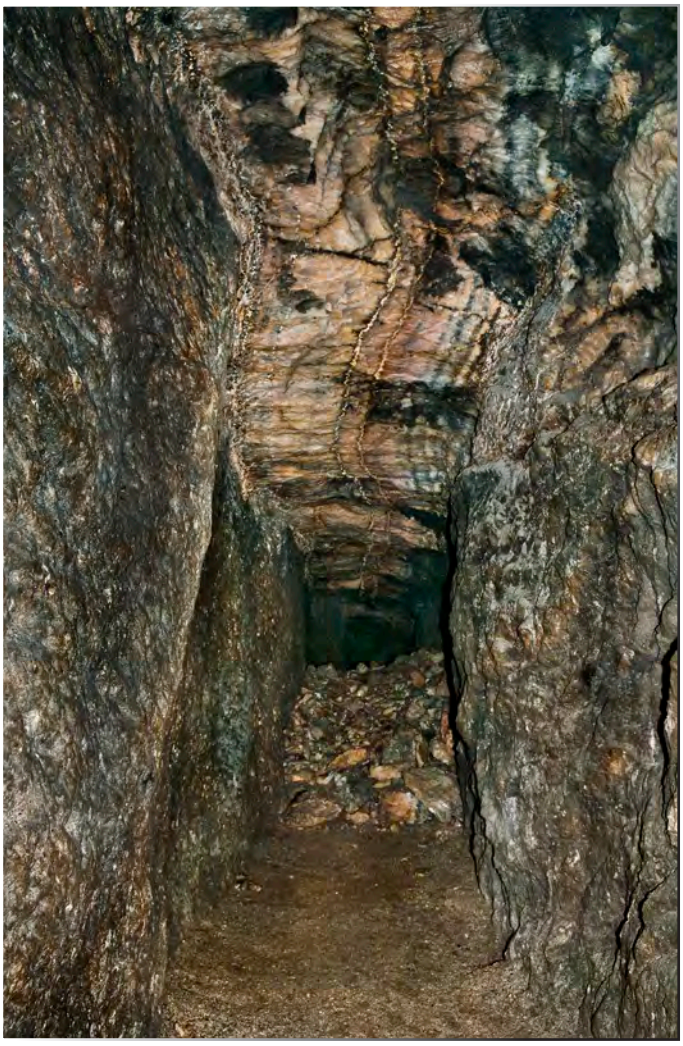


Plate 34: Vein in Raddlepits Mine looking east. The vein has been worked out next to the north (left) limestone wall because this was presumably where the galena occurred. The vein to the south consist mainly of pink barite and calcite (Photo Phil Wolstenholme).

22: Moss Rake, with Raddlepits, Hugh Grove and Rakehead Mines, and New Rake Bottom, SK 148802
Geology: Moss Rake is a strong vein largely comprised of calcite with some fluorite and barite with galena. In common with many of the veins in the orefield the galena is usually present close to the vein walls and sometimes in the centre of the vein. The vein exhibits classic 'crustiform' banding demonstrating that it was deposited from multiple phases of mineralising fluids and fault movement as the vein was forming.

Where seen in Raddlepits Mine the vein is dominated by calcite and barite with some galena. The calcite occurs as massive calcite often coated with later, finer grained brownish calcite sometimes coated with small calcite crystals. The barite varies from well crystallised botriodal masses to fine grained 'caulk'. In many places the vein shows crustiform banding typical of the orefield. Galena is frequently associated with the barite. Both the calcite and barite are often pink in colour, particularly in the western part of the accessible workings.

Archaeology: This section of Moss Rake has been extensively reworked at and near surface but there are still features of interest. Two large modern opencast quarries which are currently

open have exposed vein cheeks that contain fine examples of sweeping pickwork and stemple holes. There is also part of a 20th century underground inclined level. A small 20th century headgear has been removed in recent years.

The grilled Raddlepits engine shaft gives access to workings at a fine example of an extensive rake vein mine with some flatting and pipe development, and with unusual features such as a miners' spiral stairway, arched levels, tramways and assorted artefacts. Further west the Hugh Grove and Rakehead shafts are currently capped, one with a large boulder, but explorations have showed that they also lead to extensive rake workings. A full archaeological appraisal is currently not available. At surface, the main hillocks, etc. in this western area have been removed, but nearby a small side vein still has surviving hillocks and a climbing shaft.

On the side vein at New Rake Bottom there is small mine complex at a short surviving stretch of hillocks and fine narrow open-cuts, in part very deep, with one section that may be a natural pothole. There is a small walled dressing floor, with an ore storage bin in one corner and a ramp to a dressing or buddling area. There is a water storage pond nearby to the north-east and a ginged climbing shaft (blocked) to the west. Further west there is a ruined coe with internal climbing shaft. Nearby there is a dished hillock that may be a buddle dam.

Ecology: The grassland on this site is varied and high quality, with small patches of calaminarian vegetation with spring sandwort, and more extensive calcareous areas with eyebright, crested hair grass and autumn gentian.

23: Hartledale Mine, SK 159805
Archaeology: An intact walled hillock-top gin circle with adjacent shaft in an area that has been otherwise heavily disturbed. A crushing wheel has been placed next to the gin circle after its original site nearby to the south was removed.

24: Lambpart Mines, SK 159804
Ecology: This site includes hillocks and two small filled shafts, one with an adjacent small circular platform with a drystone retaining wall, and a possible ruined coe. The hillocks support good-quality calcareous grassland, with frequent thyme, spring sedge and glaucous sedge. Autumn gentian is rare. There are two tiny patches of calaminarian grassland with spring sandwort.

25: Moss Rake – Southfield Mines, SK 69809.
Ecology: Rich grassland has developed on the modern spoil heaps in the centre of the site. Notable species include spring sandwort, fragrant orchid, autumn gentian and small scabious.

26: Co-op Sough, SK 174811
Archaeology: An intact slabbed sough bolt at the brook side. Two other slabbed drains running under the road on the other side of the brook may well also be from sough tails (Bradwell Sough and probably Southfield North Vein Level).

27: Lambpart Vein, SK 153799
On this site ecological interest is limited to patches of species-rich neutral vegetation on the hillocks within and adjacent to a belland yard, with one part-filled small shaft.

28: Berrystall and Scrin Rakes, with Chance Mine, SK 158800.
Ecology: This area has been largely reworked although there are some remaining hillocks. One vein open-cut has a shaft with an adjacent example of walling across the vein and an entrance into the shaft side. Calaminarian vegetation is mainly restricted to a series of patches on a line of low spoil heaps along the southern edge of the site. Elsewhere there are extensive areas of species-rich calcareous grassland with frog orchid, small scabious, hairy rock cress, and cowslip.

29: Earl and Hill Rakes, Nall Hole Mine, Cow Hole and Hazlebadge Cave, SK 170802
Archaeology: Much of this vein, within a fine series of belland yards, has been reworked and the primary interest is ecological. However, at Nall Hole Mine, worked for calamine, there are large hillocks, small ore-dressing pits and a possible gin circle wall. Elsewhere there are reworked open-cuts and ponds.

At the east end of Hill Rake there are three large shaft hillocks with three buildings used for agricultural purposes. However, of the two on the central hillock, one may be a converted Newcomen engine house that is known to have stood here or nearby, and the other may perhaps have been a coe. The two belland yards to the west end of Hill Rake have been largely removed in recent years.

At the east side of Bradwell Dale, just north of the main vein there is a Cow Hole, an impressive cave chamber open to daylight, developed on mineralised vugs. This has been worked by miners and provides a good example of a place where mineral could be easily identified and followed underground. Hillocks at Hazlebadge Cave are primarily of ecological interest; this area includes a gated entrance to underground mine workings leading to a natural cave.

Ecology: Spoil heaps running down to the Bradwell road on the west side of the dale (SK17088025) support excellent areas of calaminarian grassland (OV37a) with occasional-frequent spring sandwort and several patches dominated by *Cladonia rangiformis* and other lichens. *Cladonia* without spring sandwort dominates several other patches. Moonwort is present and devil's-bit scabious is locally frequent. Calaminarian grassland covers in the order of a third of a hectare here, which is significant in a Peak District context, making this a very important site. The open vegetation is maintained by the steepness of slope, the apparent toxicity and by trampling.

Across the road on the eastern side of the dale there is more open spoil with sparse calaminarian cover containing occasional spring sandwort. The fringes hold quite species-rich calcareous vegetation with small scabious, thyme and glaucous sedge.

30: Windy Knoll Mine, SK 152796
Archaeology: A crushing stone moved from adjacent hillocks when reworked, and set upright. It is inscribed 'B & Co 1842'.

31: Intake Dale Mine and Shuttle Rake, SK 162797
Archaeology: Hillocks, mostly disturbed or removed, where the primary interest is ecological; two small areas remain intact. However, there is a fine surviving gin circle cut into the steep daleside with a rock-cut back wall at Intake Dale Mine. Below, drystone packs flank what was an old routeway following the dale bottom.

Ecology: The hillocks support species-rich calcareous grassland communities including crested hair grass, thyme, small scabious, cowslip and mountain pansy. Spring sandwort is rare to occasional in several patches of recognisable calaminarian vegetation.

32: Shuttle Rake (east), SK 174798
Ecology: One flat-topped hillock remains which is enclosed by a ruined belland-yard wall. The flat top may be what remains of a dressing floor. The hillock supports a small area of calaminarian vegetation with spring sandwort and acidic grassland (U4) with mountain pansy.

33: Maiden Rake - Heath Bush Mine, SK 143784
Archaeology: A large flat-topped hillock with a good example of a gin circle and an adjacent capped shaft. Nearby there is a possible large coe or agricultural building and a second large hillock.

Ecology: The hillocks contain small patches of species-rich neutral/calcareous vegetation.

34: Maiden Rake SK 150785
Ecology: Four spaced shaft hillocks and a further hillock to the south and a reworked area to the north, all lie within a belland yard. About one fifth of the area is neutral grassland (MG5b) with locally frequent bird's-foot trefoil, crested hair grass and quaking grass. The remainder of the vegetation is species-poor.

35: Tideslow, High and Washers Rakes, Beech Grove and Hilltop Mine SK 161779
Archaeology: There are fine examples of hillocks, with early reworking of primary spoil and buddling waste, and large open-cuts on Tideslow Rake. All are within belland yards and there are run-in shafts, damaged dressing floors, water storage and ore-dressing ponds, and leats. The water management features are particularly complex and informative with regard to the use and re-use of surface water. There is also an unusual earth-built coe with internal capped shaft, and elsewhere there is an unusual tramway cutting leading from the vein. Many of the hillocks at focal areas of larger mines along the vein no longer have the features, such as buildings, gin circles and dressing floors, that would be expected, and their removal provides a clear example of hillock reworking, most probably of 19th century date. The mines at Tideslow are documented as active from the 13th century onwards.

On High Rake there are largely reworked but still sometimes high hillocks heavily modified in the 20th century. Amongst these, at High Rake Mine, there are the substantial conserved remains exposed by 2000-08 archaeological excavations of a rare type of part-sunken Cornish pumping-engine house, for a two-cylinder Sims Engine, with adjacent condenser pit, boiler house, flue and chimney (Great Hucklow 2009; Barnatt 2011a). Nearby there are footings of a second engine house and attached boiler house, with flue and chimney base. This was originally of two storeys and was used for winding and ore crushing, with remaining dressing floor structures of atypical types behind. There are also a reservoir, a cobbled coal yard, a crushing wheel and the site of an iron crushing track with a ruined side pavement, a raised platform for a capstan and a later large gin circle, a large oval engine shaft with gritstone and limestone lining (with viewing grill), and the sites of a smithy/carpenters' shop and a mine office, the latter with visible wall robbing trenches. The High Rake shaft, which is 220m deep, is noteworthy for the fine gritstone ashlar lining where it passes through toadstone at depth, which is still visible in the section just above the summer water level (about 100m down); there are lacing stemple slots throughout.

To the north there are good examples of hillocks and hollows on several veins, including Washers Rake. In contrast, to the east end of High Rake, at Beech Grove and Hilltop Mine, the hillocks on the main vein have been largely reworked/removed.

Ecology: The western section of this site forms Tideslow Rake SSSI which supports a significant area (0.43ha) of calaminarian grassland. All three of the sub-communities are present with the closed sward being the most frequent and the lichen rich community fairly restricted. Spring sandwort generally has a high cover but alpine penny-cress is very scarce. Species-rich short calcareous grassland covers much of the lead rake mounds in the western half of the SSSI but is less distinct and more restricted to the steepest slopes in the east where acid grassland is more common. The former is herb-rich and diverse and transitional to neutral grassland locally (MG5b) whilst the latter is less diverse and includes a dense, springy mat of bryophytes. Both communities grade in and out of OV37b and the acid grassland in particular contains the occasional plant of spring sandwort.

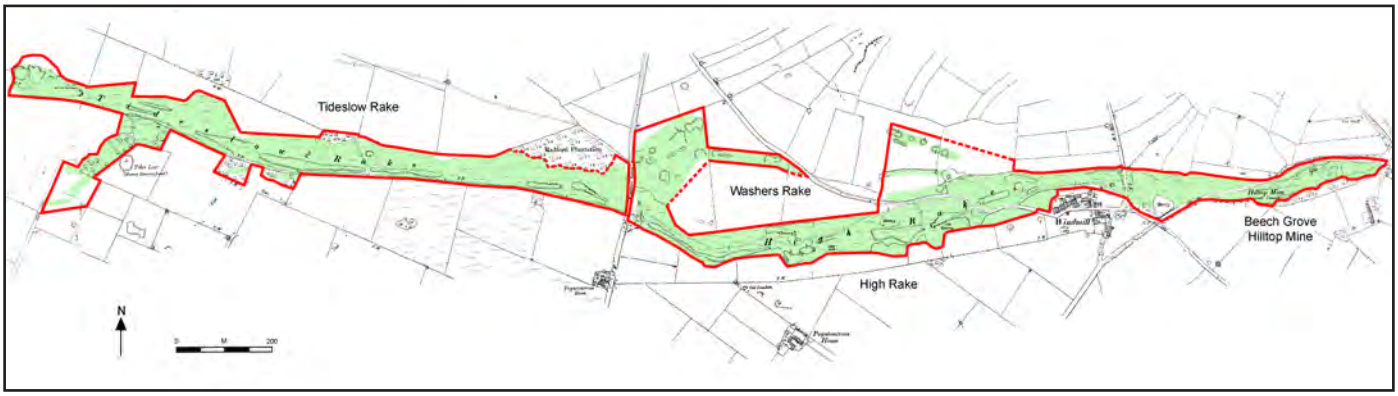
At High Rake, east of the SSSI, the ecological interest is primarily related to calaminarian grassland in the area of the mine buildings. This is associated with land recently disturbed and restored as a result of the archaeological excavations. Small patches of open calaminarian grassland (OV37a) are present with occasional, locally frequent spring sandwort. Small areas of species-rich neutral/calcareous grassland with cowslips are also distributed over the associated hillocks. To the north a number of lead rakes in the field centred on SK161780 support an intimate mosaic of neutral, calcareous and acid grassland including mountain pansy, autumn gentian and common spotted orchids. Over 70 plant species have been recorded here.

North of Windmill the remaining lead rake hillocks in the east of the enclosure support a species-rich neutral grassland with a high cover and diverse array of herbs. Old records from the site suggest that metallophytes were previously present.

Beech Grove and Hilltop mines lie to the east of the road and west of Great Hucklow. At the western end patches of species rich neutral grassland with knapweed and field scabious are present in a coarse grassland with scrub and brambles. Further east an area of hillocks supports a small area of calaminarian grassland (both OV37a and OV37b) with spring sandwort and an area of exposed loose soil with hoary whitlow grass in a CG7-type calcareous grassland sward.

36: Old and New Milldam Mines, SK 176780
Geology: Hucklow Edge Vein is a large rake vein extensively worked for lead, and more recently, fluorspar. It is well exposed in the modern Milldam fluorspar mine. It comprises multiphase 'crustiform' fluorite, calcite, barite and galena mineralisation typical of the orefield. The vein is large, sometimes several metres wide, and the galena is usually present close to the vein walls and sometimes in the centre of the vein. The vein contains a number of horses of limestone host rock that may be enclosed in both horizontal and/or vertical planes by the vein mineralisation. In places well developed slickenside's are present on fault surfaces within the vein mineralisation and at the host rock/vein interface demonstrating multiple phases of mainly horizontal fault movement.

Figure 15: Site 35: Tideslow, High and Washers Rakes (site boundary – red; surface mining features - green).



Archaeology: Surviving interest includes a small one-storey horizontal-winding engine house and a one-storey mine smithy and a two-storey mine house. A Cornish pumping engine house has been demolished and the north-western part of the site has been developed as a modern mine.

Underground within the large 20th-21st century Milldam Mine, and the interlinked earlier foci of activity at Glebe and Ladywash Mines, there are a range of modern mining features that, when work finally ceases, will be a potentially valuable testament to this phase of mining. These extensive mines have also regularly broken into earlier lead workings under Hucklow and Eyam Edges. No systematic archaeological assessment has been made, hence it is not fully clear how much historic interest remains underground. At the time of writing, explorations have begun in the Glebe Mine area of newly rediscovered mined pipe caverns and photographs of passages and mining equipment have appeared in the caving press (Beck and Noble 2012; Noble 2012; Eavis 2012).

37: New Edge and Have at All Mines, SK 182780
Archaeology: These mine sites has been extensively reworked for fluorspar and much of the mineralised hillocks removed. However, at Have At All Mine, above the upslope side of a run-in engine shaft, there is a gin circle terraced into the slope, about half of which survives beyond the area of shaft collapse. At New Edge Mine there is a small water storage pond with walled embankment at the downslope end and crude steps to the interior.

Ecology: The main area of ecological interest is at Have it All Mines where a rich neutral grassland sward is found with quaking grass, hawkbits and hawkweeds. There is also a scattering of more calcicolous species and fragments of calaminarian vegetation with spring sandwort and lichen-rich patches. These grassland communities exist as a clearing in an otherwise wooded site and merit positive conservation measures.

Further west, at New Edge Mine, the interest is now constrained by spreading bramble and bracken and is more acidic in nature with tormentil and bitter vetch. The site has a relatively rich fungal flora confined to the hillocks, including a regionally significant range of waxcap species.

38: Hucklow Edge Vein, SK 185780
Ecology: On the steep slope on this site are found two intact shaft hillocks, with run-in shafts that cut through the sandstones/ shales to the vein below. Some patches of species-rich calcareous and acidic vegetation are present but much of the site is now obscured by gorse. Cowslips are locally conspicuous.

39: Silence, Old Grove and New Grove Mines, SK 187 778
Archaeology: Silence Mine has been extensively reworked for fluorspar at surface, but at the top end of the site there are remains of steam engine buildings and associated structures. These were archaeologically excavated in 2008-10 and include the back walls of a horizontal engine house and boiler house, coal cellars, an access ginnel, a flue, and a balance-rocker pit (Barnatt 2012). Old Grove and New Grove Mine to the east have also been extensively reworked for fluorspar at surface and are primarily of ecological interest. Shale hillocks remain in the northern part of the three mines derived from sinking shafts to the mineralisation at depth.

Ecology: The hillocks are largely overgrown with scrub and tall herbs but between the mounds and on some of the level ground on the slopes there is excellent species-rich neutral grassland (MG5b). This supports five species of orchid including frequent common spotted orchid and locally frequent bee orchid. Cowslips are particularly prolific at Silence and New Grove Mines whilst bluebells are locally abundant at New Grove Mines. The mosaic of flower-rich grasslands and scrub and the variety of substrates with wetter and drier areas on this site make it particularly important for invertebrates including butterflies, beetles, grasshoppers and hoverflies. Similarly the site is important for breeding birds including a variety of migrants.

40: Old Grove Sough, SK 190776
Archaeology: This early 18th century shale gate/pumpway is not accessible and the tail is blocked. However, there is a rare and well-preserved line of eight closely-spaced ventilation shaft mounds leading north to Foolow Edge, where the vein hillocks have been heavily reworked.

41: Slater's Engine Mine, SK 192778
Ecology: The hillocks here have been largely removed and there are the ruins of a small building used for gangue processing. Around a shaft and the old building are small patches of calaminarian grassland (OV37a) with spring sandwort.

42: Bradshaw Engine Mine, SK 195778
Ecology: The hillocks here have been largely removed. Patches of calaminarian vegetation with spring sandwort remain, some of them containing abundant *Cladonia rangiformis* and other lichens.

43: Black Engine Mine, SK 197777
Ecology: The hillocks here have been largely removed. There is no calaminarian vegetation but some species-rich neutral patches remain.

44: Old Twelve Meers Mine, SK 204775
Archaeology: A gin circle platform cut into the steep hillside, with horse track and a central hollow where the bearing block has been removed, with an adjacent capped shaft on the downslope side.

45: Top Twelve Meers Mine, SK 206776
Ecology: The hillocks here have been largely removed. Calaminarian vegetation with spring sandwort and mountain pansy occurs in several patches on a flat-topped mound and the surrounding levelled spoil.

46: Broadlow Mine, SK 210775
Ecology: The hillocks here have been largely removed but those that remain contain small patches of calaminarian vegetation with spring sandwort and patches of species-rich U4 acid grassland with frequent mountain pansy.

47: Ladywash Mine, SK 219775
Archaeology: The main surviving feature of interest is the chimney from a 19th century horizontal pumping and winding engine house on a large but re-profiled hillock. An associated building dates to 20th century reworking but may in part contain some earlier fabric. The grilled engine shaft through shale gives access to the same extensive workings with geological and archaeological interest, as described under Site 36.

48: New Engine Mine, SK 224774
Archaeology: A discrete mine complex with an engine house in good condition, probably for a Cornish-type vertical engine, with a ruined boiler house and a chimney base buried under rubble. Nearby are the engine blocks and plinth for a small second engine and winding drum, and footings for a small building on the opposite side of the engine shaft may have contained a small dressing engine. A platform may well have supported a balance bob. There is a very deep capped shaft through shale (333m – the deepest recorded in the orefield). The flat-topped sinking hillock remains intact, but the adjacent dressing hillock has largely been reworked. These lie within a belland yard built after the site was abandoned.

Ecology: Patches of calaminarian vegetation, including the lichen-rich variant, occur on hillocks alongside more extensive areas of acidic grassland.

49: Magclough Sough and Engine, SK 235776
Archaeology: A low sough bolt leading to one of the major soughs of the region (Rieuwerts 1994). Above there are five ventilation shaft hillocks, including a massive hillock at Magclough Engine to the west.

50: Little Pasture Mine, SK 207772
Archaeology: A relatively intact moderate-sized mine complex within a belland yard. There are two shafts on shale hillocks derived from shaft sinking to reach the mineralisation in the limestone. The main shaft has a gin circle and nearby parts of the hillock were used as a dressing floor. On a lower terrace there is a crushing wheel and a sunken circular crushing area, now only partly defined with no surface sign of the crushing track. Nearby to the east is a well preserved mine reckoning house (used as a field barn). Below the crushing circle there is a further terrace with a short stretch of retaining wall which may be a third ore-dressing area. It is approached from the north-west by a terraced track. Further to the north-west there are 2-4 hollows that may be water storage ponds. Downslope from the mine complex there are remains of a large but heavily reworked waste hillock.

51: Dusty Pit Mine, SK 207770.
Ecology: The sides of a large flat-topped hillock support some species-rich neutral grassland.

52: Old Pasture Mine and Little Pasture Sun Vein, SK 209772
Archaeology: Upslope, on Little Pasture Sun Vein, there is a gin circle terraced into a disused hollow way and the steep slope upslope of this, with an adjacent capped shaft; the hillocks on the downslope side have been reworked.

The main part of Old Pasture Mine, downslope, has had its hillocks partially reworked/removed and is mainly of ecological interest; only at the northern end are they relatively intact. The main surviving hillock has an overgrown flat-top and to the east of this is a second flat area.

Ecology: At Old Pasture Mine the hillocks contain areas of calaminarian grassland with occasional to abundant spring sandwort. Some patches are dominated by *Cladonia rangiformis* and other lichens. Adjacent patches lack spring sandwort, and are species-poor, dominated by sheep's fescue, common sorrel and harebell, all of which are known to have lead-tolerant ecotypes.

53: Haycliffe Mine, SK 212771
Ecology: The site has had most of its hillocks partially reworked/removed; only at the northern end are they relatively intact. These contain extensive areas of calaminarian communities with occasional to abundant spring sandwort and locally frequent alpine penny-cress. The occurrence of the latter species is notable because this site lies well north of its main distribution in the Peak District, which is centred on the Matlock-Bonsall-Youlgreave area. The site has a rich lichen flora and includes areas dominated by *Cladonia rangiformis* with a number of nationally scarce species associated with metalliferous sites also being present including *Peltigera neckeri, Stereocaulon nanodes* and *Verrucaria murina.* It is also recognised as an important site for invertebrates with a range of species present utilising the bare areas of spoil including solitary bees, a couple of which are Peak District rarities. The site is a good ecological example of a lead mining site over shales where the calcareous influence on the vegetation is less marked.

54: Brookhead Mine, SK 221767
Ecology: The hillocks here have been largely removed but remaining spoil contains quite rich acidic grassland with frequent harebell and eyebright.

55: Little Brookhead Mine, SK 222766
Archaeology: An intact moderate-sized mine complex on a steep shale/gritstone slope. An upper terraced working floor has a capped shaft and a gin circle. A rectangular adjacent area, terraced into the slope, may be the site of a wooden coe and there is an adjacent possible washing pit. Above and to one side is a possible pond. There is also a lower terraced area that must also have been used for dressing. A gully with pit at one end may have been associated with buddling. A large partially-robbed hillock on the slope below contains finely-crushed processed material and shale from shaft sinking to the mineralised deposits in the limestone below.

Ecology: A small spoil heap running down below the mine in a clearing in the wood contains several bare areas and good patches of calaminarian grassland with frequent spring sandwort. Gorse encroachment is a significant threat in addition to shading from maturing trees at the edges of the site. However trampling from visitors is likely to maintain the open nature of the grassland at least in the core of the site.

56: Stoke Old Engines, SK 229768
Archaeology: A discrete mine complex at a large flat-topped hillock with twin engine shafts, one covered with a beehive cap, the other walled round. To one side is a semi-circular terrace that may well be the site of a whim gin. These deep 18th century shafts were sunk through gritstone and shale to Stoke Sough, which in turn led to the veins in underlying limestone to the west.

57: Stoke Sough, SK 239766
Archaeology: A sough, entered via a short arched section that leads to one of the major drainage levels of the region (Rieuwerts 1994); a long section is open, but contains bad air and should not be entered. Above there are two large ventilation shaft hillocks. Significant underground details include cable wear in the first shaft; a finely-dressed chamber for ventilation and water control, with the sites of a blocking 'door', a low dam, and floor between the two. Nearby there is a low water bypass (backfilled but probably unfinished), three small alcoves at the passage side and the site of a second blocking 'door'. Just upstream there is a second shaft, with a slot for a water ducting pipe at the side. This is at the beginning of a ventilation fang in the upper part of the passage going upstream, with roof hooks for later trunking. There are miners' initials at two places and intermittent tubwear.

58: Cross Low Vein, SK 182767
Ecology: Intact and well defined hillocks are present on three adjacent veins. One large hillock is covered with species-rich calcareous vegetation while the others are mainly neutral with some species-rich acidic patches.

59: Watergrove Mine, SK 191758
Archaeology: At this rich mine, on a pipeworking which was followed south and west through time, there are hillocks on the south side of road that are well preserved but to the north they have been disturbed. All lie within a series of belland yards.

Features to the north include a mine office and smithy, both still roofed, a semi-detached overseer's house and manager's house (still occupied). Nearby is a rectangular reservoir. The main engine shaft here is covered and used for a water supply for Cavendish Mill. There are also two restored beehive caps adjacent to each other, one over an engine shaft the other over a small climbing shaft.

Across the road are the foundations of a Newcomen pumping engine house together with a a good example of a ginged circular engine shaft which is flooded at depth. This site is currently being archaeologically excavated and includes a badly robbed engine house with two external boilers with ash pits and paved coal storage hoppers. There are two approach roads from the nearby 18th century turnpike road. Nearby, but lower down the slope, there is a second and larger rectangular reservoir, presumably both for the 19th century Cornish engine house with impressive chimney, and a winding house, built on the north side of the road that have now been removed. A short distance to the east of the Newcomen pumping shaft there is another restored beehive cap covering an engine shaft, with a flat adjacent area large enough for a horse gin.

Beyond to the north-east there are further hillocks, all rather damaged and some within an irregularly-shaped belland yard to the west, with shafts to the east down to the pipeworkings, two with beehive caps. This north-east area is an integral part of this historically important mine complex.

Plate 35: Site 59: The largely-removed 1794 Newcomen pumping engine house at Watergrove Mine under excavation in 2012, with coal storage hopper behind, original boiler ash pit in foreground, coe to left and later ash pit behind this. Of the features exposed, only the bob wall to right was visible before excavations started.

Ecology: At the main site north of the road a conical pile of spoil inside the gate supports calaminarian communities with spring sandwort and also patches of *Cladonia rangiformis*. There are similar small patches on a large shaft hillock by the south wall and on mounds in the south-west corner.

To the south of the road the hillocks support a complex mosaic of moderately species-rich grassland types, mostly neutral and calcareous but with some areas which are more acidic in nature. Species include lady's bedstraw, harebell, mouse-ear hawkweed, fairy flax and crested hair grass.

60: Coal Flats Head Vein, SK 197761
Ecology: The hillocks have been removed, although hollows and a shaft remain. The slopes support species-rich neutral and calcareous grasslands and include autumn gentian amongst a range of other more common species.

61: Brushfield Rake, SK 205760
Ecology: This site is the highest quality part of a line of largely reworked/removed hillocks which extend to the west along the line of a footpath. To the south of the wall centred on SK 20507607 a small area of rich and diverse calcareous grassland (CG7) exists over very thin soils fringed by hawthorn/bramble scrub. Of particular note is the locally abundant common spotted orchid and scattered bee orchids. Cowslip, thyme, salad burnet and mouse-ear hawkweed are also present. Above the wall along the sides of the path the grassland is more neutral in character with ox-eye daisy, bird's-foot trefoil, meadow cranesbill and common knapweed.

62: 'Middleton Moor Mines (north-west)', SK 196751
Ecology: Intermittently surviving vein hillocks support neutral and calcareous grassland on the steepest slopes with lady's bedstraw, bird's-foot trefoil, thyme, salad burnet and small sedges.

63: White Rake, SK 204758
Ecology: Well-preserved vein hillocks, with a limekiln inserted into these near the west end, support a mosaic of calcareous and less species-rich neutral and semi-improved grassland. The former includes thyme, harebell, bird's-foot trefoil and crested hair grass.

64: 'Middleton Pasture Rake Side Veins (west)', SK 210752
Ecology: The hillocks have largely been removed but banks of spoil in the north-east of the field include spotted orchids, bird's-foot trefoil, hoary plantain, fairy flax, common knapweed, field scabious, salad burnet and milkwort in a neutral/ calcareous sward (MG5b).

65: 'Middleton Pasture Rake Side Veins (east)', SK 215754
Ecology: The hillocks have largely been reworked/removed, although there is one area of intact mounds, and degraded examples elsewhere. The site has a mosaic of moderately species-rich calcareous and neutral grassland locally transitional to more acidic swards. Of particular interest is the rich and diverse range of grassland fungi here and on the adjacent daleside slopes. Present are a number of rare and un-common species including a European red data book waxcap (*Hygrocybe quieta*) and an abundance of earthtongue fungi with one UK red data book species (*Geoglossum elongatum*). The assemblage of species suggests this site is of national importance.

66: Tideswell Torrens, SK 144771
A linear stretch of low hillocks in the valley bottom, away from any mineralization, documented as being derived from streamside ore dressing documented in the 15th century. This is the only identified example of its type.

67: Edge Rake Mine, SK 134765
Archaeology: Two large flat-topped hillocks (and others nearby) at a discrete rake-vein mine complex, with several capped and blocked shafts, mostly within a belland yard. Features include two probable damaged gin circles, a possible crushing circle, a water storage pond, foundations of a small horizontal engine/ boiler house with the base of a circular chimney, a ruined coe and a possible ore-dressing site with four small rectangular pits.

Ecology: This site mostly supports species-poor neutral communities, but small patches of calcareous vegetation occur around excavated limestone, including mouse-ear hawkweed and thyme.

68: Red Butts Mine, SK 145753
Archaeology: A short line of well-preserved high hillocks, presumably on a short vein, with a fine hillock-top gin circle. There is a flat dressing floor adjacent, with a rectangular hollow to the side, with a sub-circular one nearby, that may well be associated with ore dressing. On the top of a higher hillock close by there is a large circular hollow which may be the site of a pond for storage of ore processing water.

Ecology: The hillocks have escaped much agricultural improvement and support fairly species-rich neutral grassland with harebell, lady's bedstraw, bulbous buttercup, meadow saxifrage, hoary plantain, pignut and mouse-ear hawkweed.

69: Thornhill Slack Vein (west), SK 153745
Ecology: A badly degraded vein working with shallow hollows runs across the plateau and into the dale. On the plateau it has been semi-improved, but the steeper slopes support a rich neutral sward with frequent bulbous buttercup, meadow saxifrage and ox-eye daisy.

70: Thornhill Slack Vein (east), SK 156744
Ecology: A surviving line of large vein hillocks, including one

that is flat-topped, and a shallow open-cut at the daleside, support a mosaic of neutral (MG6 and MG5b) communities with lady's bedstraw, sheep's fescue, fairy flax, spring sedge and harebell. The western (daleside) part of the site lies within Unit 38 of the Wye Valley SSSI where the grassland over the lead rake hillocks is similar to the surrounding daleside, i.e. a mosaic of calcareous and acid grassland.

71: 'Litton Edge Veins', SK 165755
Ecology: A small area of hillocks in the south-east corner of the field, at the junction of two small and short veins, contains moderately species-rich neutral grassland (MG5).

72: Arbourseats Veins and Sough, Wardlow Sough, Nay Green Mine and Washing Floors, SK 173747
Archaeology: Good example of multiple small to moderate sized veins with hillocks and open-cuts (some deep), with several small belland yards, ruined coes, levels and sleepered shafts.

At the top of Tansley Dale there is a gin circle wall adjacent to a run-in shaft, with a coe built later and overlying the horse walk. A small belland yard part-way down Tansley Dale has a discrete small mine complex with a flat-topped dressing floor hillock with ruined coe, a grilled but blocked adit, a water storage pond, and a possible small rectangular ore-dressing pit. Near the bottom of Tansley Dale there is a drystone walled channel on the top of a large flat-topped dressing floor hillock which leads from an underground level or sough with an internal shaft.

In the main valley bottom there are rare large Nay Green ore washing ponds fed by a stone-lined goit from Wardlow Sough (currently blocked). Nearby is Nay Green (incorrectly known as Neptune) Mine where there is a long accessible level with internal shafts to depth (Beck 1978). On the other side of the valley there is a run-in sough tail and open-cuts above leading to the sough following the main Arbourseats Vein. The spoil from these workings part-blocks the valley bottom and creates a dam for the washing ponds.

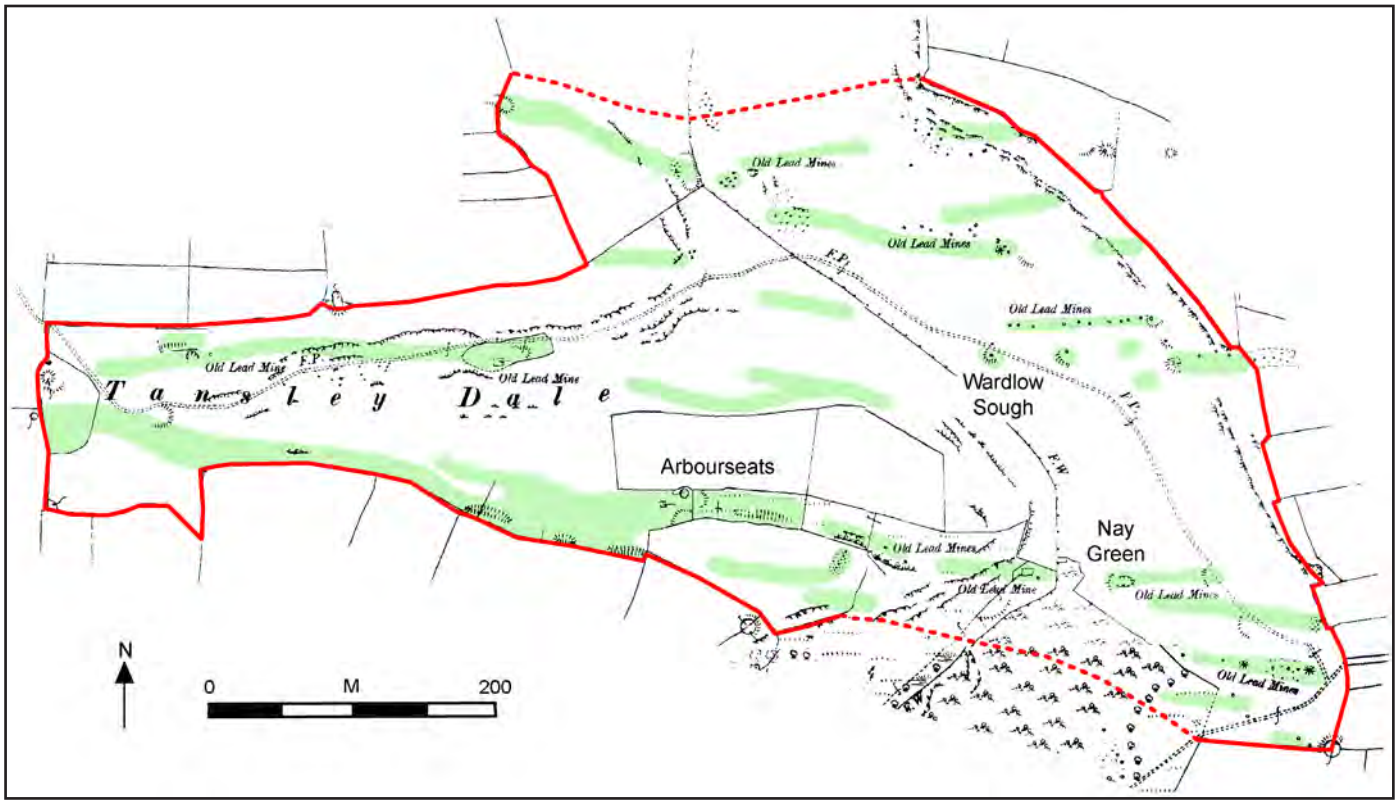
Ecology: This site lies within Cressbrook Dale SSSI forming part of Unit 1. Calcareous grassland (CG2) is extensive occurring as a very short sward over much of the hillocks (and the surrounding daleside) and making transitions with calaminarian grassland which is widespread in small patches. Typical calcareous species include meadow oat grass, small scabious, rock-rose, salad burnet and thyme whilst the calaminarian grassland includes widespread but generally only scarce (although locally abundant) spring sandwort in addition to autumn gentian, and one location for grass of Parnassus. Neutral/acid grassland is more common on the upper dale slopes including the lead mining features at the head of Tansley Dale. It is generally taller and less herb-rich than the calcareous grassland but locally supports mountain pansy and tormentil.

73: White Rake (west), SK 178747
Archaeology: A good example of large rake hillocks and hollows. In a possible belland yard to the east the open-cut is continuous. To the west a larger hillock has hollows that may well be the sites of engine and climbing shafts.

Ecology: There are three tiny fragments of calaminarian grassland (OV37) with rare spring sandwort and some remnant patches of rather poor acid grassland (U4) containing sweet vernal grass and tormentil. Further fragments of calcareous grassland with thyme and harebell occur around exposed limestone.

74: White Rake (east) and Old Seedlow Mine, SK 186748
Archaeology: Interest includes hillocks, open-cuts, shafts and a ruined belland yard. At Old Seedlow Mine to the east, within a large belland yard, there is a fine ginged engine shaft with grill, a ruined coe, two slime ponds, and a water storage pond. Further east there is a shaft with a walled gin circle and two water storage ponds. Both these mines had large waste hillocks that have been extensively reworked/removed. An open-cut between the two mines has been partially infilled with modern rubbish over several years. Since recorded in 2003, this site has had some minor removal and/or infilling of features of interest. These include a leat to the water storage pond, and a poorly-

Figure 16: Site 72: Arbourseats Veins and Sough, Wardlow Sough, Nay Green Mine and Washing Floors (site boundary – red; surface mining features - green).



defined possible gin circle with a wall at the edge defining part of this or marking one side of a coe. Further west the hillocks are largely intact and there is a fine rectangular buddle dam.

Ecology: On steeper hillock slopes there are areas of fairly rich calcareous vegetation with very small patches of calaminarian communities with spring sandwort.

75: Seedlow Rake, SK 194747
Ecology: The hillocks have been extensively reworked and contain mostly neutral grassland with some calcareous patches and very small patches of spring sandwort.

76: 'Wardlow Hey Mines (north)', SK 174742
Ecology: This site straddles the boundary of Cressbrook Dale SSSI forming part of Unit 1. Calcareous grassland (CG2) is present over the hillocks associated with several small lead veins, some of which are well preserved while others have been ploughed over. Within the SSSI this is little different to the rest of the daleside and includes carline thistle. In the fields to the east the plant community is less rich and is surrounded by semi-improved neutral grassland.

77: 'Wardlow Hey Mines (south)', SK 174738
Ecology: This site lies within Cressbrookdale SSSI forming part of Unit 2, Wardlow Hay Cop. Low hillocks, in part degraded/ removed, on three small veins, support a mosaic of calcareous (CG2), neutral (MG5b & c) and acid (U4c) grassland which in the west is flower-rich and of high quality. Autumn gentian is conspicuous in the north. Towards the south-east the grassland is poorer, becoming dominated by the acid community and invaded by scrub and brambles.

78: Cackle Mackle Mine, Blakeden Great Vein and 'Stadford Hollow', SK 193740
Archaeology: Surface interest includes extensive hillocks and hollows along moderate-sized veins, mostly partially robbed, capped shafts and several ruined coes. Features include a well-preserved hillock-top gin circle with robbed surrounding wall at Cackle Mackle Mine, with a possible stone-lined buddle on an adjacent hillock, and a small walled dressing floor, coe and water storage or ore-dressing pond on the vein to the south.

Underground, there are good examples at Stadford Hollow of short cross-cuts linking the bases of climbing shafts with the tops of the next in sequence, together forming a climbing-way going deep underground.

Ecology: The core of this site lies within Unit 2 of Longstone Moor SSSI where calaminarian grassland with spring sandwort occurs very sparsely, limited to isolated small patches. The most open areas are quite restricted in species but as the sward becomes more closed the range of species increases to include eyebright, various bedstraws and scattered mountain pansy, in addition to the thyme and fine leaved grasses. Calcareous grassland is found on the steeper slopes of the spoil hillocks forming a narrow transition into a variable acid grassland which grades from a species-poor community to a more unimproved grassland (U4b), with mountain pansy and from that to a U2 community with wavy hair grass and occasional mat grass and heather. The majority of the lead rake grassland interest is in the north and east of the site.

To the north (Unit 1 of the SSSI) the veins run through enclosed fields where acid grassland is the primary interest feature.

In the south-west a vein runs through the centre of a meadow. Mountain pansy is locally frequent in a tussocky neutral/acid grassland community.

To the east, beyond the road there are well-preserved and ploughed-down hillocks following several small veins. There are scattered small patches of calaminarian vegetation with spring sandwort and mountain pansy on the hillocks and shaft hollows in the fenced-off plantation. To the north-east on the adjacent pasture-land there are more extensive areas of calaminarian grassland with, in addition, occasional-frequent eyebright. Elsewhere on the site the lead rakes support only moderately species-rich calcareous and acid grasslands.

79: 'Middleton Moor Mines (south-east)', SK 207743
Ecology: Poorly-preserved and/or removed hillocks support calcareous grassland in the steepest areas, including rock-rose, thyme and salad burnet in a sedge-rich short turf with occasional autumn gentian.

80: Highfields Mines, SK 213743
Ecology: This site straddles the boundary of Coombs Dale SSSI. The hillocks associated with small veins support herb-rich calcareous grassland including bird's-foot trefoil, small sedges, mouse-ear hawkweed and lady's bedstraw.

81: 'Longstone Moor Mines', SK 213738
Ecology: An isolated small area of hillocks on a small vein supports calcareous grassland transitional to the surrounding acid grassland with autumn gentian, small sedges and a high bryophyte cover.

82: Enterprise and Shepherds Mines, Sallet Hole, Unwin Vein and Talbot Holes, SK 221742
Archaeology: At Enterprise Mine there is a bank of two bouse teems and a water storage pond (probably remodelled) with a feeder leat. Nearby there is an open trial level (and the site of a second arched example opposite).

Elsewhere in the area the hillocks of relatively small veins are well preserved, with some open-cuts and levels, and a ruined coe in the valley bottom at Shepherds Mine.

A natural cave on the vein to the west leads to minor vein workings with a deep internal shaft. At Sallet Hole Mine below, at valley-bottom level, the 20th century level survives and is gated, but the buildings of this now disused fluorspar mine have only been removed in recent years. The underground workings are now collapsing.

Ecology: This site is nearly all within Coombs Dale SSSI (primarily Unit 7), where small hillocks associated with the old mine workings support species-rich calcareous and calaminarian grassland. The latter is centred on SK 223743 and 220741, on steep slopes, and is characterised by rafts of vegetation and open patches of loose spoil. Spring sandwort, thyme, limestone bedstraw and eyebright are constant but the community, whilst typical, is not very diverse. The calcareous grassland on the rakes is transitional to an upland CG10 community and includes bird's-foot trefoil, eyebright and harebell together with a rich bryophyte flora.

83: Mootlow, Cowslip and Crossdale Head Veins, SK 182732
Archaeology: The eastern part of the central section has impressive large hillocks and open-cuts. Features include a small mine complex with large hillock, ruined coe, small buddle dam and an access track. At the upslope end of the site is a modern stock pond (which may be a re-used mine feature) and leat, with two possible mine water storage or ore-dressing ponds nearby. The western part of the central section has been extensively reworked for gangue mineral leaving open-cuts and hillocks that are a good example of remains left by early to mid-20th century working. Surface interest here includes ruined footings of a calcite processing plant with buildings, small dressing floor, loading platform, access tracks and a chimney flue with the base of a small circular chimney. The whole lies within a belland yard.

The western section is primarily of ecological interest, but in the dale bottom there are two ponds; one is rectangular and may have been a slimes pond, the other is circular and is either a water storage pond or an agricultural dew pond.

The eastern section at Crossdale Head Mine is again primarily of ecological interest; the hillocks have largely been removed.

Ecology: Crossdale Head Mine supports a mosaic of grassland types over a west facing slope and the remaining hillocks. Of particular note are the carline thistle, limestone bedstraw and autumn gentian within the calcareous grassland, and mountain pansy in the more acidic swards.

Hillocks in the western section similarly support calcareous grassland of conservation value, including species such as early purple orchid, milkwort, cowslips and mountain pansy.

The central section of the site, (SK 182732) with impressively large hillocks and open cuts, is the richest part of the site, supporting a diverse calcareous grassland with over 80 recorded species when surveyed in the 1990s. These included frog, fragrant, common spotted, early purple and bee orchids, autumn gentian, carline thistle and limestone bedstraw.

84: Mootlow Vein (east), SK 191729
Ecology: The hillocks here have largely been reworked/removed. There are also large but shallow and heavily reworked open-cuts. Whilst there is no remaining calaminarian grassland on the area known as Black Plantation, it does support a diverse grassland flora with the areas of greatest interest supporting a calcareous grassland flora of fairly recent origin with characteristics of a CG7 community. Mouse ear hawkweed and other hawkweeds are frequent and locally abundant and bird's-foot trefoil, fairy flax, barren strawberry, violet, cowslip, spring sedge, limestone bedstraw, common spotted and bee orchids are all present. On the steepest slopes and the edges of the open-cuts bare ground can be as much as 60% and the vegetation is less diverse. Only at the margins of the site on remnant hillocks is more established calcareous grassland present. The open ground and friable substrate contribute to the diverse nature of the invertebrate fauna on this site which includes a number of Derbyshire rarities. The slender-footed robberfly has been recorded in addition to orchid beetles both of which appear to be specialist lead rake species in the Peak District.

To the west of Black Plantation more established vegetation is present over the hillocks but here it is largely acid grassland with tormentil, bird's-foot trefoil and bitter vetch.

85: Ash Nursery Mine, SK 197728
Archaeology: Walled gin circle, now overgrown, and capped engine shaft. The adjacent mineral hillocks have been removed.

86: Longstone Edge, Hard Shaft and Silver Hillocks Veins, with Silver Hillocks Mine, SK 208730
Archaeology: The main archaeological interest is at the small Silver Hillocks Mine and comprises a coe with a possible large knockstone in the corner (or the top of a crude table/shelf). Nearby are the incomplete footings of one or perhaps two more coes and a small area of intact hillocks and hollows. Immediately to the north there is a further coe with a blocked internal shaft.

The surrounding parts of the site, which has several east/west veins, are primarily of ecological interest. The hillocks here have largely been reworked/removed. Only those on minor side-veins tend to be intact. No important archaeological features have been identified amongst the hillocks here. Minor features include shallow open-cuts, capped shafts, a ruined belland yard and ruined coes.

Ecology: A complicated mosaic of acid and calcareous grassland covers the slopes of Longstone Edge and the plateau fields above, both of which are included in this inventory for the hillocks and open-cuts present. This site is species-rich over much of the area, including the north-western part of the site which forms part of Longstone Moor SSSI (Unit 3). Scrub encroachment (including gorse) is at least locally significant. Longstone Edge is very important for butterflies, notably dingy skipper, brown argus (of the Peak District 'race'), dark green fritillary and wall brown, among several other common species. Cistus forester moth is also present.

At the western end of the site (SK 21567308) small patches of calaminarian grassland with spring sandwort are present over hillocks and associated with the open-cuts, alongside species-rich areas of calcareous (CG2) grassland with thyme and salad burnet.

87: Ash Nursery Vein, SK 201726
Ecology: Despite the partial re-working of the hillocks on this site, patches of calcareous grassland survive amongst tussocky species-poor areas. The former include mouse-ear hawkweed, bird's-foot trefoil, hoary plantain, betony, salad burnet and harebell.

88: Hassop Sough Vein (west), SK 202723
Ecology: Common rock-rose, salad burnet, mouse-ear hawkweed, fairy flax and bird's-foot trefoil are present in a calcareous grassland sward on low hillock sides at this site in Stancil Dale.

89: Hard Rake, Ash Nursery and Hassop Sough Veins, SK 206724
Ecology: Whilst some hillocks are intact, most are in poor condition or have been reworked/removed. Patches of calcareous grassland are scattered amongst the lead mining features and include mouse-ear hawkweed, hoary plantain, bird's-foot trefoil, salad burnet and common knapweed.

90: Brightside, Middle Engine, Evans Gin, Harrybecca, Bacon's and White Coe Mines, SK 222732
Geology: These mines are developed on network of small veins with fluorite, calcite and barite with galena. The veins exhibit classic 'crustiform' banding demonstrating deposition from multiple phases of mineralising fluids. Vein cavities with colourless euhedral fluorite crystals and botryoidal clumps of white and pink barite are relatively common. The unusual structural aspects of the mineralisation, referred to by miners as the 'plumbs and hadings', are described by Hunter (Barnatt and Worthington 2009, pp. 9-12).

Archaeology: Surface interest includes capped shafts and levels amongst extensive damaged/removed hillocks.

At Brightside Mine there is a rare bank of three bouse teems, an arched haulage level called the Newcastle Road, the footings of a horizontal pumping/winding engine with chimney base, and a ruined sawmill (powered from the engine house) (Fletcher and Willies 1975). A mine cottage is still inhabited.

To the west a small level, with a ruined coe by the entrance, gives access to the side of a large engine shaft at Middle Engine. Here, above at surface, there is a gin circle cut into the hillside, now overgrown and boulder strewn. Nearby is the bed of a steep incline which is presumably associated with fluorspar working. Underground there are two rare examples of levels with plankways at the floor.

A short distance further west at Harrybecca Mine, there is an overgrown gin circle, two ruined buildings and a capped shaft. A sleepered shaft within a coe gives access to a series of vein and pipe-like workings where there is evidence for firesetting and later work.

Further west again there is an interesting small 20th century fluorspar mine and plant at Bacon's Mine, associated with deep open-cuts, with levels, platforms and ore chute drystone supports, and with corrugated-iron structures that have now collapsed (Pickin 1975). The open-cuts, at what was formerly known as Harrybecca Mine and Evans Gin, can be explored underground (but are very unstable in parts) and are a good example of narrow vein workings (Barnatt and Worthington 2006; 2009). These have some of the finest and most extensive examples of

pre-gunpowder firesetting with coal in the orefield; there is also a large 20th century stope created by fluorspar miners.

Against the northern boundary of Hassop Common, above the site of White Coe Mine, there is a series of initialled meerstones marking the boundary between Hassop and Ashford Liberties. Near the west end is the site of Old Hen Mine where there are two short sections of small fireset vein working, accessed from an open-cut reworked for spar. To the south-west, beyond the area of extensive hillock reworking, there are intact small vein hillocks; both are primarily of ecological interest.

Ecology: Ecological interest associated with lead workings and the more recent fluorspar extraction is widespread across Hassop Common. However the most significant areas are to the south-east of the public highway above the wooded areas where the extensive area of calaminarian grassland is one of the largest within the National Park outside of the SSSIs (estimated at over 0.6ha). *Cladonia rangiformis* is abundant in most of the area but spring sandwort, although widely scattered, is patchy. The site merits further investigation of its lichen flora which is extensive and likely to be varied. The associated calcareous swards support bird's-foot trefoil, thyme and mouse-ear hawkweed.

Spring sandwort in a calaminarian sward is also present within the established area of woodland (SK 22367311) where the levels of toxicity have prevented successful establishment of planted trees. Very small areas are also found on hillocks in the eastern part of the Common and close to the south-western boundary.

Neutral and neutral/calcareous grasslands are present over hillocks and uneven ground closer to the northern boundary of the Common where scrub and coarse grasslands are invading the species-rich swards. Within the fields to the north, neutral grasslands with lady's bedstraw and meadow vetchling are extensive over the hillocks in the west, whilst a mosaic of calcareous and calaminarian grasslands lie over the larger hillocks in the east.

The invertebrate fauna of the Common is particularly diverse including species associated with flower-rich grasslands generally and others which are more specialised including those that are restricted to the exposed substrates associated with the toxic soils. The slender-footed robberfly (*Leptarthrus brevirostris*) is also present. Very localised in Derbyshire, it has a noted preference for lead mining sites. Dingy skipper butterflies are also present.

91: Muse Mine, SK 230739
Archaeology: A walled gin circle on flat-topped hillock and adjacent engine shaft. The adjacent hillocks have been removed and the wall largely removed with the exception of one short section.

92: Catsall Rake, SK 235738
Archaeology: A good example of a deep but narrow open-cut along a vein; hillocks within the belland yard were largely removed in the 20th century. This site may have been at work in the 1570s, when waste material was being reworked using sieves and vats, the earliest documented example of this practice in the orefield.

93: Red Rake, SK 236740
Archaeology: On the upper part of the slope there is a deep open-cut, with shallower hollows downslope where there is the entrance to a backfilled or collapsed access level with stone arching and a broad swathe of partially robbed hillocks intermixed with shallow stone quarries west of the vein throughout its length. All was reworked in the 20th century for fluorspar and to the west there is an early 20th century 'incline' or ore chute, which is carefully graded along its length, with a walled loading bay at the road side. There are also six 'barrow runs' following the contour, mostly or all of a different phase of 19th/20th century work to the incline.

The main vein open-cuts are an alternative or additional location for the 1570s work noted under Catsall Rake.

Below the road are overgrown remains of a small 20th century spar plant, comprising concrete platforms, a small machinery bed, yards and buildings, the last with remaining low stone walls in parts. To the south-east there is a 20th century powder house with partially collapsed vaulted brick roof.

94: Red Rake Mine and Newburgh Level, SK 239740
Archaeology: The main remaining interest is the fine drystone arched Newburgh Level, with an 1851 datestone, that was used for haulage, rather than being a sough, despite being commonly called Red Rake Sough. There is also a roofless stone building that was part of the mine complex. Extensive associated hillocks and other features have been reworked/removed but two shafts remain.

95: Brightside Sough, SK 242744
Archaeology: A well-preserved, arched but silted, sough bolt leading to a restored water trough with well steps.

The Central Orefield – Taddington, Monyash, Bakewell and Youlgreave.

96: St Peters Mine, SK 130731
Ecology: A small area of low hillocks, with an opencast hollow is present in the wood to the north-east end. These support species-rich calcareous vegetation with salad burnet, early purple orchid, mouse-ear hawkweed, meadow saxifrage, milkwort, harebell, glaucous sedge, hoary plantain and fairy flax.

97: Maury Mine and Sough, SK 146729
Archaeology: Surface interest includes well-preserved hillocks, open-cuts, capped shafts, ruined coes, dressing floors, water storage and/or ore-dressing ponds, buddle dams and belland yards (Barnatt and Heathcote 2003). Features south-west of the hilltop, at the main mine complex, include a fine walled gin circle, associated capped shafts, ruined coes and a small ore bin or the surround to a knockstone. Further south-west are capped shafts and ruined coes, some within a belland yard.

On the hilltop to the north-east there is a hillock-reprocessing site of probable 19th century date and unusual form, with large waste heaps, buddle dam and a possible buddling trough. On the slope down to the Wye there are further possible ore-dressing pits, open-cuts, a water storage and/or ore-dressing pond and a belland yard. Near the base of the slope there is a fine small mid-19th century mining focus comprising a run-in haulage level with associated tramway bed, large hillocks, dressing floor, a ruined coe, buddle dams and a ruined belland yard wall.

A lidded rock-cut shaft gives access to Maury Sough, which runs along the vein through natural cave passages and stopes with fine packs of deads and both wooden and iron rails. At the sough tail below there are two ruined coes. These and the sough goit walling have recently been cleared and conserved. Nearby is a sough hillock protruding into the river.

Ecology: On the plateau in the west of this site a shaft hillock and some mounds hold a small area of species-rich grassland in a semi-improved matrix. The central and eastern parts of this site lie within Unit 29 of the Wye Valley SSSI and form part of the Priestcliffe Lees nature reserve, managed by the Derbyshire Wildlife Trust. Calamanarian grassland is present on a steep slope on the lead rake hillocks centred on SK147730. Spring sandwort is present in a dense and very species-rich sward (OV37b) with a wide range of calcicoles, a suite of more neutral grassland species and a high cover of varied grasses and sedges. The more unusual species include mountain pansy, grass of Parnassus and twayblade. Calcareous and neutral grassland swards are also present. Of particular note is the presence of a varied orchid flora including early purple orchid, common spotted, frog, fragrant and bee orchids.

98: 'Maury Vein', SK 156733
Ecology: A long line of hillocks on a small vein extend down the dale from Hammerton Hill. On the hill itself about half of the area is semi-improved and the rest is species-rich: mainly neutral grassland (MG5b) with smaller more calcareous (CG2) patches. Lady's bedstraw, glaucous sedge, salad burnet, mouse-ear hawkweed, cowslip, bulbous buttercup, early purple orchid (rare), milkwort, and rock rose (rare) are all present.

The upper slopes of the dale lie within Unit 40 of the Wye Valley SSSI where the hillocks support a mosaic of calcareous and acid grassland, the former with scattered, mostly young, scrub.

99: Lees and Dove Rakes, Booth Lee Pipes and Sterndale Sough, SK 156727
Archaeology: Surface interest includes well-preserved hillocks in a fine setting, capped and run-in shafts, open-cuts, water storage and/or ore-dressing ponds and belland yards (Barnatt and Heathcote 2003). Other features include a fine walled ore-washing pond, and a run-in high-level sough tail and associated ventilation shaft mounds. There are two belland yards at mining foci with important associated features. One has a bouse teem and barrow-run, a meerstone, ore-dressing ponds and a ruined building presumably a large coe. Further east, the other yard has water storage and/or ore-dressing ponds and possible buddling troughs, with water channels from a spring high on the hillside above, and buddle dams below in the lower part of the belland yard.

Small and dangerous underground workings are accessible via the obvious entrances at Booth Lee Pipes, some possibly of considerable age. To the north-east, by the Wye, there is the run-in sough tail of Sterndale Sough, with an adjacent coe and flat-topped hillock.

To the south-east, on the hilltop, there are hillocks at a rare example of an outcropping flatwork, worked in the 17th century, with pipe and vein workings further to the south-east. In the hilltop area are an access track, a gin circle and a belland yard wall.

Ecology: This site lies almost exclusively (with the exception of a small area at the western end) within the Wye Valley SSSI.

Calaminarian grassland within Unit 29 centred on SK155727 towards the west of the site includes both the open (OV37a) and closed (OV37b) calaminarian sub-communities in mosaic with an upland calcareous (CG10)/acid (U4c) sward. Thyme, common sorrel and sheep's fescue make up most of the cover in the OV37a sward together with spring sandwort. These are supplemented by bird's-foot trefoil, limestone bedstraw and fairy flax in the closed sward (OV37b) in addition to a range of other calcicoles at a lower frequency. Mountain pansy is present here and in the upland calcareous/acid grassland where it sits alongside a mix of typical calcicole and calcifuge species.

The middle part of the site lies within Unit 45 of the SSSI and supports a similar range of community types as further west. However the closed sward is typically more neutral in character and supports a rich bryophyte layer.

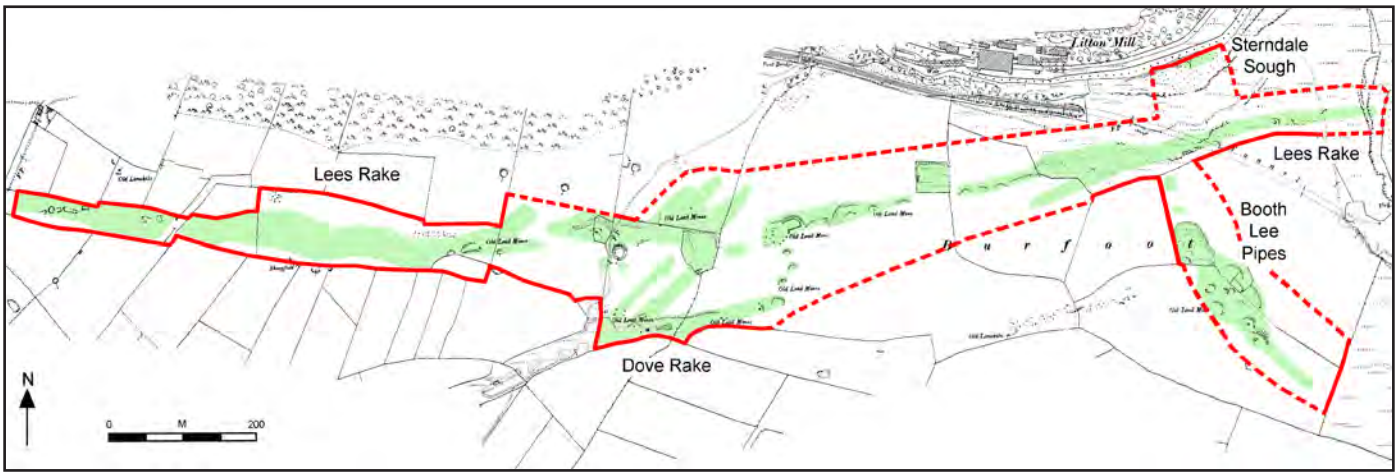
The eastern part of the site lies within Unit 46 of the SSSI. Here OV37a (the open calaminarian sub-community) is unusually extensive over extremely steep slopes where erosion as opposed to toxicity may be the most critical factor in maintaining the necessary conditions. Typical associate species are supplemented with widespread hoary whitlowgrass, hairy rock-cress, responding to the disturbance, and devil's-bit scabious on this north-facing slope. The closed sward community is also extensive with an unusually high cover of spring sandwort which extends into tall, grassy vegetation. Mountain pansy and grass of Parnassus are present in addition to the ubiquitous devil's-bit scabious. These species are also found in the surrounding upland calcareous/acid grassland which forms transitions with the calaminarian swards.

100: Dove Rake and Bulltor Title, SK 152724
Ecology: On the hilltop part of Dove Rake, mostly within long belland yards, the hillocks have been extensively reworked, leaving shallow open-cuts in parts. This area lies within Unit 29 of the Wye Valley SSSI and supports a typical herb-rich calcareous grassland. Mountain pansy, eyebright, common spotted orchid, early purple orchid, meadow saxifrage, salad burnet, meadow oat grass, crested hair grass, carline thistle, milkwort and glaucous sedge are all present. Spring sandwort is present at low cover in scattered patches but never at a frequency or cover to merit classification as calaminarian grassland.

At the south-west end of the site a broad swathe of hillocks and hollows on several veins remain. These lie within Unit 32 of the Wye Valley SSSI and support a mosaic of calcareous (most frequent) and acid grassland with frequent salad burnet; occasional meadow oat grass, carline thistle, limestone bedstraw, and thyme.

101: Windy Low Pipe, SK 168721
Ecology: A long vein-like line of hillocks with probably pipe development underground, interesting as it is documented as worked for manganese as well as lead. The hillocks support a mosaic of patches of good-quality calcareous (CG2d) and neutral (MG5b) vegetation set in a less species-rich neutral matrix. Meadow oat grass, crested hair grass, quaking grass, salad burnet, thyme and mouse-ear hawkweed are all present.

Figure 17: Site 99: Lees and Dove Rakes, Booth Lee Pipes and Sterndale Sough (site boundary – red; surface mining features - green).



102: Clocker Mine, SK 175719
Ecology: A short length of hillocks on a small vein supports a mosaic of quite rich calcareous (CG2d and CG7) vegetation. Meadow oat grass, crested hair grass, quaking grass, salad burnet, thyme, and mouse-ear hawkweed are all present.

103: 'Brushfield Veins', SK 165716
Ecology: Hillocks on a small vein support a short, fine-leaved sward, mostly with calcareous affinities. Glaucous sedge, spring sedge, crested hair grass, quaking grass, salad burnet, thyme, and small scabious are all present.

104: Middle Pasture Rake and Break Blast Vein, SK 167715
Ecology: Hillocks on Middle Pasture Rake and on two branches from this to the north side support patches of calcareous (CG2d) and neutral (MG5b) vegetation. Meadow oat grass, crested hair grass, quaking grass, salad burnet, thyme and mouse-ear hawkweed are all present.

105: Putwell Hill Mine, SK 174717
Geology: This mine worked a wide near-vertical rake vein composed largely of calcite with minimal galena. As the workings were followed to the southwest the vein was hosted in lava rather than limestone. While this is not unique, it is unusual in the orefield that such a wide (2-3m) vein has been worked in lava. When in the limestone the vein walls are well defined and show some slickensides but in the lava the vein becomes less well defined and irregular (Shaw 1980).

Archaeology: The vein has been extensively worked for calcite in the late 19th and first half of the 20th century, but was earlier mined for lead (Bird 1972). Interest includes ruined 19th and 20th century buildings and impressive underground stopes (Shaw 1980). A deep open-cut near the bottom end of the site has been capped off since 2004, but is still accessible underground. Near the eastern end of the site, which latterly was the main mining focus, there are two small buildings, with the lower half of a chimney between, and stone retained working platforms. Upslope from here there is a wide open-cut and, running across the hilltop, there are well preserved hillocks and open-cuts.

Ecology: The western part of this site lies within the Wye Valley SSSI (Unit 52 centred on SK 173717) where the hillocks and open-cut support a mosaic of calcareous and calaminarian grassland with scattered and denser areas of scrub. The calcareous grassland is particularly herb-rich including bird's-foot trefoil, rock rose and limestone bedstraw. Both the lichen-rich (OV37c) and open (OV37a) calaminarian sub-communities are present, varying mainly in the proportion of lichens and bare soil. Spring sandwort is frequent.

The hillocks in the central part of the site supports a fine-leaved neutral sward with eyebright, harebell, fairy flax and glaucous sedge. Very small patches of calcareous vegetation with locally frequent glaucous sedge and salad burnet occur within a neutral matrix on a low line of intermittent hillocks which runs across the field.

The long section of rake adjacent to Putwell Hill Spar Mine consists of a deep open-cut, with steep grassy sides at the upper end and rock faces in the lower section. At the eastern end below the cut are some spoil hillocks and a more level area. Here and in the upper part of the open-cut, there are small patches of calaminarian grassland with spring sandwort, eyebright and autumn gentian.

106: Grove Rake, SK 118704
Archaeology: A good example of hillocks and open-cuts along a relatively large vein in a long belland yard.

Ecology: There is a tiny patch of calaminarian grassland with spring sandwort adjacent to the footpath. Towards the western end is a rich bank with autumn gentian, frog orchid, wall whitlow grass and eyebright. Small fragments of acid grassland (U4) are also present, with scattered mountain pansy, heath bedstraw and rare bilberry.

107: 'Middlehill Rake', SK 128711
Ecology: Intact vein hillocks at this site support a short, species-rich calcareous sward with thyme, glaucous sedge and salad burnet. The northern part is more acid and contains tormentil, heath bedstraw and mountain pansy.

108: Wham Rake, SK 133710
Ecology: To the east the hillocks are small but intact, while to the west there has been some reworking and there is a shallow open-cut (The vein may be the site of documented 13th century mining on Taddington Moor, but this remains unproven). The hillocks support a rich and diverse vegetation with both calcareous and acid patches with frequent mountain pansy and autumn gentian. Frog orchid, mountain pansy and bilberry also occur. At the eastern end, hillocks are calcareous with frequent autumn gentian and rare spring sandwort and moonwort.

109: Glory Mine, SK 133717
Archaeology: A single remaining hillock, with buddled material immediately downslope and a concrete plinth for machinery nearby, at what is a rare example of a small late-19th century mining venture, primarily for spar.

Ecology: The shaft mound is one of the few sites in the immediate area to support calaminarian grassland and spring sandwort is locally frequent. There are also patches of calcareous vegetation with hoary plantain, thyme and rough hawkbit.

110: Horsesteads Vein, SK 142715
Archaeology: This site has a long line of hillocks, with a small gin circle cut into the slope upslope of a capped engine shaft near the east end. There is a possible small buddle dam nearby. Further west there is a fine example of a rectangular cross-sectioned shaft which has recently been conserved. Beyond are two large shaft mounds, each with capped shafts.

Ecology: The hillocks are in the form of low, grassed-over mounds and hollows that support moderately rich neutral grassland (MG5). The two shaft hillocks to the west support a mix of calcareous (CG2) and neutral (MG5b) vegetation, with cowslip, fairy flax, salad burnet, spring sedge, small scabious, hoary plantain, and mouse-ear hawkweed.

111: Edge Top Mine, SK 150714
Archaeology: A small mine within a sub-rectangular belland yard with ruined wall. There is a shaft with coe to the west and two well preserved, circular, water storage and/or ore dressing ponds and associated leats to the east.

112: Swine Rake, SK 152713
Ecology: Low hillocks on a vein are species-rich and support a mosaic of calcareous and neutral patches. Small scabious, glaucous sedge, crested hair grass, quaking grass, tormentil, lady's bedstraw and knapweed are all present.

113: Tapistone Vein, SK 161710
Ecology: A short line of low hillocks on a small vein are situated on the brow of the dale where the steepness has probably saved them from excessive agricultural improvement. Meadow saxifrage, early purple orchid, and lady's bedstraw, are all present.

114: Sheaths Pipe, SK 155703
Archaeology: A fine example of well-preserved hillocks, within a belland yard, associated with an outcropping pipe rather than a rake. Features include a blocked shaft and a possible ruined coe (The pipe may be the site of documented 13th century mining on Taddington Moor, but this remains unproven).

Ecology: This attractive site consists mainly of tall very species-rich neutral vegetation (MG5b) which is becoming coarse with some characteristics of the false oat grass community (MG1e). Knapweed is abundant and greater knapweed, salad burnet, field scabious, devil's-bit scabious are frequent. Areas with shorter sward on steeper slopes support lady's bedstraw, eyebright,

bird's-foot trefoil, hoary plantain, tormentil, harebell and salad burnet.

115: Crotie Rakes, SK 155698
Archaeology: A fine example of well-preserved hillocks at a swarm of small veins. There are also several small capped shafts.

Ecology: The remaining hillocks support patches of good neutral vegetation, with harebell, occasional small scabious and hoary plantain.

116: 'High Stool', SK 127690
Ecology: A large hillock with its centre robbed, where a few patches of neutral/calcareous grassland persist. There is a small adjacent buddle dam on the downslope side.

117: Upper Hubbadale Pipe - Water Engine Shaft, SK 137702
Archaeology: The hillocks here are in variable condition. The main point of interest is a water leat that may be associated with run-off water from a documented underground 'water engine'. It has been suggested that the shaft had a cog and rung gin but the field evidence is ambiguous.

Ecology: The hillocks support a mosaic of calcareous vegetation with rare autumn gentian and small acidic patches with heath bedstraw and wavy hair grass.

118: Field Head Vein, SK 140699
Ecology: The vein hillocks are in poor condition and have been largely semi-improved. However there remain strips of calcareous vegetation with abundant hoary plantain and some thyme, salad burnet and rough hawkbit.

119: Hubbadale Pipe – Dressing Floors, Fidler's and Sough Forefield Shafts, SK 140697
Archaeology: At Fidlers Shaft there is a large hillock with a ruined belland yard wall defining a discrete small mine site at this rich pipeworking that contains two capped shafts, one a climbing shaft, the other an engine shaft with a well-preserved gin circle to the side (Worley *et al*. 1978). To the south is a large hillock at Sough Forefield shaft, which once had a fire house on one of its shafts. To the west there is an area with multiple dressing floor hillocks, mostly in a belland yard.

120: Hubbadale Pipe - Two Gins Shaft, SK 142694
Archaeology: Large overgrown hillock with two adjacent shafts, only one of which is still open and unusually is trapezoidal in plan, and what appear to be the remains of three gin circles (Worley *et al.* 1978).

121: Hubbadale Pipe - Crotie Gin Shaft, SK 147695
Archaeology: Large overgrown hillock with a run-in shaft and presumed remains of a gin circle.

122: Hubbadale Pipe – Ralph White Close Shaft, SK 147693
Archaeology: Large overgrown hillock with a run-in shaft and presumed remains of a gin circle.

123: Whale Rake, SK 154693
Archaeology: A good example of rake hillocks of variable size. There is a poorly defined gin circle on a particularly large hillock.

Ecology: Several patches of calcareous vegetation occur on the hillocks, including small scabious, thyme, and salad burnet.

124: Whale Sough, SK 160694
Archaeology: An historically important sough to the Hubbadale Pipes with a good example of a slabbed bolt with six shaft hillocks. Underground the sough is accessible for some distance to a choke, now enterable via a reopened shaft in a hillock near the tail (Worley *et al.* 1978).

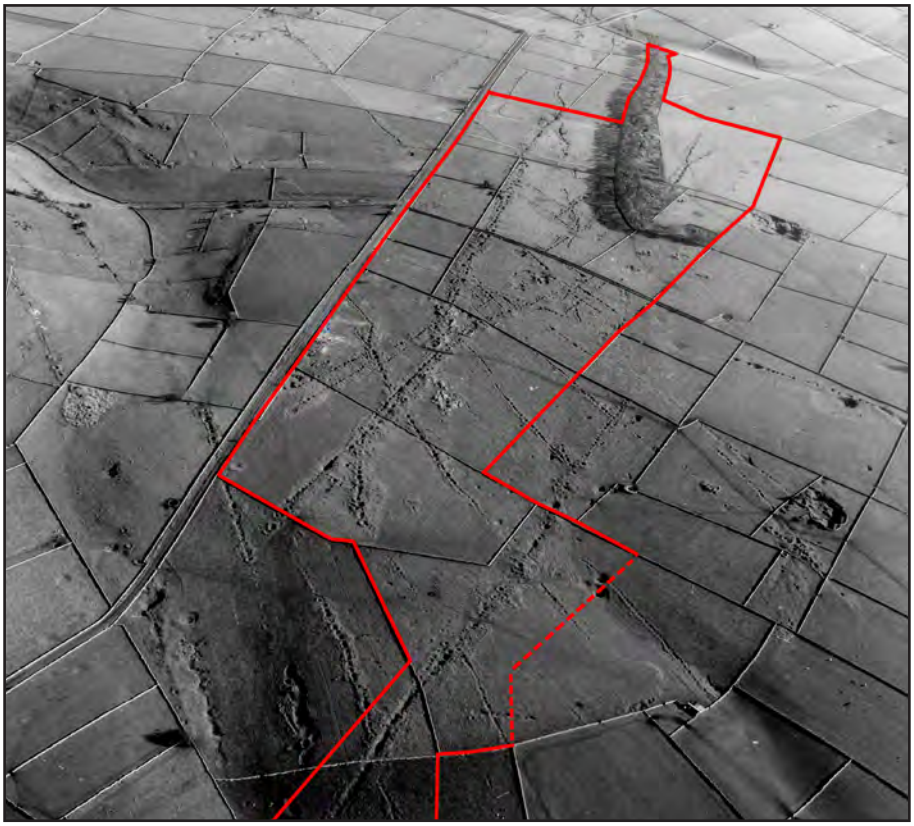
Ecology: A small patch of calcareous vegetation occurs on the hillocks.

125: Shake Rope and Sun Veins, SK 159690
Archaeology: Well-preserved examples of isolated small veins with shallow open-cuts and small upcast heaps with occasional shafts.

Ecology: The north-eastern part of the site lies within Unit 57 of the Wye Valley SSSI and is managed by Plantlife as a nature reserve. The lead rake hillocks support neutral, calcareous and acid grassland of high quality similar to the adjacent dalesides. The south-western part of the site outside the SSSI consists of species-poor neutral vegetation.

126: Hard and Glead Rakes, with 'High Low Mines', SK 156683
Archaeology: A fine example of rakes and smaller multiple veins with hillocks, open-cuts, run-in shafts and small belland yards at discrete mining foci. In one part there is an exceptional area of seven small belland yards and possible collapsed beehive shaft caps; since described in 2004 some peripheral parts of the site to the west have been damaged. There was also once a Newcomen

Plate 36: Site 126: The 'High Low Mines', looking east with Hard and Glead Rakes behind; some surrounding parts have been ploughed out since the photograph was taken (Image: National Monuments Record, English Heritage).



engine house and sub-surface evidence may remain; the hillock here contains cinders. Veins at the western end of the site are recorded as in work in 1590 and 1617 (Russell 2013).

Hard Rake Mine, in the plantation, has a capped engine shaft with an adjacent walled gin circle and dressing floor, all on a high flat-topped hillock. Further west there is a ruined smithy with a store room and/or office on the first floor.

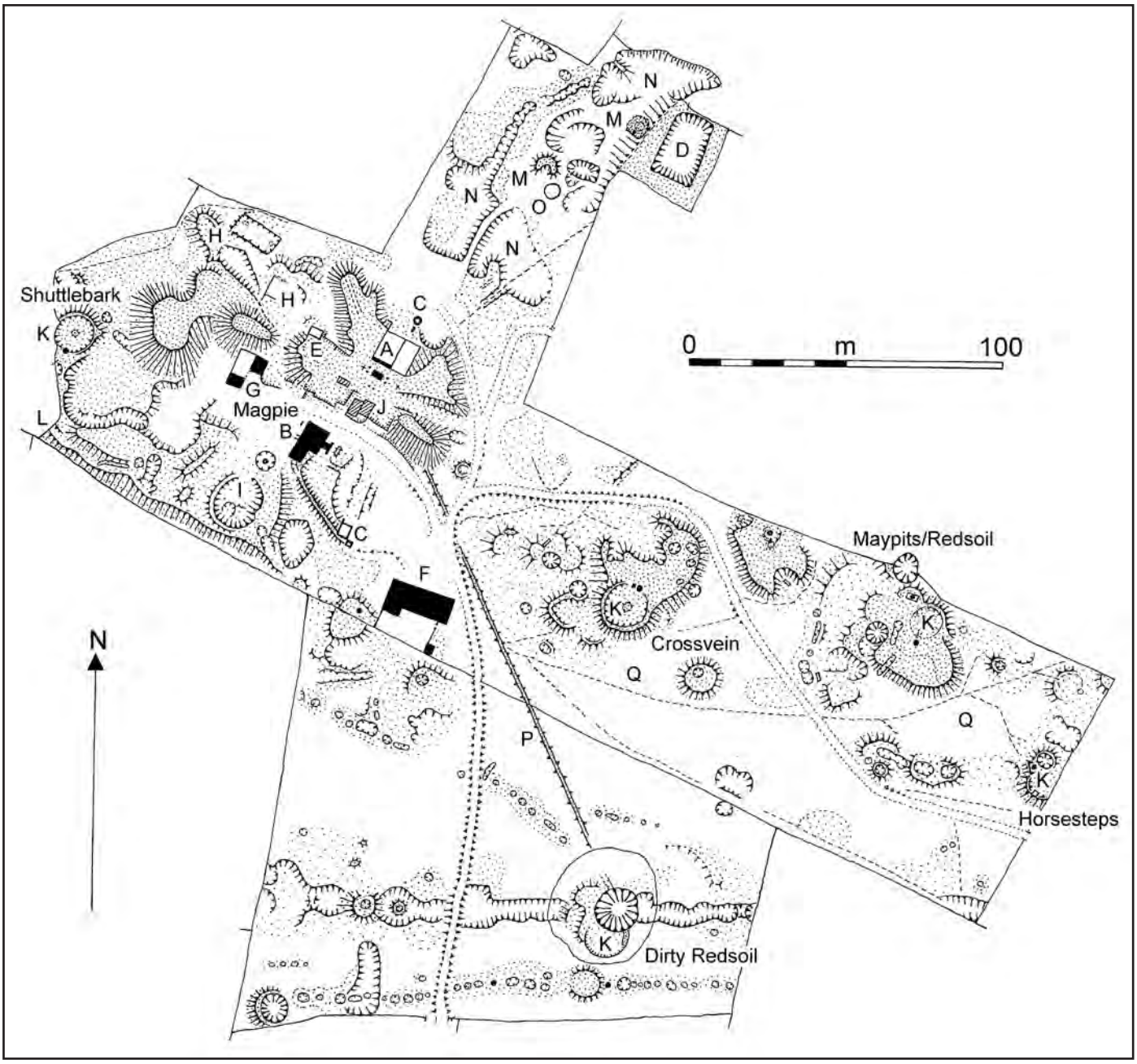
Ecology: The extensive hillocks on this site support very variable grasslands. Whilst some stretches support species-poor neutral swards, other areas support a rich mix of calcareous (CG2) and acid (U4) grassland. Mountain pansy is at least locally very conspicuous alongside autumn gentian, limestone bedstraw, cowslip, tormentil and eyebright. Moonwort, stemless thistle and frog orchid have also all been recorded. Spring sandwort is present but only in small patches and within a closed sward that is closer in nature to a calcareous than a calaminarian community. Comparison with previous surveys seems to imply a reduction in the distribution and abundance of this species over the last 10-15 years and a loss of the typically open metallophyte vegetation. The invertebrate fauna has also been recorded and includes the slender-footed robberfly, an un-common Peak District species which appears to have a preference for lead mining hillocks. A range of other species is present, attracted by the sunny aspect and sparse vegetation of the lead rakes.

The adjacent plantation has some small areas of grassland in the glades where spring sandwort has previously been recorded.

127: Fieldgrove Vein, SK 167697

Archaeology: The hillocks and shafts are in somewhat variable condition. Features include two mine complexes with large hillocks in belland yards. Both have engine shafts with well-preserved walled gin circles. The one to the north-west was a smithy with a store room and/or office on the first floor. The mine to the south-east also has a flat hillock-top dressing floor, a large 'coe', a water storage pond that is rectangular and stone-

Figure 18: Site 129: The Scheduled core of the Magpie and Dirty Redsoil Mines (A: pumping house, miners dry and engine shaft, B: winding engine house, C: chimneys, D: reservoir, E: dressing floor engine house, F: manager's house and smithy, G: possible ore store, H: dressing floor, slime ponds and buddle dam, I: putative crushing circle, J: 20th century winding house, K: gin circles, L: leat, M: limekilns, N: quarries, O: powder house, P: raised tramway, Q: drains).



lined, and a possible slime pond. The engine shafts give access to workings where a full archaeological assessment is still to be carried out (Robey 1966); features include cast-iron air pipes, wooden fanging and a kibble (Russell in prep.).

Ecology: The daleside part of this site lies within Unit 57 of the Wye Valley SSSI and is managed by Plantlife as a nature reserve. Here the lead rake drops down the steep slope as a series of hillocks supporting mainly high quality neutral and calcareous grassland. These include moonwort, mountain pansy and in a few scattered locations spring sandwort.

128: Singlow Common Vein, SK 168692
Ecology: A line of small intact hillocks following a vein are species-rich and include small scabious, salad burnet, thyme and mouse-ear hawkweed in a calcareous sward with patches of neutral vegetation (MG5b) with burnet saxifrage, cowslip, and restharrow.

Plate 37: Site 129: The rolls crushers and weights at Magpie Mine in the earlier-20th century, with their small engine house behind in better condition than today. No examples of rolls crushers survive today at Peak District mines.

129: Magpie and Dirty Redsoil Mines, with Talbot Holes, SK 171681
Archaeology: The exceptional Magpie Mine, where several veins come together, with the core area within a belland yard, has fine hillocks and a complex suite of 19th century buildings (Brown and Ford 1971; Butcher 1971; Willies 1974; 2003; Willies et al 1980; Barnatt and Vernon 2007). These include a Cornish pumping engine house, a miners' dry, a horizontal winding engine house and boiler house, two chimneys (one from an earlier Cornish winding house) and flues, a reservoir, a small horizontal engine house (used for rolls crushers and perhaps also other dressing floor equipment), a manager's house with attached smithy, a small building that may have been an ore store, and a powder house. Nearby there is a dressing floor with ruined wall, a small buddle dam, slime ponds, and the site of a postulated but unlikely damaged crushing circle. There is also a 20th century head gear, winding house and two crab winches.

Elsewhere on site, in some cases at discrete smaller mine complexes, there are several grilled climbing and engine shafts made safe for easy inspection; five gin circles of which one is walled and the others are embanked and on flat-topped dressing floor hillocks; ruined coes and shallow reworked open-cuts. There is also an embanked leat for the water pumped from underground at the main shaft, and one or two limekilns and associated quarries for constructing the buildings and a raised tramway to bring ore to the main dressing floor. Many of the hillocks were partially reworked in the 19th century as small-scale operations and there are associated ore-dressing pits/buddles. There is also a complex series of small drains of uncertain date, which appear to be designed to drain the site surface rather than be related to specific features. To the west, around Talbot Holes, there are good hillocks on several veins.

The large diameter main engine shaft, with viewing grill, is one of the most impressive in the orefield and it is open down to sough level but contains dangerous obstructions; the passage into Magpie Sough has collapsed. Other shafts give access to short sections of vein workings.

Ecology: This site is a blaze of wildflowers in the spring and early summer. The calaminarian areas are concentrated around the old mine buildings and to the south and west of them. There are also three fragments in the field to the east. They consist mainly of OV37a with spring sandwort locally frequent; there are some patches of OV37b and one or two dominated by *Cladonia rangiformis*. In terms of the area of calaminarian vegetation this is amongst the most important sites in the orefield outside of SSSIs. Acid grassland also occurs across the site where mountain pansy is particularly prolific alongside tormentil and patches of mat grass; there are also areas of calcareous grassland (CG2) including rare early purple orchid.

130: Trueblue Mine, SK 178680
Archaeology: This rake-mine site within a belland yard includes low hillocks and hollows across much of the field, a capped shaft, a walled gin circle, ruins of an exceptional group of four to six coes, one with a possible collapsed climbing shaft, a dressing floor, a very large dew or water storage pond, a possible stone-lined buddle and possible ore-dressing ponds and pits. An adjacent two-storey building is presumably a field barn rather than being mine-related.

Ecology: A small but species-rich site, this includes extensive areas of calcareous (CG10 and CG7) vegetation with abundant thyme. Spring sandwort, quaking grass and mountain pansy are rare. One very small patch of calaminarian vegetation with spring sandwort is discernible.

131: Magpie Sough, SK 179696
Geology: The 'Blende Vein', which, where visible, is a pipe deposit, was intersected during the driving of Magpie Sough and is one of the few ore bodies in the Peak District worked primarily for its zinc mineralisation. In contrast to the many pipe workings in the east of the orefield, until drained by the sough this pipe was deep within the groundwater zone and un-affected by weathering and other near-surface processes. It is one of the only pipes of this type currently accessible in the orefield.

While not large, the pipe consists of a series of interconnected cavities that were subsequently mineralised with calcite with some sphalerite, barite, pyrite and galena. There is evidence of dark coloured (black) hydrocarbon in both fluid inclusions within the mineral suite and filling cavities in fossils (corals and brachiopods). The mineralisation comprises both typical cavity fill, with crystal development in the open voids, and a possibly earlier mineral sedimentary accumulations in the bottom of the cavities. (Worley 1976).

Archaeology: The last major sough driven in the region (Willies *et al.* 1980). On the steep slope above is a large waste heap at a now destroyed shaft down to the sough. The grilled rebuilt entrance section leads to a fine late-19th century sough and Magpie Mine vein workings of 19th and 20th century date. The

Plate 38: Part of the Blende Vein in Magpie Sough. This pipe is largely composed of white calcite in grey limestone with black sulphides (mainly sphalerite with minor galena) and hydrocarbon.

outer half of the sough was used by boats and has the remains of three sets of wooden gates for flash locks. The same section of passage has evidence for a false floor with timber joists, presumably earlier and supporting a tramway. The inner two-thirds of the sough was driven using high explosives and there are distinctive shotholes. There is a working at Blende Vein part-way along the sough, and a 20th century tramway from here to the Magpie Vein, and another on a false floor in the workings above, at the mine end of the sough.

132: Kirkdale Rake and Woodfurlong Vein, SK 179689
Ecology: Intact small hillocks are present in the west following two veins on the daleside, but in the east those on the southern one have been largely removed. These hillocks support small patches of acidic grassland.

133: 'Potter's Vein', SK 182685
Ecology: Lines of small intact hillocks following two or three close-spaced veins on the steep daleside, one of which is probably called Potter's Vein. These hillocks support acidic grassland with frequent tormentil, heath bedstraw and harebell. A species-rich calcareous grassland is extensive over the northern part of the site with many of the community constants including frequent thyme and bird's-foot trefoil and occasional rockrose and eyebright. Survey has shown that the daleside is of national importance for grassland fungi with a few species appearing to be preferentially sited in proximity to the hillocks including *Hygrocybe conica*, *H reidii* and *H psittacina*.

134: Arrock Vein, SK 189692
Ecology: A line of small intact hillocks following a vein on the steep daleside support mainly calcareous grassland with frequent fairy flax, bird's-foot trefoil, sedges, rough hawkbit, thyme and mous-ear hawkweed. Spring sandwort occurs in one location. Survey has shown that the daleside is of national importance for grassland fungi, with a few species appearing to be preferentially sited in proximity to the hillocks, including a species rarely seen, *Hygrocybe mucronella*.

135: 'Sparklow Mines', SK 128658
Archaeology: A good example of well-preserved hillocks on several small veins, put in the inventory as a representative example of this type of mining.

Ecology: A large shaft hollow at the north-west end supports calcareous grassland with crested hair grass, thyme, hairy oat grass (rare), limestone bedstraw and salad burnet. The rest of this area is species-rich neutral grassland with quaking grass, crested hair grass, glaucous sedge, bird's-foot trefoil, ox-eye daisy, bulbous buttercup, kidney vetch, field scabious, northern marsh orchid, early purple orchid, milkwort and hay rattle.

Four lines of low hillocks and hollows which cross the field to the south are species-rich, two of them in particular An interrupted vein line along the length of the field supports MG5b with an admixture of calcareous species. Quaking grass, sweet vernal grass, glaucous sedge and spring sedge are all occasional/locally frequent. Other species present include bulbous buttercup, mouse-ear hawkweed, hairy oat grass, crested hair grass, limestone bedstraw, lady's bedstraw and tormentil. A second prominent long line of low mounds and hollows supports mainly MG5b with smaller areas of CG2 and CG10 at the SE end and includes locally frequent mountain pansy. Thyme, eyebright, frog orchid, common spotted orchid, early purple orchid, hairy oat grass, milkwort, crested hair grass, and autumn gentian are all present.

Hillocks occur on a complex series of small veins centred on SK127656 in the south-west. Despite efforts to improve the grassland agriculturally there are many species-rich patches and a mix of neutral, acidic and calcareous communities. The most acidic patches support mountain pansy, bilberry (rare), mat grass, wavy hair grass, heath milkwort and heath bedstraw. Others hold a mixture of calcareous, neutral and acidic species probably most appropriately assigned to CG10. Quaking grass is locally frequent; hairy oat grass, crested hair grass, common bent, sweet vernal grass, wavy hair grass and mat grass are all present, as are glaucous sedge and spring sedge. Notable herbs include mountain pansy, heath bedstraw, small scabious, early purple orchid, mouse-ear hawkweed, salad burnet, fairy flax, tormentil, harebell and field scabious.

136: 'Hutmoor Butts Mines', SK 135670
Archaeology: A rare survival of a number of intact workings on several small closely-spaced veins with capped small shafts, one or two ruined coes, and what may well be a rectangular ore washing pond with a semi-circular end.

Ecology: The hillocks support a rich mosaic of calcareous and neutral grassland. Spring sandwort, cowslip, grass of Parnassus, autumn gentian and mountain pansy are all present.

137: 'Tagg Lane Mines', SK 140661
Ecology: Hillocks on small veins, with two capped shafts, support good quality calcareous grassland (CG2) with frequent bird's-foot trefoil, thyme, sedges and eyebright. Frog orchid and quaking grass are rare.

138: Crimbo and Whalfe Pipe Mines, SK 144674
Archaeology: At surface there are several intermittent pipeworking and vein hillocks, mostly damaged, some with capped/lidded shafts, and an outcropping pipe open-cut. The south-western end lies within a belland yard. There are two surviving gin circles and the poorly defined remains of a third with a ruined protecting wall. There are also one or possibly

two ruined coes, one with a lidded climbing shaft. At one shaft hillock there is the base of a chimney and stonework/brickwork at the site of two demolished horizontal steam engine houses.

The extensive underground features (now often known as Hillocks and Knotlow Mines) include pipe and vein workings, hand-picked climbing shafts and larger engine shafts, and several fine examples of coffin levels and later access levels (Kitchen and Penny 1973). Hillocks Mine has evidence for firesetting in its upper workings (Barnatt and Worthington 2006), and a smoke trail has been reported in Knotlow Mine.

Ecology: Spring sandwort is present at this site in one small patch of calaminarian vegetation. There are much more extensive areas of species-rich neutral (MG5b) and calcareous (CG2) grassland.

139: Brecks Mine, SK 149677
Ecology: A little spring sandwort is scattered on the sides of one of the two open-cuts adjacent to the quarry. There are also extensive patches of calcareous vegetation with frequent small scabious and rare autumn gentian.

140: 'Bagshaw Dale Mines', SK 156666
Ecology: A small length of vein hillocks, and ploughed-out hillocks on a second possible vein, support patches of neutral/calcareous grassland with thyme, harebell, and knapweed.

141: Great Greensward Mine, SK 164672
Archaeology: The hillocks are mostly removed. A lidded oval engine shaft, in a three sided walled recess in a hillock, has rare *in-situ* underground pumps and guide rails for a cage (Buckley and Howard 1995). Nearby at surface there is a raised stone mounting bed for a horizontal pumping/winding engine, erected outdoors or once housed in a wooden/corrugated iron engine house. Behind this there is a ruined stone-built boiler house with attached chimney base with a brick lining. In the boiler house wall there is the site of a drawing door with *in-situ* iron guide rails. Nearby there is a grilled climbing shaft with a fine example of stone climbing stemples (top currently buried). At the south-east end of the field there is a second engine shaft and a climbing shaft.

Ecology: The hillock and other parts of the site contain areas of neutral/calcareous grassland.

142: Old Beck Mine, SK 169671
Archaeology: Two hillocks amongst otherwise degraded rake hillocks, both with possible flat-topped dressing floors. One has a gin circle on its flat top next to an oval engine shaft with gritstone blocks with iron bars at the two ends. The other dressing floor had two smaller shafts, one of which is still open within a ruined coe. This is on a hading vein and at depth the footwall has an unusual cut slot that allows a vertical kibble lift.

***Ecology*:** Two sets of hillocks support species-rich neutral vegetation with abundant common knapweed, lady's bedstraw, field scabious, bird's-foot trefoil, and rare cowslip.

143: Mandale Rake (north-west), SK 169675
Ecology: Most of the hillocks following this part of Mandale Rake and side veins have been reworked/removed; small surface workings at the fringes of the site remain, as does a re-worked open-cut. The hillocks are dominated by herb-poor acid grassland (U4) with wavy hair grass, other grasses and heath bedstraw. Small patches of richer and varied calcareous vegetation (CG2, CG7, CG10) occur: these contain thyme, crested hair grass, mouse-ear hawkweed and autumn gentian. Mountain pansy occurs in several places.

144: Long Rake, SK 130647
Ecology: A surviving shaft hillock exists, with a low mound to the west, beyond which the vein hillocks have been removed. The hillock holds neutral (MG5b) grassland with quaking grass, eyebright, thyme, yellow oat grass, lady's bedstraw and knapweed. The rest is taller neutral (MG1e) grassland, with knapweed and frequent field scabious.

145: Cotesfield Mine, SK 136647
Archaeology: A part-removed belland yard wall contains a gin circle with adjacent capped engine shaft. Adjacent mining within the vein took place at least as early as the 12th century as this vein is mentioned as an 'old mine' in a charter of this date.

Ecology: The vegetation on this site is mainly tall-herb neutral grassland transitional from species-rich neutral MG5b to MG1.

146: 'The Street Mines', SK 142648
Ecology: About half of the area of the intermittent hillocks on a braided ESE/WNW vein with a further vein branching to the WSW, supports semi-improved grassland. The rest consists of species-rich neutral and acidic communities, including locally frequent hay rattle; glaucous sedge; crested hair grass, yellow oat grass, quaking grass, spring sedge, crested hair grass, salad burnet, lady's bedstraw and bulbous buttercup, with mountain pansy, mat grass, wavy hair grass, tormentil, sheep's fescue, heath bedstraw in the acidic patches.

147: 'Summerhill Mines', SK 154644
Ecology: There are patches of acidic (U4) vegetation with some mountain pansy associated with the hillocks on veins associated with capped shafts, a belland yard and dressing floor with a flat area that possibly once had a gin.

148: 'One Ash Moor Mines' and Water Icicle Close Mine, SK 159643
Archaeology: Hillocks on veins, with several capped shafts, where the primary interest is ecological. At the northern edge of the area is a rare survival of a line of four beehive caps over small shafts. The shaft at Water Icicle Close Mine leads to natural passages where miners have removed stalagmites (thought to be for incorporation into a grotto at Chatsworth) and to narrow vein workings.

Ecology: The hillocks support patches of good quality acidic vegetation (U4) with bilberry, mountain pansy and heath bedstraw.

149: Pasture/Hole Rake, SK 158656
Ecology: Vein hillocks, with a now-dry water storage or ore-dressing pond, support a mosaic of species-rich neutral (MG5b) and calcareous grassland communities with associated patches of acidic vegetation.

150: 'Ferndale Mines', SK 159659
Ecology: A small length of vein hillocks supports a mosaic of species-rich neutral (MG5b) and calcareous vegetation.

151: Mandale Rake, SK 186665
Archaeology: This is the only surviving stretch of large hillocks and hollows on this historically important rake. Adjacent there is a well-preserved 1820s mine reckoning house. Mandale Rake is documented as active in the 1280s and the late-16th century.

Ecology: One of the lines of hillocks lies within a plantation. The other two are covered with neutral grassland, about half of which is the species-rich MG5b community.

152: Mandale and Lathkill Dale Mines, Soughs and Veins, with Sideway and Gank Hole Veins, SK 194659
Geology: Exposures of the vein in the workings of Mandale Mine are infrequent, most of the vein having been mined out. However, where they are visible they show that it is one of the few large barite dominated veins to have been mined in the orefield. It consists largely of crustiform pink and white barite that has grown towards the centre of the vein from the limestone walls. 'Spots' of galena occur throughout the vein but are more frequent close to the walls and, occasionally, in the centre of the vein. Occasional vugs in the centre of the vein where the barite growing in from both walls has not completely filled the vein

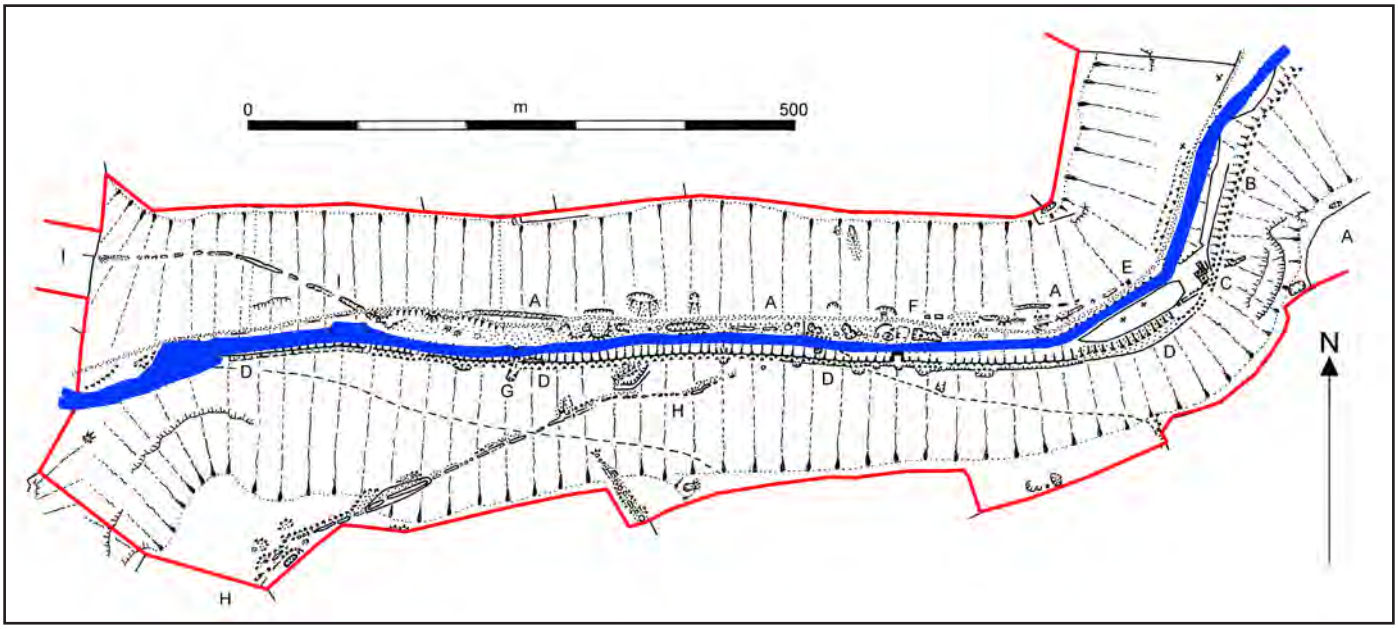
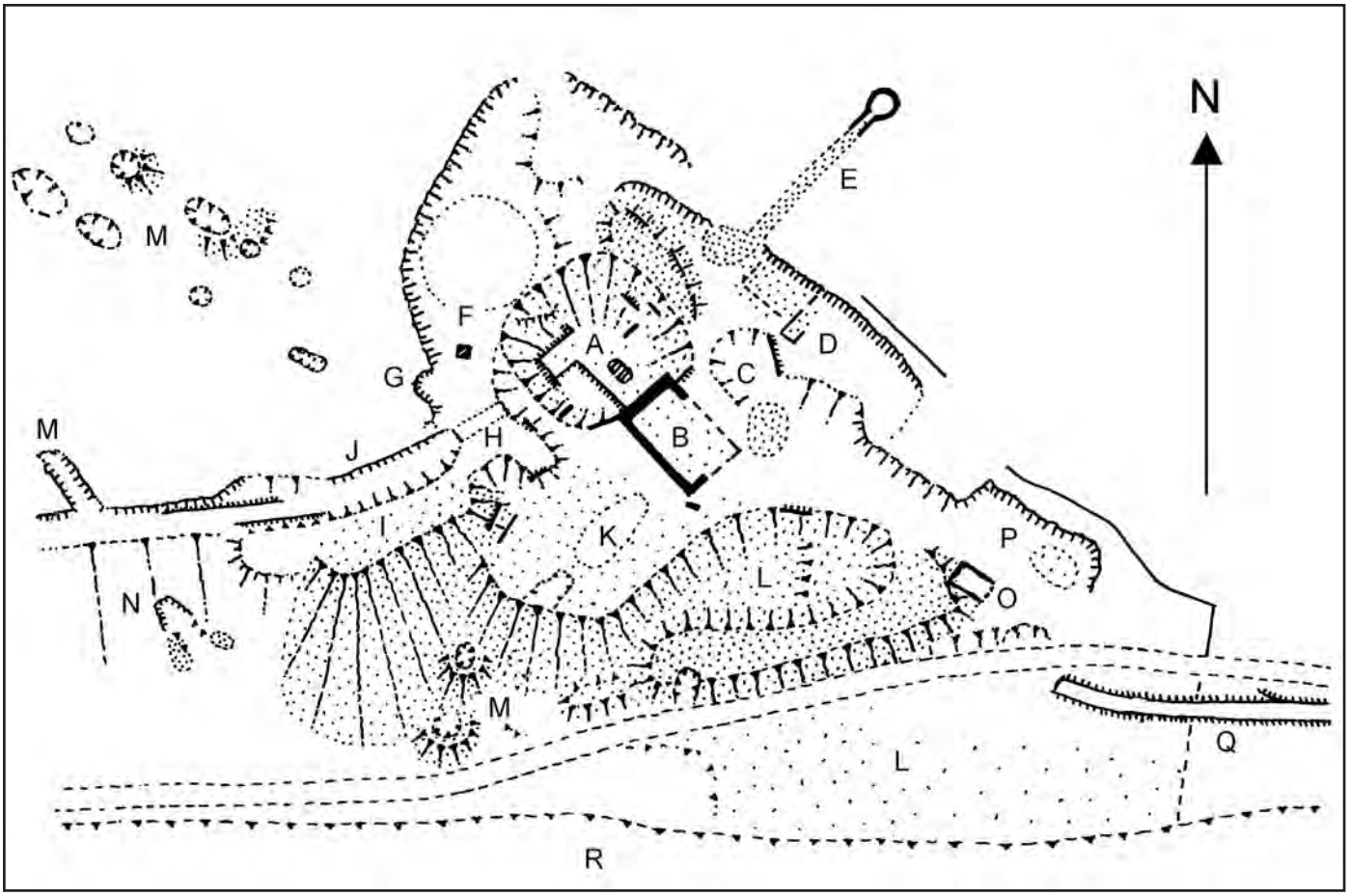


Figure 19: Site 152: The main western area, showing the main features of Lathkill Dale Mine; the vein continues eastwards above the dale, descending again to river level below Over Haddon (A: Lathkill Dale Vein, B: Mandale waterwheel leat, C: Bateman's House, D: Bateman's House leat, E: powder house, F: waterwheel pit, G: Sideway Level, H: Sideway Vein, I: Gank Hole Vein).

Figure 20: Site 152: The focal area of Mandale Mine showing the main features (A: shaft and wheel pit, B: engine house, C: site of boiler house, D: ruined smithy, E: flue and chimney, F: shafts and probable site of whim gin, G: inclined level, H: tramway terrace over tunnel, I: waste heap, J: waterwheel leat, K: dressing floor, L: hillock robbing, M: earlier mining, N: side level, O: coe, P: quarry, Q: sough goit, R: river).



cavity usually exhibit botryoidal deposits of barite consisting of numerous small bladed crystals and may be pink or white. Occasional nodules of goethite after marcasite are also present. The limestone walls clearly show slickensides with a near horizontal orientation.

Archaeology: This site includes a number of mining features at nationally important historic mines at its core and others surrounding them which give context (Rieuwerts 2000a; Barnatt 2005b).

The surface features at Mandale Mine include a ruined Cornish pumping engine house, flue and chimney. Nearby there is a waterwheel pit, a tunnel for the waterwheel leat, capped shafts, a gated entrance to an inclined level into the mine, a large and part-paved dressing floor, two badly-ruined small buildings of group value, a large part-robbed hillock, a poorly defined gin circle, and the fine goit and entrance to Mandale Sough. Together they form an important example of a mine complex.

On the daletop above there are further hillocks. Extending up the valley from Mandale Mine there is a long waterwheel leat/terrace for a launder, the pillars of an aqueduct over the river, and a header pond with a dam across the river.

At the eastern end of Lathkill Dale Mine there are the ruins of Bateman's House, a complex mine building that started life as an unusual industrial 'shed', that was later converted to a manager's house and possibly a mine office. There is a large accessible shaft to one side, and a second beneath the building, reached via a 'cross-cut', which leads down to the sough where there is a chamber that may have once contained a rare Dakeyne disc engine. Nearby there are associated garden terraces, walled enclosures, earlier boundary stones and the entrance to a level. On the other side of the river there is the Lathkill Dale Mine powder house. Further upriver, within a ruined belland yard, there is the large Lathkill Dale Mine waterwheel pit with a launder breast wall by the leat. Other features nearby include several badly-ruined small 'coes' of particular interest given their context in relation to the wheel, a hillock-top working platform, a poorly-preserved walled gin circle, capped shafts and hillocks. Together they form another important example of a mine complex.

In this general part of the valley bottom there are also further degraded hillocks and two minor open-cuts. On the opposite side of the river there is the entrance to Sideway Level and a series of hillocks following Sideway Vein up the daleside. Here there are fine examples of deep open-cuts with vertical rock-cut sides, together with small hillocks and shafts. There is a large water storage pond at the daletop.

East of Bateman's House, Lathkill Dale Vein has well-preserved hillocks. A short way beyond the eastern end of these, there is the bolt tail of Lathkill Dale Sough and vestiges of sough hillocks nearby. A recently reopened shaft next to the Over Haddon Mill, is a fine example cut carefully through tufa to have a rectangular cross-section, with a cross-cut near the bottom for the water from the adjacent mill wheel, which was placed in a deep pit cut into the tufa. The sough in this eastern part runs through a natural cave developed within the tufa. Mandale Mine is first documented as active in the 1280s; most of the visible surface features are 19th century in date.

To the west at Gank Hole Vein there is a ruined coe, minor examples of hillocks and shallow open-cuts. Further west there is the entrance to an accessible stope working, outside which are well-preserved but small, stone-retained, dressing platforms and a loading bay.

Underground features include Mandale Sough that in part is arched or slabbed-over, together with stopes, a striking chamber at the base of a horse-whim shaft and a barrel-vaulted chamber below the steam engine house/wheel pit shaft associated with the engines here (Tune 1969; Worley and Ford 1976; Rieuwerts 2000a). A gated side vein has evidence for firesetting (Barnatt and Worthington 2006). Part of Lathkill Dale Sough is accessible in dry conditions via the shaft at Bateman's House and via a level behind Bateman's House leading to a second shaft. Sideway Level, is a fine 19th century access level leading to stopes. Gank Hole Vein has very unstable workings to the east (Riley 1977), but, from a separate entrance further west, a good example of a narrow stope rich in ochre can be accessed.

Ecology: This site lies almost exclusively within Lathkill Dale SSSI and primarily within areas of ash woodland. Specialist lead rake flora is all but absent.

153: Long Rake Mine, SK 187642
Archaeology: The 20th century headgear and one-storey horizontal winding engine house of the calcite mine remain; the engine was moved into the yard several years ago.

154: Long Rake Open-cuts, SK 196646
Geology: Long Rake Spar Mine worked a wide, strong calcite-dominated vein over a length of about 1km for decorative spar from surface to a depth of around 340m where workings were limited by the water table (this includes the open-cuts listed here towards the east end). Both at the east and west ends of the workings the vein becomes disordered. To the east the vein has also been worked over a distance of several kilometres for lead and, more recently, for fluorspar. To the west the vein is disordered and un-worked for about 200m and was then worked by Arbor Low Mine for calcite over a length of about 700m, the vein being of similar character to that in Long Rake Spar Mine. Arbor Low Mine is now inaccessible.

In Long Rake Spar Mine the vein, up to 5m wide, consists of massive white calcite with galena often present as small crystals close to both walls and, sometimes, in the centre of the vein. Slickensides are common on the limestone walls of the vein and clearly demonstrate near horizontal movement. There are a number of small vuggy mineralised pipes associated with the main vein that contain clear calcite crystals and probably represent a late phase of mineralisation.

The mine workings also intersect a number of sediment filled phreatic caves.

Archaeology: Wide reworked open-cuts and disturbed hillocks within a long belland yard. One deep open-cut leads to extensive underground stopes worked for calcite in the 19th and 20th centuries. Here unstable workings include large stopes, ring-arched levels with tramways, timber ore chutes, and an engine shaft with fittings and ladderways.

Ecology: The site supports mostly plantation woodland with a small area of calaminarian (OV37) vegetation at the western end with spring sandwort and alpine penny-cress.

155: 'Lomberdale Mines (west)', SK 190641
Ecology: Low hillocks on several small veins support patches of species-rich neutral vegetation, with eyebright and frequent harebell, and one small area of calaminarian grassland with spring sandwort and *Cladonia* lichens.

156: 'Crossflat Mines', SK 187637
Ecology: Small hillocks on a vein are mainly covered in tall herb (MG1e) vegetation with some more fine-leaved patches. Knapweed, harebell and crested hair grass are present.

157: Spar Rake and Friday Vein, SK 189633
Ecology: Small ploughed-down hillocks along five parallel veins support a short, fine-leaved sward, mainly calcareous (CG2) with neutral (MG5c) grassland on the margins: rest-harrow, betony, tormentil, salad burnet and glaucous sedge are all present.

158: Beet Need Vein, SK 194639
Ecology: Small well-preserved hillocks along two parallel veins, one called Beet Need Vein, the other's name not known, contain areas of neutral/calcareous grassland**.**

159: Soft Rake, SK 195641
Ecology: Small somewhat degraded hillocks are present on two veins, one called Soft Rake, the other's name is not known. The vegetation is mainly species-rich neutral grassland with devil's-bit scabious, bird's-foot trefoil, lady's bedstraw and knapweed.

160: 'Lomberdale Mines (east)', SK 200643
Ecology: Surviving hillocks on several veins support small patches of calcareous vegetation in a semi-improved matrix. The northern hillocks are relatively high, while the others are low and follow smaller veins.

161: 'Lomberdale Mines (south-east)', SK 202641
Ecology: All that remains on this site is a reworked vein hollow with two small areas of calaminarian vegetation with spring sandwort.

162: Timperley, Alma and Cobbler Mines, SK 201635
Ecology: Extensive hillocks on several veins, some ploughed down and/or robbed, support patches of calaminarian vegetation with spring sandwort, and a range of neutral and acidic (U4) grassland communities, the latter with tormentil and heath bedstraw.

163: Calton Hill Pipe, SK 208638
Ecology: The hillocks have been largely removed but two small intact areas have ecological interest. This includes small patches of calaminarian vegetation with spring sandwort and *Cladonia* lichens and larger areas of neutral grassland (MG5).

164: Wenley Hill Vein, SK 208636
Ecology: One large hillock remains on this site. In the south-east part of this is a patch of the calaminarian community with spring sandwort, alpine penny-cress and *Cladonia* lichens. The rest contains rather species-poor neutral vegetation.

165: Mawstone Mine, SK 211633
Archaeology: A large hillock with a surviving large ore-dressing shed, a small one storey mine office, and traces of other buildings, all close to a shaft top and dating from the late 19th/early 20th century. Nearby are further hillocks upslope and the remains of 20th century gangue processing plant. Set at a distance from the hillocks, there is a small dilapidated powder house. The shaft through shale to the mineralisation below gives access to underground workings but these are normally flooded.

Ecology: There is extensive calaminarian grassland on the large mound at the southern end of the site, with spring sandwort and alpine penny-cress, together with a larger area of varied calcareous grassland including mouse-ear hawkweed and ox-eye daisy. Unusually, marsh orchids are also present.

166: Black Shale Pitts and Pienet Nest Veins, SK 215638
Ecology: There is a large and high but damaged hillock at the capped Pienet Nest Engine Shaft. The now lost Crash Purse Shaft was once nearby to the south-east. Both are of historical importance because of the early 19th century water pressure engines installed underground here; that at Crash Purse was designed by Trevithick. The Pienet Nest hillock supports extensive areas of open calaminarian vegetation (OV37a), with spring sandwort throughout and occasional alpine penny-cress.

167: Bacon Close Vein and Page's Shaft, SK 218638
Archaeology: To the south-east is the impressive Page's Shaft and surrounding hillock; the grilled shaft sunk through shale is a fine example of a large engine shaft; there was once a hydraulic engine underground in this shaft. There are large but damaged hillocks to the north-west; a prominent beehive cap is a modern rebuild. To the south-east the hillocks in the caravan field have been levelled but are of ecological interest.

Ecology: Small patches of calaminarian grassland with occasional spring sandwort and local alpine penny-cress are present on the hillocks but about one-third of the hillock area supports rather species-poor acidic (U4) grassland. Calaminarian grassland is extensive on the levelled land which now forms the caravan site and includes abundant spring sandwort and occasional alpine penny-cress in addition to a high cover of *Cladonia* lichens and mosses. This community grades into a tightly mown neutral grassland sward which is at least locally species-rich (typically with frequent bird's-foot trefoil) and occasionally includes individual spring sandwort plants.

168: 'Bradford Dale Mines', SK 216641
Ecology: Hillocks exist along several veins. In the valley bottom is a large hillock with capped shaft and probable slime ponds. There are also two trial workings in the cliffs on natural joints. The shaft hillock contains five very small patches of calaminarian grassland with occasional spring sandwort and, in one of them, alpine penny-cress. A narrow strip of calaminarian grassland lies on the eastern side along a path descending a bank. This contains spring sandwort, alpine penny-cress and maiden pink. Maiden pink is struggling to survive. Together with the site on the north side of the dale (Site 169) this is an important location for maiden pink which is now restricted to a handful of sites in the Peak District.

169: 'Bradford Dale Mines (north)', SK 217643
Ecology: Largely-intact high hillocks exist along a small vein. The southern end of these hillocks support a few patches of maiden pink and rare spring sandwort, with the latter associated with bare soils and limestone and the former more widely distributed in the associated neutral/calcareous vegetation. Together with the site on the south side of the dale (Site 168) this is an important location for maiden pink which is now restricted to a handful of sites in the Peak District.

170: Prospect Mine (south), SK 223641
Ecology: A small area of surviving hillocks that contain patches of neutral/calcareous grassland.

171: Prospect Mine, SK 223642
Archaeology: A rectangular one-storey 19th century powder house in good condition, with stone flag roof above a barrel vault, recently fully restored by the landowner. The mine lay nearby to the south. The roof provides a roost site for up to 20 Natterer's bats.

172: 'Youlgreave Fields Mines (west)', SK 211648
Ecology: A line of vein hillocks in good condition support mainly neutral grassland, but a small patch of calaminarian vegetation with spring sandwort and *Cladonia* lichens occurs at the south-east end.

173: 'Youlgreave Fields Mines (east)', SK 216646
Ecology: The site has extensive hillocks over a broad area, some high, others low. The vegetation is a mosaic of acidic (U4), species-rich neutral (MG5b) and less diverse neutral grassland. Notable species include cowslip, bitter vetch, lady's bedstraw and quaking grass.

174: Broadmeadow Mine, SK 224643
Archaeology: This occupied building, now a row of cottages built in three phases, is documented as the offices of the Alport Mining Company. The building was associated with an adjacent engine shaft that led down to a hydraulic engine chamber, there was also a nearby climbing shaft, but both are believed to now be filled.

175: Blith Forefield Mine, SK 225643
Ecology: Reworked and largely removed hillocks and a capped shaft exist within a belland yard. The remaining shaft hillock supports frequent dark mullein, a Derbyshire Red Data Book species. The levelled spoil is mainly covered with a sparse calaminarian community containing spring sandwort and alpine

penny-cress. Maiden pink was formerly present but that part of the site has become overgrown and it hasn't been recorded recently.

176: Wheels Rake Mine and Shining Sough, SK 228648
Archaeology: At Wheels Rake Mine the main feature of interest is a well-preserved walled-pit with arched roof, at a covered shaft top, which once held a large balance bob. This pit is set within a damaged hillock. The balance bob was once attached via flat rods to a large documented waterwheel used for mine pumping and winding, the wheel pit of which is now no longer apparent; presumably lower parts remain buried on site. Adjacent to the balance bob pit there is a scrin working that gave access to Shining Sough which is now normally flooded. Upstream from the pit there is a surviving head-race leat for the waterwheel, leading from a substantial reservoir dam across the river, parts of which survive (in part removed in the 20th century when a pipeline was laid down the valley).

177: Bowers Rake Goit, SK 236651
Archaeology: A long straight open leat, probably dug to take water from a waterwheel pumping engine on Bowers Rake further west erected about 1700.

178: Thornhill's Sough and Bowers Rake, SK 237649
Archaeology: A good example of five closely-spaced ventilation shaft hillocks following a short sough to Bowers Rake, where there are further spaced hillocks on the vein working.

179: Rainster Sough, SK 238653
Archaeology: A sough leat from the sough tail to the river comprising a silted gully across flat land.

180: Black Sough, SK 241657
Archaeology: A sough leat from the sough tail to the river comprising a silted gully across flat land. Nearby there is a unique upright marker stone that marked the line of the sough, now re-erected out of line.

181: Stanton Sough, SK 250656
Archaeology: A sough leat from the sough tail to the river, comprising a broad silted gully across flat land.

182: Hillcarr Sough, SK 259637
Archaeology: Fine arched entrance tunnel to one of the longest soughs and ore extraction canals in the orefield. There is also a 'jetty' where material from the sough was unloaded from boats and placed in large waste heaps nearby. A goit leads via two ponds to the River Derwent. Nearby there is a limekiln that may be associated with the sough. In the other direction, a paved access route leads upslope to a large ventilation shaft hillock (passing 1-2 possible small examples part way along). This has a capped shaft with an adjacent platform (possibly for a gin) and a nearby enclosed yard.

Underground, the first section of the sough is lined with gritstone ashlar throughout, but with rock sides in parts, running to a point over 500m in, where a major collapse prevents access beyond. Detail included timber roof stemples and plugs for fittings at the passage side.

183: Hillcarr Sough - Brown Bank Shaft, SK 230630
Archaeology: The main interest is a dam, with dressed stone abutments, and an overflow race. These were built for water blast ventilation to Hillcarr Sough; they are the only certain remains of this type in the orefield. There is also a ruined possible coe nearby. The capped ventilation shaft itself is no longer visible, but there is a flat working area cut into the hillside immediately above.

184: 'Kenslow Mines', SK 184627
Ecology: The small hillocks on this vein have been largely ploughed-down but are covered in tall-herb communities: cowslip, lady's mantle and salad burnet are present.

185: Limekiln Rake, SK 182624
Ecology: The names of two of the three veins here are not known. A small area of hillocks in the north-east corner support some patches of calcareous vegetation.

186: Wood Top Vein, SK 184622
Ecology: Small hillocks remain in good condition on two veins, the eastern one of which is known as Wood Top Vein. They contain neutral (MG5b) vegetation and a little spring sandwort is present in areas adjoining, indicating a recent transition from a calaminarian community.

187: 'Bolderstone Mines (west)', SK 176609
Ecology: The hillocks have been largely reworked/removed except to the north-eastern edge of the site, while there is a shallow open-cut at the north-west end. This open-cut is marked as an 'Ironstone Mine' on the 1840 Ordnance Survey one-inch map and as a 'Gravel Pit' on the later 19th century twenty five-inch map. Despite the reworking this is a rich and interesting site with a mosaic of calcareous, neutral and acidic communities. Autumn gentian, cowslip, crested hair grass, kidney vetch and marsh orchids are present.

188: 'Bolderstone Mines (east)', SK 180608
Ecology: Small hillocks on two veins, some in poor condition, supporting rich calcareous vegetation with frequent autumn gentian.

189: Umber Mine, SK 190612
Ecology: The hillocks have been largely reworked, leaving displaced material and shallow open-cuts. These support mainly neutral vegetation with calcareous communities around rock outcrops. Cowslip, small scabious, rough hawkbit and stemless thistle are present.

190: 'Gratton Mines', SK 200613
Ecology: Small hillocks to the north-west are in good condition, but to the south-east there is only a reworked vein hollow with the associated hillocks largely removed. The hillocks contain areas of neutral/calcareous grassland.

191: Long Rake, SK 190603
Archaeology: a good example of isolated but visually prominent vein workings in good condition.

Ecology: This site straddles the boundary of Long Dale & Gratton Dale SSSI, including parts of Units 3 and 5. The hillocks support good examples of calcareous grassland.

192: Mouldridge Mine, SK 194595
Geology: Mouldridge Mine consists of a good example of a series of interconnected mineralised pipes. These are lined with white calcite containing fluorite and spots of galena. In places auricalcite is present.

Archaeology: Surface features include well-preserved pipe-working hillocks, capped shafts, a dressing floor, a ruined coe and a belland yard in a small discrete mine complex. A grilled level leads to a good example of a complex series of underground pipe workings with shafts to surface, two of which are unusually close together, a 20th century underground dressing floor, fine walled packs of deads and a winze (Pearce *et al*. 1984).

Ecology: This site lies entirely within Long Dale & Gratton Dale SSSI, including parts of units 2 and 4. The hillocks and associated features support calcareous, acid and all three of the calaminarian grassland sub-communities. The lichen rich sub-community is restricted to an un-grazed location whilst the other sites are scattered within the grazed area of the dale. Spring sandwort is very variable in terms of cover but is frequent locally. Common associates include thyme, harebell and eyebright. The calcareous grassland forms the bulk of the grassland. It is not particularly diverse but supports the community constants including salad burnet, fairy flax and small scabious. The acid

grassland is mainly found where the hillocks extend onto the plateau above the south-eastern side of the dale. It includes frequent mountain pansy in a range of colour types, bitter vetch and tormentil.

The South-Eastern Orefield – Winster, Matlock and Wirksworth.

193: Dunnington and Hardbeat Mines, Rath and Cowlica Rakes, and Rath Rake Sough, SK 211605
Archaeology: Extensive well-preserved pipe and vein working hillocks and open-cuts, with a number of capped shafts. In places there are large opencast-type workings, presumably in pipes or flats, and one area has a large number of near-contiguous shaft hillocks, which suggest flat or pipe works were mined below surface in 'bell-pit' fashion. Surface features include several buddle dams (some large) associated with 19th century hillock reworking, one with two barrow runs, several ore-dressing pits, a possible pond, two water leats or trunk buddles, three probable/possible gin circles, a ruined circular coe or walled shaft and two buildings on Rath Rake which are presumably large mine coes (or agricultural buildings).

A line of spaced hillocks follows a vein on the line of Rath Rake Sough; some of these hillocks may well also be the sites of ventilation shafts. The sough tail is a low slabbed bolt, the oldest of its type still open.

There has been no recorded underground exploration of the main part of the historically important and extensive Dunnington pipe workings.

Ecology: A large area of the hillocks at Dunnington mines support species-rich neutral vegetation with lady's bedstraw and quaking grass, and smaller patches of calcareous and good-quality acidic vegetation with mountain pansy. In the late summer when the devil's-bit scabious, knapweed, autumn gentian and harebells are flowering this is a rare glimpse of how White Peak grasslands would have been before the large scale agricultural improvement necessary during and after World War II. It is a large remnant of a forgotten floral landscape. The extensive remains also support goldfinches, butterflies and moths which feed on the areas of less species rich grassland containing thistles and ragwort. Brown hares delight in the varied topography of the site.

194: Rainslow Scrins, SK 220603
Archaeology: Extensive open-cuts on closely-spaced veins but with many areas reworked and the hillocks disturbed or removed, with several capped shafts, three buddle dams (one very large), a trunk buddle or water leat, a walled shaft and possible ruined coes.

Ecology: More than half the hillocks support rich neutral grassland communities (MG5a, MG5b) with much smaller patches of calcareous vegetation. The structure of the grassland here is very varied, making it an important site for invertebrates and small mammals.

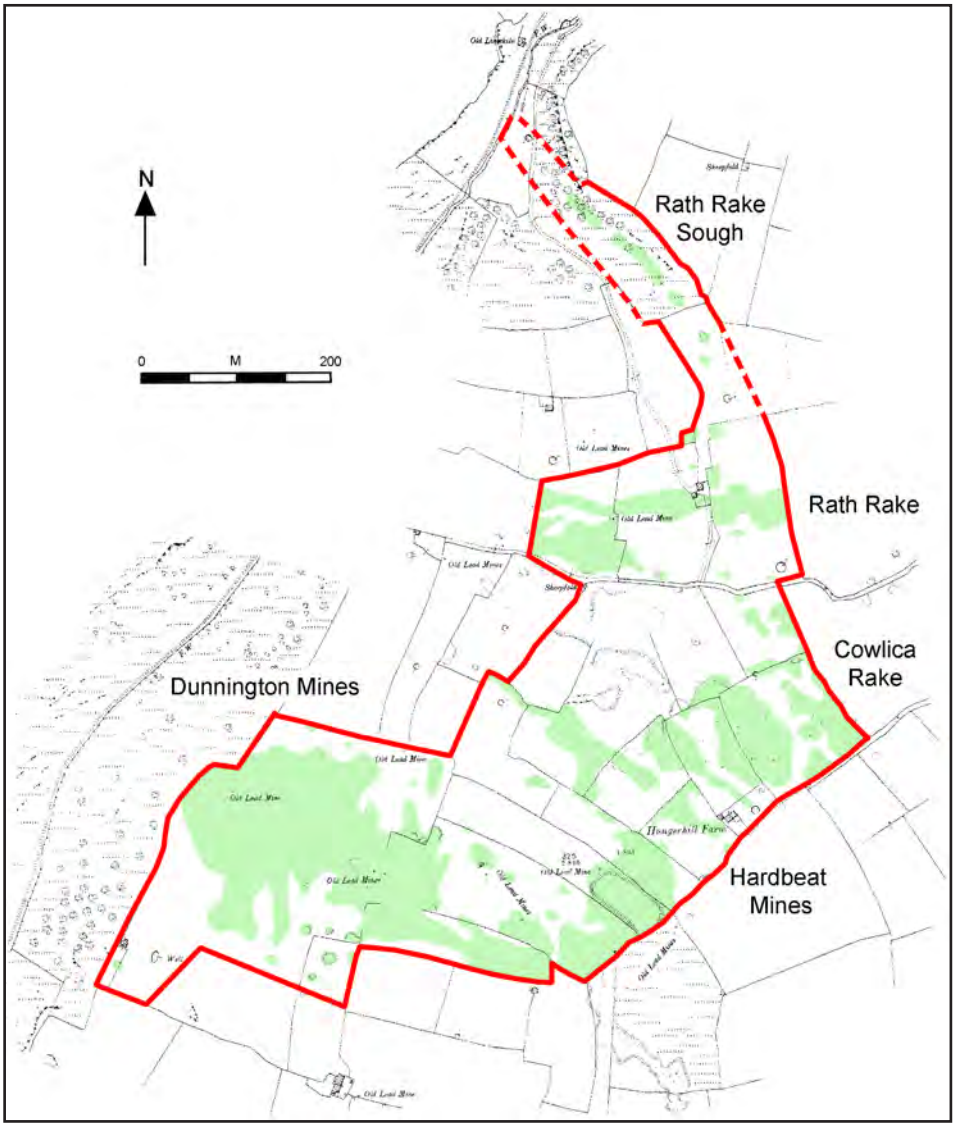
195: Portaway Mine, SK 230611
Archaeology: Disturbed hillocks where the primary interest is ecological. A capped engine shaft in a large hillock may give access to the known extensive pipe and vein workings (also see U18, U19).

Ecology: A bank containing old spoil at the eastern end and top of the slope holds patches of calaminarian grassland with occasional-frequent spring sandwort. Alpine penny-cress also occurs in one patch.

196: Brown Edge, White Great Rake and Lickpenny Mines, SK 234601
Archaeology: Extensive hillocks on pipes and related veins, with many ploughed-over or removed, but with intact examples and several shafts; nothing is recorded of what lies below ground. The remains include six fine examples of buddle dams, a water leat from a shaft to buddle dams, a well-preserved stone-lined water channel from shaft to stone-lined buddle, and two or possibly three gin circles including a good example on a flat-topped hillock.

197: Winster Ore House, SK 237601
Archaeology: A restored one-storey ore house; the only one of its type in the orefield.

Figure 21: Site 193: Dunnington and Hardbeat Mines, Rath and Cowlica Rakes, and Rath Rake Sough (site boundary – red; surface mining features - green).



198: Yatestoop Mine, SK 244614
Archaeology: A series of exceptionally large hillocks with engine shafts to Yatestoop Pipe deep under shale cover, two of which are still open but capped. Surface interest includes two possible gin circles (one suggested only on the basis of a large flat-topped hillock at the top shaft where a steam engine was installed underground), and ruins of a small building that may be a mine coe or an agricultural building. Exceptionally, there were five or six Newcomen pumping engines at surface, including the earliest in the orefield. No surface traces of their engine houses have been recognised but in most cases the sites look relatively undisturbed and excavation may reveal footings, etc.

Documented extensive underground pipe workings may well be of great interest but large parts are currently not accessible (archaeological character of accessible workings currently poorly documented).

199: Old Millclose Mine – Watt's Engine House, SK 258618
Archaeology: Surface features include the ruins of the Watt's Shaft Cornish pumping engine house, the foundations of a winding house possibly also incorporating a boiler for this to the north, and a larger boiler house between with three short flues to a chimney base (Pickin 1982). There are also foundations of another building, slope-retaining walls, and the site of a capstan. The shaft gives access to one small section of extensive and important pipe workings (see U25). Very extensive hillocks have been largely removed/reworked and thus are not included in the defined area of interest.

Ecology: The hillocks contain areas of neutral/calcareous grassland and a tiny patch contains spring sandwort.

200: Millclose Mine, SK 258623
Geology: Unfortunately all of the extensive workings of the 'modern' Mill Close Mine have been flooded since the mine closed in 1939 and so have not been accessible for examination by geologists for over 70 years. The mine is anomalous in the orefield in that the major vein structures worked have a north-south trend while most of the major veins in the orefield have a more east-west trend. The suite of mineralisation present is typical of the eastern side of the orefield comprising of fluorite, calcite and barite gangue minerals with galena. The variety of styles of mineralisation is unusual (see Ford 2004 for a detailed description). Deposits include typical vein style of mineralisation accompanied by flats, pipes and replacement deposits. Some of the pipes worked consisted of a breccia of fallen mineralised blocks, presumably detached from the vein walls by dissolution processes occurring during the phases of mineralisation, enclosed in black mud. Because of their location at depth below the shale cover these deposits are not the same as the sedimentary ore deposits that are found in many parts of the orefield which are the result of geologically recent, often sub-surface, erosion and deposition processes.

There are several 'toadstone' horizons in the mine and these appear to have trapped the mineralising fluids beneath them as they migrated from depth to the northeast until they flowed through a pathway then to be trapped beneath the next higher toadstone. This lead to the deposition of rich ore deposits below each of the toadstone beds that occur beneath progressively older beds to the north.

Archaeology: Surface interest at this once historically very important mine (Willies *et al*. 1989) includes the lower parts of a Cornish pumping engine house and chimney, together with the associated boiler house; the lower part of a bob wall at a second engine house; a mine office/reckoning house; a one storey workshop range; and a 20th century generator house and an electric-winder house. All are within a modern industrial complex. Very extensive hillocks nearby are in poor condition.

Two exceptionally large shafts exist, one grilled and leading down to a level branching off Yatestoop Sough (see Site 201); all at depth is flooded.

201: Yatestoop Sough, SK 264626
Archaeology: An arched and paved sough tail gives access to a long accessible section of this major sough, including a branch level, with remains of a plankway above the water (Warriner 2000b). This leads to two exceptionally large shafts, both at Millclose Mine. One has *in-situ* pump rods, together with support timbers and garlands in the shaft side. The other has timber guides for cages, while adjacent at sough level there is a chamber for a balance bob.

202: Hadland and Delf Veins, SK 241603
Ecology: A small number of hillocks, including a part-robbed hillock to the south-west with capped shaft with an adjacent platform that has a possible poorly defined gin circle. These contain small areas of neutral/calcareous grassland.

203: 'Longtor Mines', SK 248600
Archaeology: Broad area of hillocks and open-cuts on closely spaced veins, much reworked in the past, but with several important features. These include small capped shafts and open-cuts, and three large engine shafts, two of which are visible through grills and are fine examples of oval ginged shafts; little is known of what lies underground. One shaft has a possible leat leading from it. A large hillock at the north-western end of the defined area has a possible gin circle. There is also a stone-lined buddle, a ruined coe and several large buddle dams.

Ecology: The calcareous sward exists in a complex mosaic with herb-rich neutral grassland with which is shares many species. It is distinguished by a higher cover of calcicoles which include thyme, small scabious, fairy flax, salad burnet, autumn gentian and rare frog orchid. Cowslip and common rock rose are also present. The diverse structure of the grassland also makes it excellent habitat for invertebrates and ground nesting birds such as meadow pipit.

The eastern end of the site supports patches of good quality acidic vegetation with mountain pansy. Some of the mature hawthorn scrub that occurs at this eastern end is also of benefit to breeding birds and as an important early nectar source for invertebrates.

204: Winster Pitts, Drummers Venture, Horsebuttocks and Burning Drake Mines, SK 247603
Archaeology: Well-preserved pipe-vein hillocks and dressing floors at a series of adjacent mines (Willies 1998). Surface features at Winster Pitts and Drummers Venture include exceptional survival of various types of buddles, including leats or trunk buddles, stone lined buddles, ore-dressing pits, ponds and buddle dams. There is also a gin circle and a ruined coe.

Shafts lead to underground workings at Winster Pitts and Horsebuttocks/Burning Drake Mines (Penney and Dixon 1990; 1999); the latter are extensive and include important pipe workings and levels which extend well to the north of the main access shaft (where there were further access shafts). Taken together, in these mines there are underground mine artefacts, inscriptions, a coffin level, railed levels, dressing floors with a buddle, a hotch and clay-lined leats.

Ecology: The dominant grassland on Winster Pitts is semi-improved. The taller hillocks on the west support the most interesting vegetation with areas of herb rich sward which include mouse-ear hawkweed, lady's bedstraw, eyebright, bush vetch, harebell and meadow buttercup. The notable species, musk thistle has been recorded here. Frog orchid occurs rarely and rough hawkbit, quaking grass and fairy flax are all present.

205: Wet Sough, Limekiln and Painterway Veins, SK 244609
Archaeology: By the stream is the short and probably unfinished Wet Sough driven through shale, which is documented in 1627, the earliest recorded in the orefield. A hole in its floor leads to later cave-type pipeworkings which have been worked for lead ore in the sediments. Just north of the stream on Painterway Vein

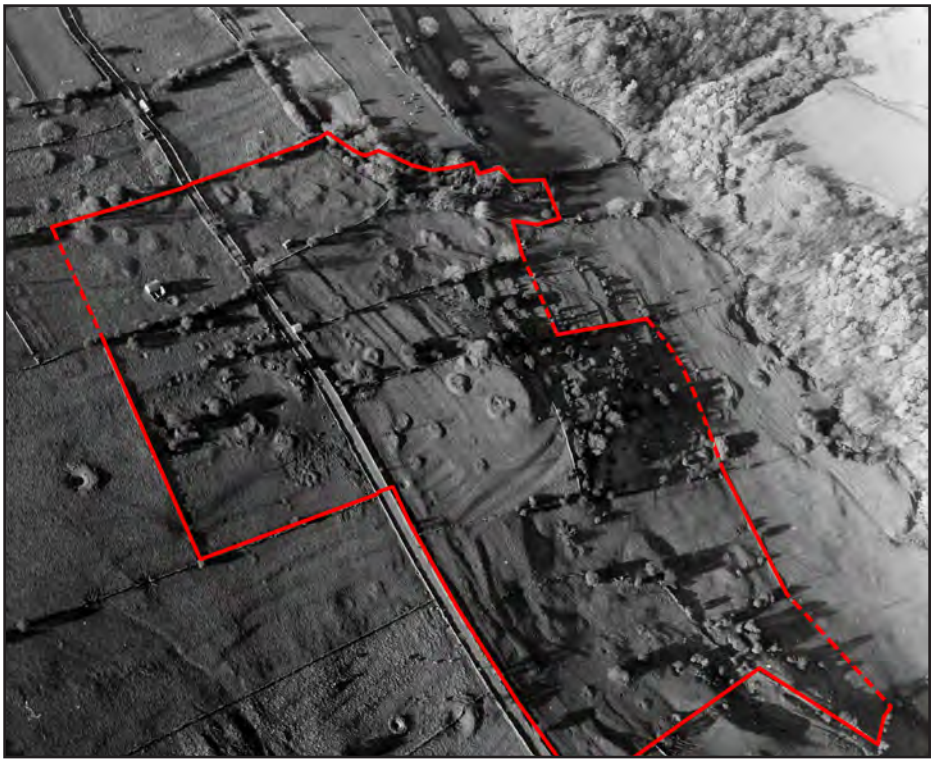
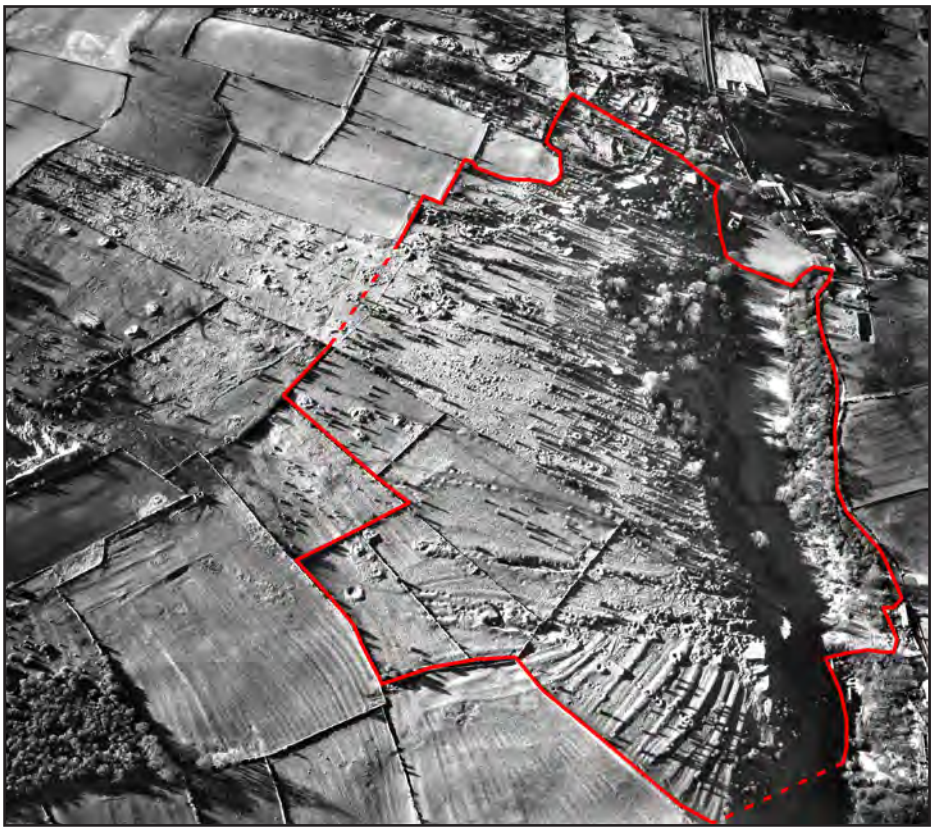


Plate 39: (Top) Site 206: The Bithoms Veins and Innocent Mines, looking north-westwards, showing prominent mine hillocks overlying medieval cultivation earthworks (Image: Derek Riley Collection).

Plate 40: (Bottom) Site 209: The Davis and Mount Pleasant Mines, looking westwards, with continuations of the mining remains in poorer condition to the left. Some hillocks overlie medieval cultivation earthworks (Image: National Monuments Record, English Heritage).



there are atypical puddled shalegates that took the surface streams into the mine for underground use further north. To the south there are relatively small hillocks where the interest is primarily ecological, overlying medieval strip lynchets/ridge and furrow, two with adjacent gin circles cut into the slope. There is a third to the north of the shalegates.

Ecology: The hillocks contain areas of neutral/calcareous grassland.

206: Bithoms Veins, Innocent Mines, and Weet Sough, SK 249607

Archaeology: An extensive area of surviving hillocks, associated with a series of pipe and vein workings, overlying medieval strip lynchets. There are a small number of capped shafts, several buddle dams, two possible ruined coes and ventilation shaft mounds on the line of Weet Sough. Stone beehive caps on a large number of shafts have been removed in recent years. The underground workings are known to have been extensive but there has been no recorded modern exploration.

Ecology: One field to the south of the road centred on SK 259606 contains a range of neutral grassland sub-communities (MG5a, b,& c). Mouse-ear hawkweed, hairy oat grass and lady's bedstraw are present. Current records for the fields north of the road are limited.

207: Shakersdale Mines (north), SK 253606

Ecology: On this site there are intact hillocks on two adjacent veins and a small rubble-filled open-cut. A further hillock just to the east has a concave top, which is probably a small dressing floor. The hillocks support good-quality neutral (MG5b) vegetation with quaking grass, harebell and lady's bedstraw.

208: Watterings Close and Shakersdale Mines, SK 254603

Archaeology: Surviving hillocks on two close parallel veins, with several capped shafts, including two with beehive caps, at least one ruined coe, two or possibly three stone-lined buddles, one or possibly two buddle dams, a barrow-run or raised launder, the foundations of a reckoning house, and the footings of what may have been a ventilation fire house (the only known surviving example in the orefield).

Ecology: The hillocks largely support a short, calcareous sward (CG2 and CG7) with knapweed, salad burnet and shining cranesbill.

209: Davis and Mount Pleasant Mines, Basrobin Sough, and Old Millclose Mine, SK 259607

Geology: The workings listed here as within Old Millclose Mine are a small accessible upper part of a network of veins and caves filled with sediments,

sometimes galena rich, which form part of the up dip extension of the Mill Close Mine vein structure (see sites 200, U25).

Archaeology: Surface remains comprising hillocks along numerous small pipe and vein workings, many still relatively intact. There are many capped shafts, open-cuts (some from 19th century reworking), a small hillock-top gin circle with visible slots for the whim gin supports, two barrow-runs or raised launders, stone-lined leats or trunk buddles, and buddle dams (some very large and including two fine banked sets). One long leat links a shaft to buddle dams. The site as a whole has extensive surface evidence for the relative age of mining, medieval strip lynchets/ ridge and furrow and Romano-British settlements.

Basrobin Sough has a walled 'well' enclosure at the entrance to the slabbed level; this can be followed for some distance underground. A shaft on the side of Wensley Dale gives access to upper workings of Old Millclose Mine (Warriner 2000a; Rieuwerts 2000c). These largely comprise natural cave passages where there is important evidence for extensive removal of mineral-rich natural sediments. Associated with this is a well-preserved underground buddle with an adjacent shaft used as a 'well', and several miners' artefacts and initials. For other parts of the extensive Old Millclose workings see Site U25. The Mount Pleasant and Davis Mines are not documented as having been explored in recent times but may also be important.

Ecology: The many workings and hillocks in the large field at the western half of the site support small patches of calaminarian grassland with spring sandwort and alpine penny-cress, and good quality calcareous communities (CG2 and CG7).

210: Old Ash, Lords and Ladies, Northern Dale Pipe, Hit and Miss, and Tearsall Mines, with Snitterton Park Fire Engine, SK 267605

Geology: The workings of this mine exploited galena, fluorite, barite and calcite mineralisation typical of the Peak District. It is particularly notable because most of the styles of mineralisation present in the orefield are represented in the small area of the mine.

The majority of the mineralisation is located close to the contact between unaltered and dolomitised limestone. Several small veins (scrins) have been mined for galena and associated with these are pipes and flats. The pipes are mainly developed in the dolomitised limestone close to the unaltered limestone, the cavities being formed by pre- or early mineral deposition stage dissolution of the dolomite. They are lined with banded fluorite with galena and some late stage barite and calcite. Most of the galena is present close to the walls and calcite represents a late stage of mineralisation being present in the remaining vugs. Galena rich flats have developed in a prominent bedding plane, and where not extracted by the miners these comprise mainly galena up to 3cm thick.

In addition to the primary mineralisation, post mineralisation caves are present. In some of these the miners appear to have mined the sediments for their residual galena content though none of the latter survives.

Archaeology: Surface remains comprising fine examples of hillocks along numerous small veins and pipe/flat workings, many still relatively intact. There are many capped shafts, some with dressing floors. Northern Dale intersects caves with pipe deposits.

The Tearsall engine shaft has an adjacent coe, while at the nearby Hit and Miss Mine there are ore-dressing features, including small pits on a series of flat platforms, a ruined rectangular coe nearby, and a circular example above. The gin circle at Dalefield Mine has been removed in recent years.

Above Northern Dale at the Old Ash Mines there is a stone-lined buddle, with another further north, and the probable foundations of a Newcomen pumping engine house, with cinders, etc., known as the Snitterton Park Fire Engine. Waste tips at the base of the hillside are associated with at least two soughs and sometimes still issue water. In Northern Dale there is a buddle dam below the upper entrance to Lords and Ladies Mine and 1-2 small circular buddles (one stone-lined) and accompanying leats amongst the workings to the south.

The underground pipe workings in Northern Dale, at Old Ash Mine and the adjacent Lords and Ladies Mine, including a newly identified southern extension, are particularly important as rare examples of demonstrably early workings with evidence

Plate 41: Site 210: The mines above Northern Dale, looking south-west, showing the complex interrelationship between mining and cultivation earthworks of Romano-British and medieval date (Image: Derek Riley Collection).

for firesetting with coal (Barnatt and Worthington 2006; 2007). These workings also have fireset shafts and ventilation walls, fine packs of deads, sledways and water channels. The flattings mined at Lords and Ladies Mine outcrop on the dale side and have been mined at surface to the south. Above the dale to the south-east a deep shaft on Northern Dale Pipe gives access to further fireset and later pipe/flat workings. There are also small vein workings.

The Hit and Miss Mine (Tearsall Pipe Caverns no. 2) pipe workings are also important as examples of complex small workings, some probably early, with a large number of small shafts from surface. There are several other shafts which await archaeological assessment.

Mines somewhere at Northern Dale and Tearsall are documented as active in the 1530s and 1540s respectively. Radiocarbon dates from the Old Ash and Lords and Ladies Mines show that the firesetting spans the second half of the 16th and the 17th centuries (Barnatt and Worthington 2006; 2007). The site as a whole has extensive surface evidence for the relative age of mining and medieval strip lynchets, ridge and furrow, and boulder-defined walls.

Ecology: Hillocks on the grassland above Northern Dale to the north and west hold some small patches of calaminarian vegetation with spring sandwort and rare alpine penny-cress as well as quite rich calcareous vegetation. There are further small areas of calaminarian communities at the bottom of Northern Dale, one around a small mine entrance with spring sandwort, and a smaller patch on the spoil on the western bank, alongside a larger area of calcareous vegetation with abundant mouse-ear hawkweed and thyme. Small scabious and salad burnet are found in calcareous patches at the bottom of the dale.

211: Oxclose, Lee Wood, Lee Close, Ash Plantation and Noon Nick Mines, with Crowholt Level and Lee Close/ White Hillocks Sough, SK 272598

Geology: Oxclose Mine has a number of small veins comprised of multiphase, crustiform fluorite, calcite, barite and galena mineralisation typical of the orefield. Several small pipe deposits occur with collapse structures containing blocks of lava and marcasite mineralization. Noon Nick Mine (Jug Holes) has cave chambers with mineral-rich sediments that have been mined.

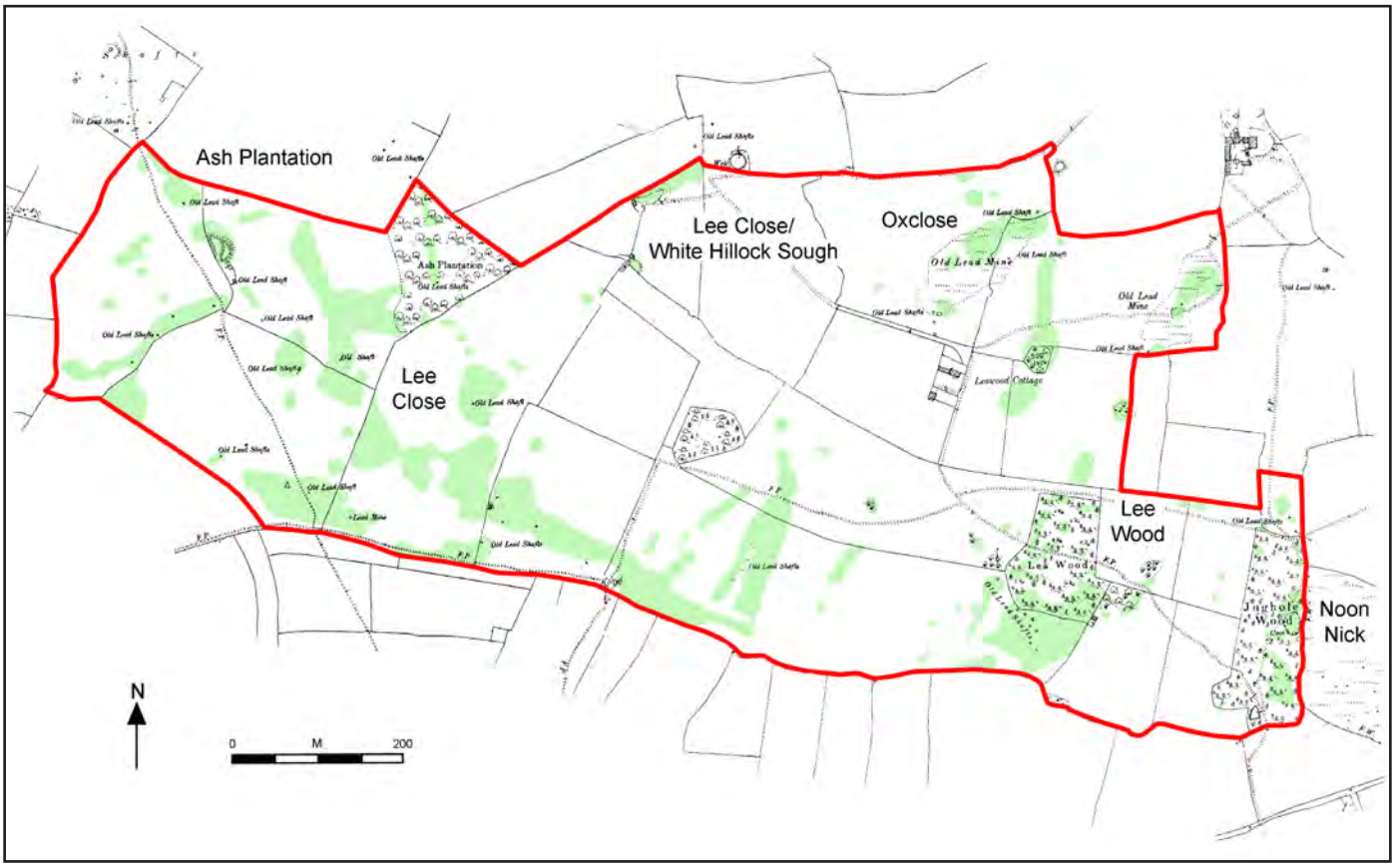
Archaeology: Many scattered hillocks with shafts, mostly to pipe workings, some partially reworked others intact. Surface features at Ash Plantation include a buddling complex, with a long leat from a shaft above, a stone-lined buddle at the base with adjacent ruined walls of a possible coe and/or small yards, and a high hillock and buddle dam below. Below there is another stone-lined buddle and a small buddle dam. Further east there is a ruined coe with a cupboard in one wall.

At the Lee Close Mines there is a ruined coe and a water storage or ore-dressing pond with an associated tramway and buddle dam. Below the Lee Close Mines there is the open tail of Lee Close/White Hillocks Sough and a possible lower but collapsed sough tail and/or haulage level, associated with a fine large coe with wall cupboard, and a large partially reworked hillock with associated buddle dams below.

At the Oxclose Mines there are the lower walls of a Newcomen engine house and a nearby cinder heap. At the Lee Wood Mines and nearby veins there is a stone-lined buddle, a possible gin circle and a ruined coe.

At Noon Nick (Jug Holes) there is an impressive open pipe-cavern entrance enlarged by mining. At surface there is a water

Figure 22: Site 211: Oxclose, Lee Wood, Lee Close, Ash Plantation and Noon Nick Mines, with Crowholt Level and Lee Close/ White Hillocks Sough (site boundary – red; surface mining features - green).



storage pond, a tramway-cutting to a 19th century level entrance (now altered), and platforms associated with a 20th century inclined tramway.

Underground features at Oxclose Mine include extensive pipe workings, a fine coffin level sough known as the Crowholt Level, and a 20th century inclined tramway with a winch and pulley, an air compressor tank, and further tramway with tubs. There are many inscriptions, the earliest dating to 1623.

Noon Nick also has a 19th century arched level and a 20th century fluorspar-extraction tramway and tubs. There is also a 17th century inscription in the roof of one chamber, next to a small shaft to surface, made before the chamber deposits were removed. Elsewhere in the mine there is evidence for firesetting with coal (Barnatt and Worthington 2006).

Lee Close/White Hillocks Sough can still be followed for some distance underground and may be the earliest accessible hand-picked sough in limestone in the orefield. It links with workings above and both have a variety of tramway rails and a tub. The upper workings can also be entered via a shaft on the ridgetop above; there are several miners' inscriptions, and a stone/clay built buddling or washing tank, in these upper workings. The Lee Wood Pipes are known to be accessible (archaeological character of workings currently poorly documented).

Both the Oxclose and Noon Nick Mines are documented as working in the 1530s. The site as a whole has extensive surface evidence for the relative age of mining and medieval strip lynchets, and ridge and furrow.

Ecology: This is a rich site that contains several small patches of calaminarian grassland with spring sandwort and alpine penny-cress and larger patches of species-rich calcareous vegetation. The lead mine remains look their best in the late spring when the cowslips and early purple orchids are in full flower. A heap of spoil below Noon Nick (Jug Holes) contains both of these metallophyte species. Adjacent to this is a grassed-over old tramway with occasional to frequent alpine penny-cress along its length.

212: Hunger Hill Vein and Naylor Yate Mines, SK 281595
Ecology: Some intact hillocks remain on the steep scrub-covered slope to the north. The hillocks mainly support neutral vegetation, some of it species-rich (MG5). There are also several patches of calcareous (CG7) grassland containing mouse-ear hawkweed and thyme, a few acidic areas, and one very small patch of calaminarian vegetation with spring sandwort.

213: Orchard Sough, SK 281608
Archaeology: A low slabbed sough bolt which can be followed for some distance.

214: Old Kennill Grove, SK 252597
Ecology: A small area of disturbed and part removed hillocks support good quality neutral vegetation.

215: Slack Mines, SK 258599
Ecology: Some areas on this site appear to have been reworked but small hillocks and hollows support species-rich neutral vegetation with patches of calcareous grassland around small outcroppings of limestone.

216: Gorseydale, Hangworm, Beans and Bacon, Slack Breaks and Fiery Dragon Mines, SK 255592
Archaeology: Extensive area of mostly well-preserved hillocks on a series of small veins and pipe workings, with many capped shafts. Surface features include several coes, including a double example, and a gin circle at Hangworm Mine and a dilapidated level entrance at Beans and Bacon Mine.

Many shafts give access to good examples of small underground workings and are important for the understanding of this type of mining. A deep shaft at the northern end of Slack Breaks leads to extensive pipe workings.

The eastern part of the defined area has mostly disturbed hillocks but is still of ecological interest.

Ecology: The greatest interest lies in an extensive series of old workings in the south-east part of the site, centred on SK 260592, where lines of hillocks and open-cuts at the eastern end hold extensive patches of calaminarian vegetation (OV37 types a and b) with occasional to frequent spring sandwort. Smaller patches of OV37, including the closed-sward-with-*Thlaspi* type, are scattered elsewhere on spoil across the fields. Mountain pansy is also present and moonwort is rare. The spoil also supports patches of species-rich calcareous (CG2) and acidic (U4) vegetation. The worked out fluorspar open-cut is naturally re-vegetating with a mix of calcareous and neutral grassland with frequent harebell, thyme, mouse-ear hawkweed, occasional kidney vetch and rare spring sandwort and alpine penny-cress.

Further west, at Beans & Bacon Mine (centred on SK255591), five small patches of calaminarian vegetation with spring sandwort occur on the hillocks. However the site is recognised as of particular significance in terms of the quality and diversity of the calcareous swards with additional areas of species-rich neutral grassland. Scattered well established hawthorn scrub is present and evidence suggests this is expanding.

In the north-east part of the site, one small patch of calaminarian grassland with rare spring sandwort occurs in the north-west corner of one field (SK259594) along with patches of calcareous vegetation on low hillocks nearby. Two fields a little to the west, centred on SK 258594, hold extensive patches of very species-rich neutral vegetation (MG5b) that include quaking grass, sheep's fescue, lady's bedstraw, sweet vernal grass, crested dog's tail, frog orchid, common spotted orchid, cowslip (locally frequent), mountain pansy, bird's-foot trefoil, bulbous buttercup, pignut, moonwort, hoary plantain, hairy oat grass, and field scabious.

217: 'Whitelow Mines' (west), SK 252581
Archaeology: Well-preserved hillocks on a series of small veins with many capped shafts. In parts small workings are continuous and the lines of veins not obvious; here the mining developed on rare mineralised cellular blockwork joints in the limestone. One shaft lies on a small hillock-top dressing floor with a shelter wall and possible rectangular ore-dressing pit. A nearby hillock has a small stone-lined buddle. Another shaft has a shelter wall and a further example is walled round. There is also a possible pond. The Whitelow Mines are documented as active in the 1540s.

Ecology: At the main western field patches of calaminarian grassland (both OV37a & b) occur throughout, with spring sandwort locally frequent, amounting to 10% cover. Moonwort, crested hair grass and mountain pansy also occur. The rest is generally rich calcareous (CG2), with mountain pansy frequent, moonwort locally frequent, kidney vetch, thyme, salad burnet and glaucous sedge all present.

The reworked eastern field composing this site contains several lines of mounds and hollows. There are some small patches of calaminarian vegetation with spring sandwort and alpine penny-cress on lines of mounds and hollows. Mountain pansy, frog orchid and moonwort are also present in species-rich calcareous grassland.

218: 'Whitelow Mines' (east), SK 257583
Archaeology: This site has been extensively reworked for gangue mineral in the mid-20th century leaving large open-cuts, new hillocks and access tracks. While the lead mine interest has largely been removed, the exceptions being a few small hillocks and two capped shafts, the site is one of the best surviving examples of gangue working where the site has not been subsequently landscaped. There are two abandoned cranes on site which date from this period of extraction. The Whitelow Mines are documented as active in the 1540s.

Ecology: Calaminarian grassland with occasional-frequent, locally abundant spring sandwort and rare mountain pansy occurs on spoil in the two north-western fields and makes up about 15% of the area. There are also patches of calcareous and neutral grassland which support good populations of orchids including frog orchid.

219: 'Horsedale Mines' (north-west), SK 264585
Ecology: Hillocks on a series of veins, in part degraded, with capped shafts, shallow open-cuts, a possible stone-lined buddle and probable water storage and/or ore-dressing ponds, support species-rich, mainly neutral grassland. Locally this grades into calcareous grassland in several areas, and small patches of acidic vegetation with mountain pansy are also present. Noteworthy species include restharrow, meadow oat-grass, eyebright, burnet saxifrage, small scabious, field scabious and knapweed.

220: 'Horsedale Mines' (south-east) and Horsedale Sough, SK 267581
Archaeology: Well-preserved small hillocks on a series of small veins, combined with shafts on higher hillocks, some with walls to provide shelter to the small dressing floors on their flat tops. There are several capped shafts and ruined coes. There is a fine example of a small mine complex comprising a high but small hillock, with a coe with an internal shaft, a dressing floor embanked at its edge, and a hollow to one side that may be an ore-dressing pit. Some of the mine hillocks overlie large medieval strip lynchets. In the valley to the north-east there is a low sough bolt with strong water flow. Capped shafts nearby could potentially give access to the sough.

Ecology: The site contains a small patch of calaminarian grassland with spring sandwort within a matrix of neutral vegetation, some of it quite species-rich with areas of early purple orchids and cowslips in the spring.

221: 'Bonsall Lees Mines', SK 267573
Archaeology: An extensive area of hillocks and hollows on many small veins and occasional pipe workings, sometimes partially reworked, occasionally leaving open-cuts. There are many capped shafts at a series of small mines, some retaining fine beehives, and ruined coes, mostly rectangular but including circular examples, sometimes associated with small dressing floors on flat hillock tops, some walled, and/or small belland

Plate 42: Site 221: The 'Bonsall Lees Mines', looking south-west are a particularly complete set of remains on many discrete veins, mostly well preserved but with damage in particular fields (Image: National Monuments Record, English Heritage).

yards (part in Brossler 1998). Three hillock-top walls are circular and may have contained cog and rung gins. One area retains fine and densely packed examples of all these features. Other surface features include several stone-lined buddles, including one well-known restored example on the side of a hillock (Gregory and Tune 1967), the entrance to a slabbed haulage level on the valley side, and the entrance to a very small level nearby. The Bonsall Lees Mines are documented as active in the 1540s.

Ecology: Bonsall Leys SSSI lies within this site centred on SK 265575 north of Slaley Lane. The main SSSI interest is the exceptionally rich grassland communities which have developed over and between the extensive hillocks and hollows and other surface features. These include neutral, calcareous, acid and calaminarian grassland communities with the latter covering a significant area in the context of the Peak District (0.38ha), albeit in small dispersed patches. Examples of all three OV37 sub-communities are present, each supporting both spring sandwort and alpine penny-cress although the open community with a high cover of bare soil only covers a very small area. Also present is the closed sward with alpine penny-cress which is characteristic of the Bonsall area. The surrounding neutral and calcareous grassland is particularly rich and includes frog orchid, in addition to at least six other more common orchids, whilst moonwort and mountain pansy are present in a variety of the community types – mountain pansy occurring in a range of colour forms. Small heath and wall brown butterflies are present and common redstarts use the scattered hawthorns.

Three fields to the east of the SSSI, centred on SK266576, SK268574 and SK269576, include patches of calaminarian grassland associated with spoil hillocks and hollows. This amounts to less than 10% of the lead mining vegetation here and includes the typical open sub-community, the more species-rich variant, patches that are *Cladonia*-rich, and the closed sward with alpine penny-cress. These exist in mosaic with rich calcareous grassland communities with kidney vetch, limestone bedstraw, small scabious and burnet saxifrage and a rather species-poor acidic grassland with tormentil and rare bitter vetch. Mountain pansy is locally frequent on the hillocks.

Immediately to the south of Slaley Lane the lead rake interest spans twelve fields centred on SK268571. Extensive areas of hillocks support patches of calaminarian grassland, with spring sandwort and rare/occasional alpine penny-cress, amounting to 10% of the total area. These include open and species-rich sub-communities and the closed sward with alpine penny-cress variant. Rich calcareous grassland (with meadow oat grass, small scabious, kidney vetch, limestone bedstraw) and acidic grassland (with mountain pansy, bitter vetch and tormentil) are also present.

Further south, a high quality herb-rich calcareous grassland covers most of the lead rake mounds in units 12 and 15 of the Via Gellia SSSI (centred on SK 270571) and more generally over the adjacent dale-sides. On the hillocks it exists in mosaic with areas of calaminarian vegetation including the closed and lichen-rich sub-communities and the local variant 'closed sward with alpine penny-cress'. Spring sandwort is absent from the latter but constant and locally frequent in the other community types whilst alpine penny-cress is present throughout. Moonwort, kidney vetch, devil's-bit scabious, small scabious and mountain pansy are amongst the associate species.

222: Low Mine, SK 281585
Archaeology: This mine has overgrown remains, mostly of concrete, of a small 20th century mining venture. Here there is a rare example of the footings of a dressing plant, built into the slope, with a series of terraced platforms and bases that would have supported the dressing equipment. Above the plant there is a reworked open-cut.

223: Dovedale and Sparhole Mines, SK 290585
Archaeology: Important examples of large but overgrown vein hillocks in the wooded grounds of the Heights of Abraham, just north of Coalpit Rake. Unlike much of the area listed for its underground remains where the surface remains are badly damaged, the hillocks at Dovedale and Sparhole Mines have not been reworked (Barnatt and Worthington 2009).

Ecology: This site lies within Masson Hill SSSI (Unit 18) which is largely ash woodland where specialist flora associated with the lead mining remains is largely absent.

224: The Upper Nestus Pipes, SK 290589
Ecology: Unlike much of the area listed for its archaeological underground remains, the surface area here is important ecologically. Units 10, 11 and 15 of Masson Hill SSSI support areas of calaminarian grassland over heavily reworked hillocks with all three sub-communities represented. These are surrounded by a neutral/calcareous grassland. Long-term rabbit grazing and visitor pressure has impacted on the quality and characteristics of many of the communities which are generally poor in wildflowers but locally spring sandwort appears to be thriving. The lichen rich community is only present where these pressures are limited.

225: Masson Farm Level, SK 292590
Archaeology: A narrow accessible level, probably a high level sough, with a walled and slabbed entrance.

226: High Tor Mines, SK 297589
Archaeology: A complex series of spectacular deep open-cuts on Hard Rake and High Tor Rakes (Roman and Fern Caves), mostly open to surface. This is a classic example of this type of working that may be of significant antiquity, with many pre-dating peripheral areas fireset with coal (Barnatt and Worthington 2006; 2009). There are also accessible workings at the base of the cliff to the west and north, the latter going some distance. On the woodland slopes to the south there are further small surface workings. Documentary evidence for working Hard Rake has been traced back to 1467 (Rieuwerts 2010, p. 142).

Ecology: Vegetation associated with vein hillocks in the north-east of the site includes a narrow band of calaminarian grassland. Spring sandwort occurs throughout with sheep's sorrel and locally frequent sheep's fescue. A striking feature is the abundance and cover of *Cladonia* lichens. Alpine penny-cress is very sparsely distributed along the vein, but becomes more prominent in the adjacent more grass dominated vegetation. Other notable species include moonwort and fragrant orchid.

On the steep slopes, deposits of lead spoil have formed small screes and here pockets of calaminarian grassland occur with spring sandwort and alpine penny-cress, but both are sparsely distributed. Sheep's fescue is locally frequent and other characteristic plants include sheep's sorrel, burnet-saxifrage and wild thyme. *Cladonia* lichens are locally quite prominent and bare ground dominates some areas. Additional species of note include lily-of-the-valley and nearby mountain melick.

227: Jackdaw and Station Quarry Veins, SK 296582
Ecology: Small hillocks on minor veins included calaminarian grassland across a small area of approximately 7 x 7 metres. Spring sandwort is frequent, but sparsely distributed whilst alpine penny-cress appears to be absent. Sheep's fescue is abundant together with sheep's sorrel and frequent ribwort plantain. There is a relatively rich associate flora that includes harebell, eyebright, white clover and meadow vetchling. Moonwort is also present, though rare. Bryophyte cover is relatively high and there is little bare ground present. The surrounding vegetation is moderately species-rich neutral grassland.

228: 'Marks Dale Mines', SK 251561
Archaeology: This side valley off the Via Gellia has extensive mining remains along several relatively small veins. There are hillocks, two good examples of open levels, several coes including some in good condition, a stone-lined buddle, a possible pond and a gin circle terraced into the valley side.

229: Red Rake, SK 255560
Ecology: The meadow here supports species-rich neutral to calcareous grassland and calaminarian grassland vegetation on small vein hillocks. The lead spoil community includes alpine penny-cress, wild thyme, spring sandwort and heath bedstraw. The grassland community is characterised by the grasses crested dog's-tail, red fescue, quaking grass, sweet vernal grass and cock's-foot. Typical herbs include common knapweed, meadow vetchling, common bird's-foot trefoil, meadow saxifrage, pignut, harebell, salad burnet, lady's bedstraw and field scabious. Damper areas support species like ragged robin, meadowsweet and soft rush.

230: 'Ible Wood Mines', SK 255565
Archaeology: Within dense woodland there are a large number of small shafts (some uncapped) and hillocks, spread widely across the slope, presumably on a complex series of small veins. There are coes, including one standing to near full height, a stone-lined buddle, an open level and run-in levels. Nothing is recorded of what interest there is underground.

231: Snake Mine, SK 261555
Archaeology: An intact mine complex upon a large reveted hillock, on the top of which is a small walled dressing floor with a gin circle and shaft. On a terrace to one side there is a coe containing a horizontal level to the shaft, a dressing floor and a stone lined buddle (Gregory and Tune 1967). The shaft gives access to informative underground vein workings (Tune *et al.* 1968). Other hillocks nearby are primarily of ecological interest.

Ecology: Areas of neutral and neutral-calcareous grassland are present on the hillocks at this site.

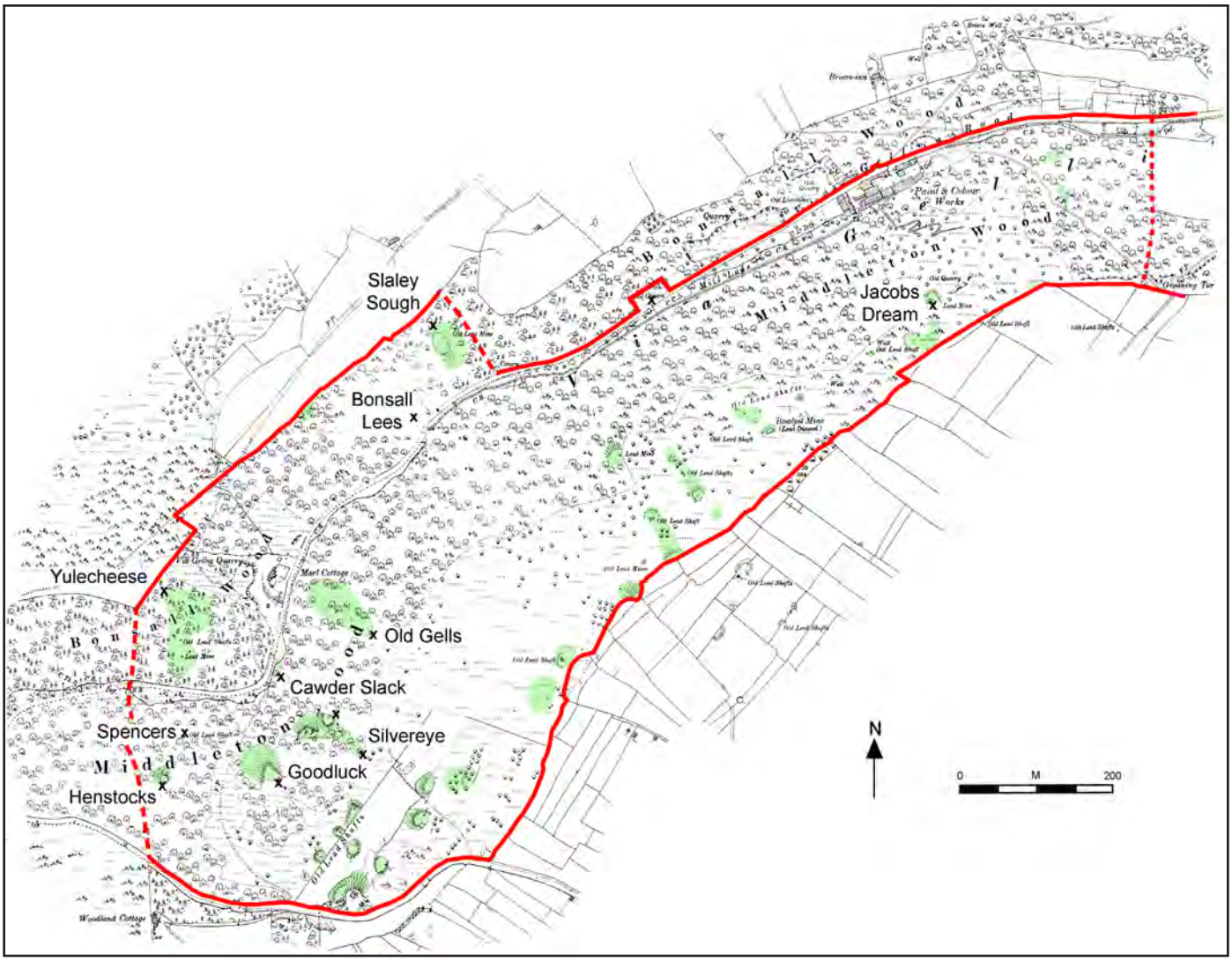
232: Black Rakes, Welshmans Venture and Bondog Hole Mines, with Merry Tom and Thumper Sitch Levels, SK 265562
Geology: Several of the levels in the Via Gellia, including those in this entry, intersect small calcite/barite veins that carry small amounts of galena (also see 233).

Archaeology: Small mines on several small veins have survived because the hillocks are largely of limestone rather than gangue mineral. At surface there a large number shafts with associated hillocks, small dressing floors and ruined coes. Some shafts occur in clusters and are unusually close together. One particularly fine example of a small mine complex comprises a mound-top dressing floor with a small drawing shaft upslope, a coe with an attached circular wall that presumably contains a blocked climbing shaft to one side, and a stone-lined buddle downslope. Elsewhere, there are two ponds that may be associated with water storage or ore-dressing.

On the slopes of the Via Gellia below the main complex, some workings continue and include two levels with coes at Merry Tom, and two levels at Thumper Sitch, the upper one with a coe.

On the upper parts of the slope the mines become larger with large flat-topped hillocks/dressing floors. There are several engine/climbing shafts, some walled out, ruined coes and an

Figure 23: Site 233: The western half of the 'Via Gellia Mines' (site boundary – red; surface mining features – green; mine entrances - black crosses).



arched level or high level sough. One hillock has a walled gin circle on an embanked hillock and several others have flat areas large enough to have contained further examples. Another hillock lies within a small belland yard. At Welshmans Venture Mine there is a well-preserved large coe, an engine shaft and the overgrown site of a gin. At Bondog Hole Mine there is a terraced and walled belland yard and dressing floor, with room for the documented gin circle and a ruined powder house (or simply a coe), all on top of a large hillock. Workings extending to the east have a further two ruined coes.

There are underground vein workings across this site that are similar to those lower down the Via Gellia (see Site 232), including access levels, with wooden rails and a fine example of a stemple climbing way in the upper level at Merry Tom.

Ecology: The northern part of this site lies within the Via Gellia SSSI. Ash dominated woodland, scrub, bracken and calcareous grassland are present over the lead mining remains.

233: 'Via Gellia Mines', SK 278572
Geology: Several of the levels in the Via Gellia intersect small calcite/barite veins that carry small amounts of galena (also see 232).

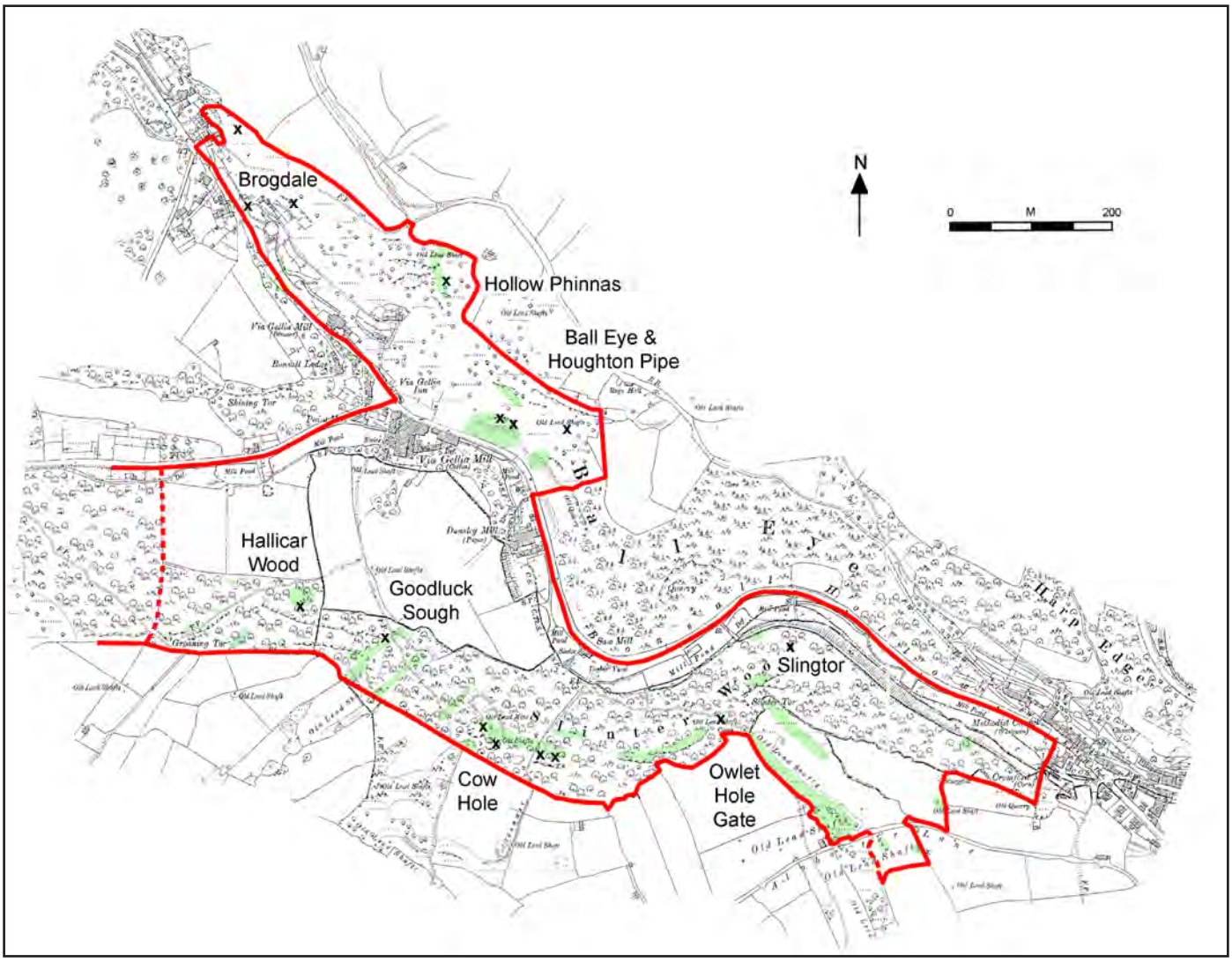
Goodluck Mine worked several galena bearing scrins on the south side of the Via Gellia. None of the veins are spectacular or large but there are several good examples of narrow (a few centimetres wide) veins carrying fluorite, calcite, barite and galena in the extensive accessible workings. Of particular note is the fact that these veins are sometimes offset at major joints and small faults.

Ball Eye Mine worked a number of small veins, both primary and sediment filled pipes and replacement flats. The veins comprise multiphase crustiform fluorite, calcite, barite and galena mineralisation up to a few tens of centimetres wide. The pipe deposits consist of similar banded fluorite, calcite, barite and galena mineralisation and are closely associated with the vein mineralisation. There are also a number of pipe cavities containing residual galena and locally derived sediments. Galena from Ball Eye Mine is noted for a higher than usual (for the orefield) silver content.

Slaley Sough intersects a number of veins below the Lower Matlock Lava. Above the lava the veins have been extensively worked for lead but those intersected by the level below the lava are weak and very poor in lead. They largely comprise irregular veins of calcite and barite with rare spots of galena. The base of the lava is highly pyritic and where the lava is seen in the mine workings it is highly altered to a soft green/grey clay which is sometimes stained yellow or brown as a result of pyrite decomposition.

Archaeology: The steep slopes of the Via Gellia contain a large number of small mines (Hurt 1970; Smith and Ford 1971; Flindall and Hayes 1971; 1972a; 1973; Amner and Naylor 1972; Flindall *et al.* 1977; Bull 1979). At surface the evidence largely

Figure 24: Site 233: The eastern half of the 'Via Gellia Mines' (site boundary – red; surface mining features – green; mine entrances - black crosses).



comprises a scattering of shafts and levels with associated hillocks at veins and pipes, some with belland yards, coes and stone-lined buddles, including a fine large coe at Jacobs Dream Mine and restored coes at Goodluck Mine.

Underground workings include important pipe workings at Ball Eye Mine and Houghton Pipe (the upper Ball Eye workings from Ruggs Hall are now partly removed by quarrying). There are also small pipe workings at Hollow Phinnis to the west, and on the south side of the valley at Cow Hole. There are also important and extensive workings in small veins at Spencer's Level, Henstocks, Goodluck, Silver Eye, Cawder Slack Levels, Old Gells, Jacobs Dream, Hallicar Wood (Groaning Tor) Level, Goodluck Sough Level, Owlet Hole Gate, Slingtor Level, Yulecheese (Dunsley Springs) Level, Slaley Sough Level, Bonsall Lees Level, and Brogdale or Bald Pie (Clatterway) Mine and Sough, all of which are particularly instructive with regard to this type of mine. Features include levels, coffin levels, stopes, packs of deads, shafts, winzes, stone stemples, sledways, tramways, wooden rails, stone rail-tub guides, drilled survey markers, plugs for wall fittings along a passage side, a clay water channel, and miners' inscriptions. Fountrabby Sough within the Ball Eye Mines includes fine coffin level pickwork. The Hollow Phinnis pipes and vein workings, and a small working in Slinter Wood, have evidence for firesetting (Barnatt and Worthington 2006).

The Ball Eye Mines are documented as active in 1550 and are reputedly unusual for the high level of silver in the ore.

Ecology: This site includes significant parts of Via Gellia SSSI and part of Unit 2 of Rose End Meadows SSSI at the east end of the site as defined here.

At the west end of the site, spring sandwort is present at a low cover in a woodland clearing near Dunsley Springs Level in Unit 16 (SK 269567) together with marjoram and devil's-bit scabious as well as the more usual community components.

On the south side of the dale, one small area of calaminarian grassland over spoil at Goodluck Mine, kept open by both visitor trampling and toxicity, lies within the woodland in Unit 8 (SK 270565). Spring sandwort is abundant but other species are limited. Tree seedlings are frequent.

A large spoil heap within a scrubby woodland edge at a shelf on the upper dale side is present in Unit 9 at approx. SK 271564. The steepness of the hillock slopes encourage erosion which contributes to keeping the sward open so that bare ground covers 30-70% of the site. Spring sandwort is locally frequent but with the exception of sheep's fescue and thyme other components are sparse.

Spoil heaps are widespread but scattered on the upper dale side, midway between Old Gells and Jacobs Dream Mines, in Unit 10 (centred on SK 274567) where they support calaminarian grassland becoming invaded by tall grasses and scrub. Both OV37a and b are present (the open and closed sub-communities) with the latter dominated by bryophytes. Spring sandwort is present throughout although it is only locally frequent in OV37a. Thyme, sheep's fescue and spring sedge are the most common associates with limestone bedstraw infrequent. The calaminarian swards grade into calcareous grassland with milkwort and rock rose, and into a taller ranker sward with red fescue and false oat grass.

Unit 5 includes a large area of calaminarian vegetation on a very steep slope around Ball Eye Mine which keeps open in part due to erosion (SK 285574). The vegetation grades in and out of all three of the sub-communities so that whilst the species component remains the same the proportions of each varies (particularly sheep's fescue) and bare spoil varies from 30-70%. Spring sandwort is frequent in all 3 sub-communities and alpine penny-cress is widespread at low frequency. The calaminarian vegetation grades into a narrow margin of calcareous grassland at the edges of the surrounding scrub/woodland.

Unit 1 of the Via Gellia SSSI at the eastern end of the site, centred *c.* SK 290570, above the dale side includes relatively short species-rich calcareous grassland over spoil heaps with a rich sedge and grass component and a good range and abundance of herbs. The latter include salad burnet, rock rose, milkwort, burnet saxifrage, eyebright and small scabious. This grades into a moderately species-rich neutral grassland over deeper soil.

Nearby, but also in the Rose Meadow SSSI (centred on SK 2905 3569), hillocks support OV37a/b similar to the other hillocks within Site 237 (Rose Rake etc.)

234: Carnhill Wifes Sough, SK 292573
Archaeology: A narrow, slabbed sough level which can be followed for some distance.

235: Cromford Sough, SK 295568
Archaeology: A sunken, walled enclosure known as the 'Bear Pit', contains the present entrance to the sough. A long section of this major sough is still accessible, the first part arched, further in with evidence for the original passage and later enlargement, with shafts to surface, miners initials, and a side branch that has evidence of very early gunpowder work dating to the 17th century (Rieuwerts 1983; 1998c).

236: Bullestree Sough, SK 303573
Archaeology: An open sough tail next to the river at a historically important sough.

237: Rose Rake and Slintor Great Vein, SK 291566
Ecology: Part of Rose End Meadows SSSI, this site has hillocks of different sizes, in part reworked, on several veins. Calaminarian grassland is present on isolated spoil heaps within a matrix of neutral (MG5) grassland on both the hillocks and the surrounding flatter land. The neutral grassland is typically species-rich with knapweed, lady's bedstraw, rough hawkbit, salad burnet, ox-eye daisy and cowslip. Spring sandwort and less frequently alpine penny-cress are present within the calaminarian community which also supports sedges, thyme and harebell. Much of the sward is typical of OV37a/b which is kept open by cattle grazing. On steeper slopes where access is more difficult the community is lichen-rich (OV37c). These areas appear to be more toxic and have a more gravelly/stony substrate. Calcareous grassland herbs are also more frequent in the sward. The open conditions on the hillocks within Rose End Meadows SSSI support a specialised ground-dwelling (terricolous) lichen community, including the nationally scarce species *Vezdaea retigera*, *Verrucaria melaenella* and *Verrucaria murnia*.

238: 'Hallicar Lane Mines (East)', SK 281566
Ecology: This area, also known as Groaning Tor Meadows, forms part of a larger series of fields some of which are included within the Rose End Meadows SSSI. Calaminarian grassland is limited at this site, where there are hillocks on several veins, all in poor condition. The grassland community is species-rich and characterised by the grasses crested dog's-tail, quaking grass, sweet vernal grass and red fescue and herbaceous species such as lady's bedstraw, common knapweed, pignut, yellow rattle, meadow vetchling, salad burnet, cowslip, bugle, oxeye daisy and field scabious. Fragrant orchid has been recorded from the meadow.

239: 'Hallicar Lane Mines (West)', SK 278566
Ecology: This site has grassland vegetation that is intermediate between neutral and calcareous grassland types and includes small areas of calaminarian grassland associated with partly intact vein hillocks. The grassland is characterised by the grasses crested dog's-tail, red fescue, sweet vernal grass, quaking grass and crested hair grass. There is a rich associate herb component including harebell, common knapweed, field scabious, autumn hawkbit, lady's bedstraw, cowslip, salad burnet and mountain pansy as well as spring sandwort.

240: 'Burrows Mine area', SK 274564
Ecology: Small hillocks with neutral vegetation on several veins, mostly in poor condition, that are present within numerous small fields which include Units 65 – 68 of Rose End meadows SSSI.

241: 'Stichen Mine area', SK 279562
Ecology: Poorly preserved hillocks on more than one vein straddle the boundary of Unit 71 of Rose End Meadows SSSI. The interest is primarily neutral grassland.

242: Godbehere Vein and Cromford Moor Mine, SK 290556
Archaeology: Ruined walls and the base of a stone chimney may be the remains of a documented Newcomen-type winding engine house built in 1818. At the same site there is a capped shaft, concrete foundations and a tank built in association with a 1920s calcite mine. Large underground stopes are not normally accessible (Porter 1990). There are extensive hillocks to the west, north and east but these have been landscaped to provide car parking, while at Black Rocks they are suffering badly from erosion. Both areas are of ecological interest.

Ecology: The area comprises the lower slope leading up to Black Rocks, a gritstone outcrop east of the Carboniferous limestone outcrop. Calaminarian grassland probably once covered much of this spoil-covered slope, but is today fragmented and separated by large areas of bare ground, exposed largely as a result of excessive trampling by visitors to the site. The best remaining areas are characterized by short, open turfs of sheep's fescue, with frequent to abundant spring sandwort together with more scattered, but constant alpine penny-cress. Wild thyme is fairly frequent and occurs with a variety of associate species including common bird's-foot trefoil, glaucous sedge, autumn hawkbit, sheep sorrel, ribwort plantain and less frequently common milkwort, fairy flax and eyebright. The vegetation most closely resembles OV37b with OV37a present across smaller areas

Calaminarian grassland also occurs in association with damaged hillocks near the lower car park. Spring sandwort and alpine penny-cress are both locally frequent with sheep's sorrel, wild thyme, lichens and bare ground. Another interesting feature of these grasslands is the periodic abundance of the ferns adder's-tongue-fern and moonwort.

243: Gang Mine, SK 286557
Archaeology: Hillocks and open-cuts cover much of a large central area and provide a very good example of this type of multiple-vein mining. There are also several capped shafts, two ruined coes and the site of an early reckoning house with 'engine' of unknown type that may repay excavation. These mines are known to have been working in the 16th century and had a large output in the 17th century, and are historically very important.

Ecology: Gang Mine SSSI covers a large part of this site which is managed as a nature reserve by Derbyshire Wildlife Trust. The extensive hillocks are unusual in retaining a particularly great diversity of spoil materials of varying levels of metal contamination, from very fine spoil to large rock fragments. This has resulted in a range of colonisation from unstable and bare areas, through to closed turf. The open spoil areas support large populations of alpine penny-cress and spring sandwort, whilst important assemblages of lichens including species of *Cladonia* and *Peltigera* are found in more closed swards. Mountain pansy and moonwort are also present, with this site holding the highest known density of moonwort on mineral spoil in the country. The closed turf also supports many plants characteristic of calcareous grassland such as kidney vetch, rockrose, small scabious, fairy flax, glaucous sedge, spring-sedge, crested hair-grass and limestone bedstraw. Unusually for this habitat, the locally uncommon dyer's greenweed is also present. There is an abrupt transition to mostly species-rich neutral grassland at the edges of the spoil heaps. This supports species such as lady's bedstraw, mouse-ear hawkweed and pignut. Pyramidal orchid is also present.

The open areas and bare spoil provide ideal conditions for ground-hunting invertebrates such as ground beetles and wolf spiders, with the latter including the nationally scarce species, *Pirata latitans.*

This site supports the greatest area of calaminarian grassland in the Peak District orefield and is considered an outstanding and unique site, recognised as floristically the richest anthropogenic calaminarian site in the United Kingdom. For this reason it has been designated as a Special Area of Conservation.

There are also small areas of calaminarian grassland outside of the SSSI but still within the Gang Mine site. These include Dean Fields to the north-west and fields to the east. In all cases small patches of calaminarian grassland are still present and can sometimes be very diverse whilst still supporting alpine penny-cress, spring sandwort, notable species like moonwort and other typical lead spoil flora including *Cladonia* lichens.

244: Gang Vein, SK 283556
Ecology: Calaminarian grassland is patchy across this area, occurring in small quantities wherever lead spoil remains exposed on the poorly preserved hillocks on an historically important vein. Typically spring sandwort occurs with sheep's sorrel, sheep's fescue, wild thyme, harebell and salad burnet. The wider grassland vegetation can be very species-rich, but has been invaded by false-oat grass in recent years as well as suffering some tipping and levelling.

245: Magpie Scrins, SK 282560
Ecology: Hillocks on a series of small veins, with shafts, include a small area of calaminarian grassland covering an estimated 10m x 8m. In places trees, scrub and coarse grassland vegetation have encroached upon what was formerly a more extensive area. Calcareous grassland vegetation is also present and forms an intimate mosaic with the calaminarian, making estimates of the extent of this area difficult. The most typical areas have patches of spring sandwort and alpine penny-cress growing with common sorrel, meadow buttercup, germander speedwell, burnet saxifrage, small scabious, oxeye daisy, yarrow, wild thyme, spring sedge, eyebright, common rock-rose, common knapweed, common milkwort, pignut and devil's-bit scabious. Grasses include sheep's fescue, false oat-grass, crested hair grass and red fescue.

246: Ratchwood Mine - Founder Shaft, SK 283552
Archaeology: Large flat-topped hillock with lidded shaft sunk through shale, overgrown gin circle with footings of wall to one side and a small ruined coe in the hillock side. There are extensive underground vein workings with stopes and levels (Warriner and Birkett 1982). Details include tramway rails and miners' artefacts.

247: Ratchwood and Rantor Mines, SK 284549
Archaeology: A site with large hillocks with flat-topped dressing floors, ruined coes and other buildings (one a ruined mine office and reckoning house), and capped shafts, one with a beehive capping. The shafts lead down through shale to the mineral deposits in the limestone at depth. There is also a poorly defined gin circle, slight remains of a line of rectangular bouse teems, a pond and a small buddle dam. The two mines lie within possible ruined belland yards.

Ecology: Calaminarian grassland vegetation is a prominent feature of this site, with the best examples occurring over prominent hillocks in the west and around old mine shafts elsewhere. This is one of the more significant sites for calaminarian grassland outside of the National Park and statutory site designations.

Typically the vegetation comprises an open turf with the grasses sheep's fescue, common bent, sweet vernal grass and crested hair-grass present together with locally frequent spring sandwort, wild thyme, sheep's sorrel, common bird's-foot trefoil, harebell, eyebright and more rarely fairy flax. Species of *Cladonia* lichens are prominent on many of the spoil heaps and

bare soils, whilst scree and till material is a significant feature. Alpine penny-cress is also present, but tends to be scattered at this site.

The hillock communities grade into neutral grassland communities that support swards characterised by crested dog's-tail, red fescue, Yorkshire fog and cock's-foot with quaking grass and yellow oat grass more locally. These swards are of variable botanical diversity (more diverse in the north), but can include red and white clovers, germander speedwell, yarrow, common bird's-foot trefoil, burnet saxifrage, lady's bedstraw, rough hawkbit, smooth hawk's-beard, meadow vetchling, common knapweed, spring sedge, glaucous sedge and mouse-ear hawkweed.

248: 'Colehill Quarry Veins', SK 287551
Ecology: The vein hillocks here have been heavily modified by quarrying and there are extensive areas of bare ground with scattered very small patches of calaminarian grassland. Spring sandwort appears to be the only indicator in this area occurring with wild thyme, fairy flax and other calcareous grassland species.

249: Meerbrook Sough, SK 326552
Archaeology: A broad and finely built, arched sough tail portal that leads to a long but wet accessible section of this major sough; this has been used as a water supply and access permission is not normally granted.

250: Meerbrook Sough Mine, SK 288545
Archaeology: The main surviving features of interest are a horizontal winding engine and boiler house, now used as a dwelling, and an adjacent coe.

251: Yokecliffe Rake (East), SK 275537
Ecology: Damaged hillocks in woodland at an historically important vein support calaminarian grassland that includes typical indicator species such as spring sandwort and alpine penny-cress amid a more extensive area of flower-rich lowland calcareous grassland.

252: Dream Hole, Fox Holes and Sand Hole Mines, SK 273531
Archaeology: An area with extensive surviving hillocks and a number of capped shafts on several veins. Other features include a ruined coe and elsewhere a possible damaged gin circle. Underground workings include Dream Hole with important Quaternary deposits and vein workings, including evidence for firesetting (Barnatt and Worthington 2006), and Fox Holes where a large natural chamber was mined for ochre.

Ecology: Some alpine penny-cress is recorded across this area, but the extent of the calaminarian and other grassland interest is not fully known.

253: 'Intake Quarry South Veins', SK 270546
Ecology: Vein hillocks modified by quarrying activity support areas of species-rich calcareous as well as sparser more ephemeral vegetation with a lot of bare ground. In these areas spring sandwort is known to occur.

254: 'Intake Quarry North Veins', SK 271550
Ecology: Vein hillocks modified by quarrying activity support areas of species-rich calcareous as well as sparser more ephemeral vegetation with a lot of bare ground. In these areas spring sandwort is known to occur.

255: Yokecliffe Rake, with Quickset, Old Gells/Ashtree, Shining Cloud and Nile Mines, SK 265539
Archaeology: An area with surviving hillocks and many capped shafts. The remains on Yokecliffe Rake comprise very large hillocks spaced at frequent intervals, with smaller hillocks between, each of the former the site of an underground mine. Several of these have ruined coes on the hillock tops and that at Quickset Mine also has a small walled mound-top dressing floor. To the north there are hillocks on multiple smaller veins and there are also ruined coes here.

Old Gells Mine/Ash Tree on Yokecliffe Rake provides an exceptionally interesting but small example of easily accessible underground vein and pipe/cave workings (Barnatt and Worthington 2006; 2009). This mine includes evidence for early firesetting work and a rock-cut ore-chute. At depth, entered via a deep shaft, there are large 20th century stopes worked for calcite.

Ecology: Patches of calaminarian grassland are scattered amongst the mining hillocks in this area and these can form relatively extensive areas of vegetation. Both spring sandwort and alpine penny-cress are present together with sheep's fescue, sheep's sorrel, wild thyme, salad burnet, burnet-saxifrage and lady's bedstraw. There are also areas of flower-rich calcareous grassland and together these two vegetation types form an important mosaic of semi-natural grassland vegetation.

256: 'Carsington Pasture' with Great Rake, Nickalum and Perseverance Mines, SK 244542
Archaeology: Extensive hillocks and shafts survive at rakes and multiple smaller veins, although some areas have been reworked, particularly to the north-east. The eastern part of the site has in recent years suffered significant damage as the result of off-road vehicle events; this includes extensive and sometime deep vehicle ruts, and minor damage to coes and belland yards; a wind farm is now in the process of being erected.

There is a variety of mines, including larger ones at Great Rake and Nickalum Mines. The former had an early 20th century horizontal winding engine house of corrugated iron for which concrete mounting beds survive for the engine and various other ore processing equipment. There is also a concrete hotch, a displaced crushing wheel, the winch and earthworks of an inclined tramway, and a possible ruined powder house. The main features are within an earlier flat dressing floor with a surrounding wall, with ruined coes and other buildings, and a probable but poorly-defined gin circle.

Nickalum Mine has a walled belland yard; however, the remains of a stone horizontal-winding house, a ruined coe, a probable gin circle and a possible water storage pond have been levelled in recent years. Nearby there are large buddle dams.

Another interesting smaller mine is Perseverance Mine which has shafts, a gin circle set into the slope, a large coe, a smaller coe, a stone-lined buddle, a leat, a water storage pond, slime ponds and a buddle dam. Most of the other mines were small in scale and a variety of features are associated with these. They include small belland yards, hillock-top dressing floors, coes (some large and one with a remaining chimney), a stone-lined buddle, and water storage and/or ore-dressing ponds. An arched level entrance appears to have been removed or buried in recent times.

Capped shafts across the area give access to a variety of underground vein and pipe workings, some apparently of great interest but currently poorly documented.

Rare direct relationships with relict boundaries exist, which suggest the mining here started at a medieval or earlier date in at least two cases. There is documentary evidence that Fleetlow in south-eastern part of the Pasture was actively being mined in 1467.

Ecology: This extensive area of land is largely dominated by species-poor semi-improved grassland. However there are pockets of more diverse calcareous grassland and scattered across the site on hillocks and disturbed spoil spring sandwort can be found. No significant areas of calaminarian grassland have been identified as yet.

257: Roundlow Mine, SK 238548
Archaeology: A well-preserved area of hillocks and shafts onto pipe-vein workings, with several capped shafts, including an engine shaft on a flat-topped hillock with poorly-defined small

gin circle with a rare intact limestone bearing block with a central iron bearing socket.

Ecology: This site is dominated by flower-rich calcareous grassland and though hillocks are common calaminarian grassland is limited to small patches of grassland with the only metallophytes recorded being alpine penny-cress. Typical calcareous species include common rock-rose, small scabious, fairy flax, moonwort, frog orchid, fragrant orchid and autumn gentian.

258: 'Kings Hill Mine', SK 232546
Ecology: Small poorly-preserved hillocks provide a suitable habitat for small areas of high quality grassland but detailed records from this area are currently limited.

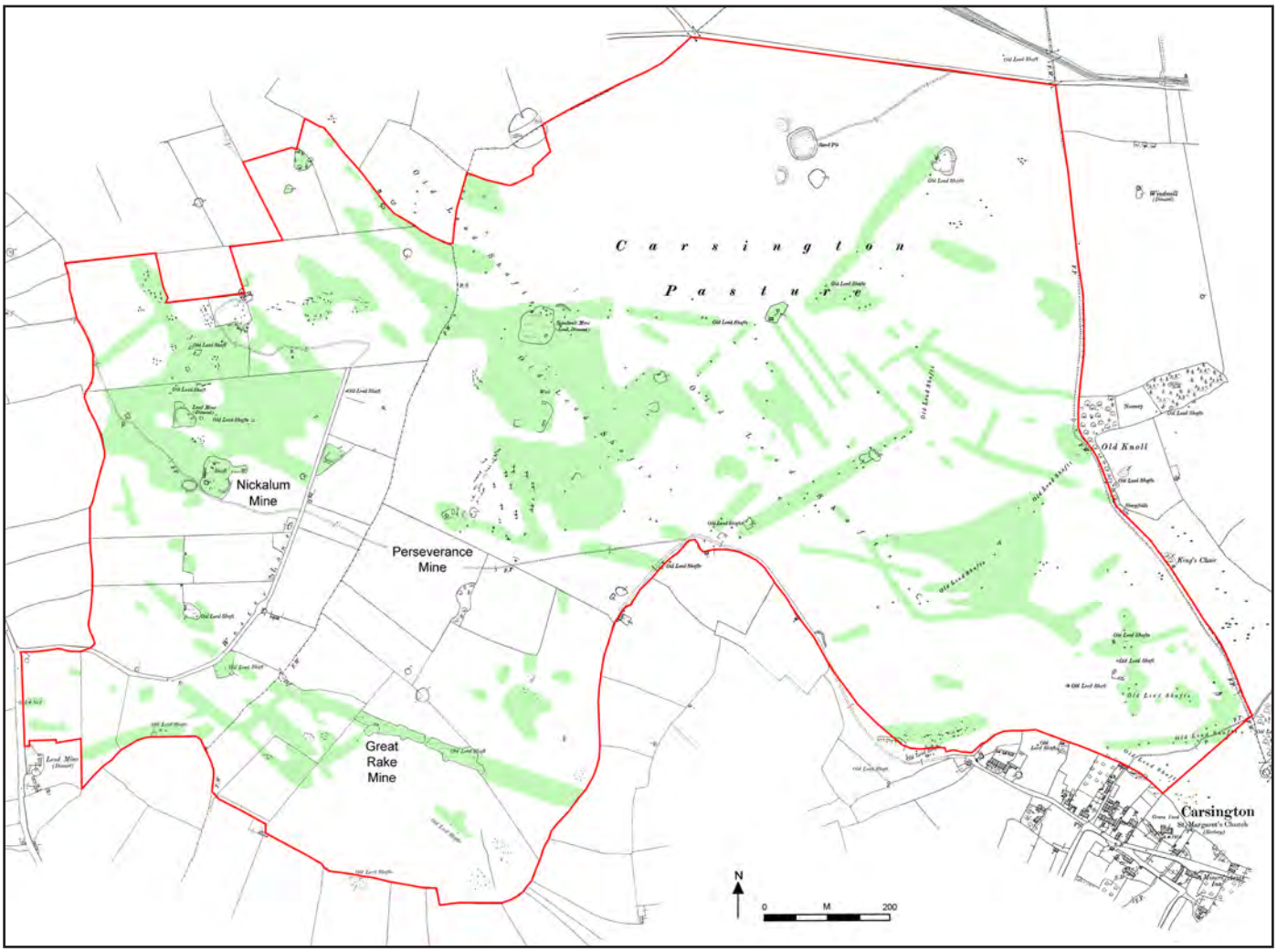
259: 'Rainster Rocks and Suckstone Mines', SK 223547
Archaeology: An extensive area with surviving hillocks and some shafts on multiple small veins. There is also a ruined coe. In its eastern half the hillocks of small mines are very extensive, in some areas with continuous cover (including parts not indicated on the geological map). In the west the veins are less common and also usually small. However, these are important because of their stratigraphic relationships with both the Rainster Rocks Iron Age/Romano-British settlement and extensive medieval strip lynchets and ridge and furrow.

Ecology: Rainster Rocks is a prominent outcrop of Carboniferous Limestone that, together with several fields to the east, supports a notable and diverse flora mainly comprising flower-rich lowland calcareous grassland. The topography is broken by outcropping rock as well as lead mining features. Around the latter there remain pockets of calaminarian grassland with spring sandwort locally frequent. Other plants present include lady's bedstraw, cowslip, fairy flax, burnet saxifrage, devil's-bit scabious and frog orchid.

260: Ballington Wood Mine, SK 211547
Archaeology: Large hillocks on a short section of vein, with a short section of shallow open-cut part-way down the steep valley side. A large opencast pit to the side may be the site of a pipe/flatting development at the point the workings were at their richest. Beyond the area defined in the Inventory the vein quickly becomes small. Within the defined area there are two ruined coes, one with a capped shaft inside, the other with a fireplace, and an embanked gin circle with central mound next to a capped engine shaft with an atypically-shaped bouse teem on the downslope side. Between here and the open-cut is a possible stone-lined buddle.

261: 'Ballidon Oldfields Veins', SK 204551
Ecology: Hillocks along a small vein have been in part degraded and tipped into. At both ends the remains comprise intermittent trials only. The upper, level section in the east consists of intermittent mounds and hollows that support a generally semi-improved sward. On the steep slope to the west is a calcareous community including glaucous sedge, harebell, small scabious, sheep's fescue, crested hair grass, salad burnet, field scabious, mouse-ear hawkweed and eyebright. Frequent red bartsia is relatively unusual.

Figure 25: Site 256: 'Carsington Pasture', with Great Rake, Nickalum and Perseverance Mines (site boundary – red; surface mining features - green).



The Eastern Outliers - Ashover and Crich.

262: Blackwell and Spencers Rakes, SK 353 621
Archaeology: Two intersecting open-cuts survive in an area that has largely been quarried away. These are fine vertical-sided and deep examples, with underground evidence for lead mining and 20th century reworking. Here, close to the intersection of the two rakes, there is also evidence for early firesetting using coal (Barnatt and Worthington 2006).

263: Wakebridge Mine, SK 339 557
Archaeology: This site retains the ruins of a Cornish engine house, with a nearby workshop. There are adjacent shafts and the engine house reservoir remains.

264: Fritchley Sough, SK 358534
Archaeology: A small arched sough tail with a keystone with 1753 date. This can be followed for some distance but can have bad air (Warriner 1981).

The North-Western Fringes – Buxton.

265: 'Upper Edge Veins', SK 075689
Ecology: Three short lines of hillocks on small veins support upland calcareous grassland (CG10) with glaucous sedge, quaking grass, mat grass, tormentil, violets and thyme.

266: 'Greensides Mines', SK 071685
Ecology: Intermittent hillocks and capped shafts exist on three small veins, one running north-west/south-east, the others leaving it at right-angles to the north-east and at a more acute angle to the south-west. These support calcareous vegetation with meadow oat grass, thyme, salad burnet, quaking grass, crested hair grass, glaucous sedge and milkwort.

267: Gingerbread Rake, SK 077682
Ecology: Low hillocks with shallow open-cuts on a small vein support a mix of acidic and calcareous species: mountain pansy, common dog violet, heath bedstraw, tormentil, glaucous sedge, crested hair grass and thyme are all present. Limestone bedstraw is rare around the edges of exposed limestone. The level sections between hillocks are semi-improved.

268: Fortunate Vein, SK 088678
Ecology: An intermittent line of hillocks on a small vein, supporting species-rich calcareous grassland, closest in character to the CG2a sub-community. Quaking grass and glaucous sedge are frequent in addition to a lower cover/frequency of crested hair grass, heath grass, meadow oat grass, small scabious, eyebright, stemless thistle, tormentil, carline thistle, salad burnet and fairy flax.

269: 'Hitter Hill Veins', SK 087667
Ecology A long line of hillocks, some damaged, are present on a relatively small braided vein, with an open adit near the west end. About half consists of semi-improved neutral grassland. Calcareous grassland (CG2) covers a further 10% with rare hairy oat grass, limestone bedstraw, glaucous sedge, and thyme whilst 20% supports neutral/calcareous grassland (MG5b) with quaking grass, crested hair grass, pignut, lady's bedstraw, meadow saxifrage and bulbous buttercup.

The South-Western Fringes – Hartington and Parwich.

270: 'Carder Low North Vein', SK 127627
Ecology: A short small vein with hollows and hillocks, with a narrow shallow open-cut at the eastern end, supports small patches of calcareous grassland on the exposed limestone; the rest consists of neutral communities.

271: Carder Low Vein, SK 129624
Ecology: A short stretch of surviving vein hillocks exist at the vein's north-west end. These have been affected to some extent by improvement but retain patches of species-rich vegetation including quaking grass, crested hair grass, thyme, mouse-ear hawkweed, spring sedge, limestone bedstraw, lady's bedstraw and bulbous buttercup.

272: Horsesteps Vein (west), SK 133628
Archaeology: A well preserved line of rake hillocks, except at the centre where there is a mine complex on a hillock, with the vein hillocks removed to either side for reprocessing at this site. Here there is a sleepered shaft with an adjacent gin circle with a ruined surrounding wall. The circle is partly overlain by the ruined walls of a large rectangular building, presumably a coe. A short water channel, with small adjacent platform, leads to two ore-dressing ponds at the downslope end of the hillock.

Ecology: A long line of intermittent hillocks runs north-west/south-east along the north-east wall. The mounds and hollows diminish in size towards the south-east. Rather less than a quarter is MG5b, the rest MG6.

273: Horsesteps Vein (east), SK 137626
Ecology: A small irregular area of small hillocks lie at the eastern end of Horsesteps Vein where it appears to bifurcate or have pipe/flat development. These hillocks are quite species-rich and includes locally frequent hay rattle, rare glaucous sedge, yellow oat grass, quaking grass, spring sedge, crested hair grass, salad burnet, lady's bedstraw and bulbous buttercup.

The daleside part of this site lies within Unit 2 of Long Dale, Hartington SSSI. The hillocks here support calcareous grassland similar to the rest of the daleside.

274: Lean Low Rakes, SK 148626
Ecology: To the north are very degraded remains on a rake, with a shaft at the north-west end. To the south are hillocks on a second vein running ENE/WSW, with two hillocks nearby on a largely removed set of remains on a third vein. Most of the remaining hillocks support quite species-rich neutral grassland, with eyebright, lady's bedstraw, quaking grass, thyme, harebell, tormentil and glaucous sedge.

275: 'Greenhead Vein', SK 157587
Ecology: A line of hillocks on a small vein support hairy oat grass, knapweed, field scabious, lady's bedstraw and meadow vetchling amongst tall, coarse grasses. The community is best described as the species-rich sub-community of the false-oat grass MG1 neutral grassland.

276: White Rake and Cobseats Vein, SK 159583
Ecology: A line of prominent hillocks survives along part of White Rake, while all that survives of Cobseats Vein in the same field is a capped shaft and hillock in the south-east corner of the field. These support patches of neutral/calcareous (MG5b) and calcareous (CG2) grassland. Meadow oat grass is rare; hoary plantain is frequent, eyebright, ox-eye daisy, glaucous sedge, spring sedge and salad burnet are all present.

277: 'Lees Barn Veins (north)', SK 157572
Ecology: To the north is a line of hillocks on a small vein. To the south there is a small area with mine hillocks together with a limekiln and quarry. Parts of the mounds with exposed limestone support CG7 vegetation and there are small patches of species-rich MG5, but most show the effects of agricultural improvement and are species-poor.

278: 'Lees Barn Veins (south)', SK 156567
Ecology: An intermittent line of hollows and hillocks on a small vein generally have a fine-leaved sward containing glaucous sedge, spring sedge, bulbous buttercup, crested hair grass, yarrow and bird's-foot trefoil.

279: Ramshorn Vein, SK 163675
Ecology: About half of the area of the degraded hillocks and hollows on a small vein supports a CG7 community with frequent thyme, bird's-foot trefoil and glaucous sedge, and rare eyebright. The rest is species-poor neutral grassland.

280: Alsop Moor Ironstone Mines, SK 166573
Archaeology: Lines of hollows and hillocks on two 'east/west' veins run through the centre of the plantation, with one extending eastwards into the next field where there is a single large flat-topped hillock. This site in unusual is that it was worked for haematite rather than lead at the beginning of the 20th century.

Ecology: The level top of the large eastern hillock supports tall-herb vegetation with a more species-rich neutral community on the sides. Eyebright is rare.

281: 'Parwich Upper Moor Veins', SK 171574
Ecology: The long eastern line of hillocks on the two parallel veins on this site mostly consists of neutral/calcareous grassland (MG5b) with occasional-frequent glaucous sedge, ribwort plantain and yarrow. Lady's bedstraw, crested hair grass, harebell, sheep's fescue, and yellow oat grass are also present. The western line is shorter and supports a less species-rich semi-improved grassland type.

282: 'Parwich Middle Moor Veins', SK 178561
Ecology: A line of small partially-degraded hollows and hillocks crosses the dry valley diagonally. Most supports species-rich calcareous grassland (CG2 without meadow oat grass). Quaking grass and glaucous sedge are occasional/locally frequent; autumn gentian, carline thistle, thyme, small scabious, crested hair grass, heath grass, milkwort, tormentil and mouse-ear hawkweed are all present. The rest of the hillocks show the effects of some improvement and developing hawthorn scrub.

283: 'Roystone Rocks Vein', SK 196568
Ecology: A line of hillocks on a small vein support mainly species-rich calcareous grassland on the steeper slopes. This becomes less diverse and more neutral where the slope levels out and agricultural improvement has been possible. Carline thistle is rare but locally frequent; autumn gentian is occasional; meadow oat grass, crested hair grass, quaking grass, hoary plantain, small scabious, salad burnet and tormentil are all present.

284: 'Minninglow Grange Veins' SK 204577
Ecology: Intermittent hillocks are present on two small, short, parallel veins. The north-western one is now covered with gorse. The other is half-covered by neutral grassland showing many calcareous affinities (MG5b) with thyme, hoary plantain, salad burnet, spring sedge, eyebright, mouse-ear hawkweed, harebell and sheep's fescue.

285: 'Minninglow Vein', SK 207575
Ecology: A very small patch of calaminarian grassland with spring sandwort is located halfway up the slope of the largest hillock at the eastern end of a small vein. The rest of the hillocks support neutral grassland, in part agriculturally improved and species-poor. Eyebright, mouse-ear hawkweed, glaucous sedge, yarrow, harebell, lady's bedstraw and ribwort plantain are all occasional in the richer areas.

286: 'Ballidon Moor Veins (north)', SK 208567
Ecology: Hillocks are present on two main veins, with smaller examples on two others. Just under one third of the hillocks consist of species-rich neutral grassland (MG5b) with eyebright, harebell, yarrow, lady's bedstraw, glaucous sedge, and bird's-foot trefoil. The rest are relatively species-poor (MG6), as are other parts of the field.

287: 'Ballidon Moor Veins (south-west)', SK 207564
Ecology: Hillocks on three small parallel veins support mainly semi-improved grassland but patches of more species-rich neutral vegetation occur with lady's bedstraw, quaking grass, glaucous sedge, salad burnet, sheep's fescue, harebell and mouse-ear hawkweed.

288: 'Ballidon Moor Veins (south-east)', SK 211562
Ecology: A line of hillocks on a small vein show some signs of the improvement that has affected the rest of the field, but mostly support a fine-leaved neutral sward with eyebright, glaucous sedge, lady's bedstraw, quaking grass and mouse-ear hawkweed.

289: 'Green Low Mines', SK 231582
Ecology: Six hillocks with shaft hollows in a small discrete cluster support an open calcareous grassland (CG7) with limestone bedstraw and thyme over lime-rich substrates. There are also patches of species-rich neutral grassland (MG5) among more semi-improved communities. Hawthorn scrub is partly obscuring some of the shaft hollows.

290: 'Parwich Hill Veins', SK 186551
Ecology: Two lines of low hillocks on small veins on the steep hillside have been partially affected by agricultural improvement, but about half of the area supports a calcareous community with thyme, limestone bedstraw, locally frequent eyebright, salad burnet, hoary plantain, and mouse-ear hawkweed.

291: Rushycliff and Nancy Consuls, SK 177531
Archaeology: An area of mostly well-preserved small hillocks, to the south-east of the Newton Grange mines, which run almost continuously over a broad area. While the hillocks sometimes follow lines at the peripheries, at the core they seem to represent a rare example for this part of the orefield of flatwork or pipework development.

Ecology: The slopes of the hillocks and hollows locally support a diverse neutral grassland (MG5b) with salad burnet and cowslips. Elsewhere agricultural improvement and disturbance has resulted in a more species-poor sward. The semi-mature and mature hawthorns, whilst adding character and structure to the site, are also responsible for shading out the typical grassland communities.

<u>The Staffordshire Mines – Warslow, Wetton and Stanton.</u>

292: Dale Mine, SK 094586
Geology: This mine worked a series of lead bearing pipes. Where seen in the accessible workings the pipes are of typical Peak District style and not similar to the nearby Deep Ecton and Clayton pipes. They are fairly irregular in outline and appear to be associated with minor faulting in thicker bedded limestone units. While mine records suggest that significant amounts have been produced by the mine at some depth, where seen underground the pipes consist of calcite and minor fluorite, with no galena noted. Associated with the pipes is the development a number of small phreatic cavities on both bedding and fault planes. These are filled with fluvial sediments. Thinly bedded limestones exposed in the workings are spectacularly folded.

Archaeology: Surface features above this rich pipeworking include a belland yard approached by a mine road, within which are dressing floors, blocked shafts, a well-preserved gin circle, a range of six small rectangular 'settling tanks' probably for recovering finely crushed ore and 'cleaning' the water used for dressing (Porter and Robey 2000). There are also the possible buried footings of two Cornish engine houses with adjacent sealed engine shaft, the sites of a smithy and an earlier Newcomen-type engine house later converted to an ore house, an adjacent quarry for their construction, and two small conjoined rectangular reservoir ponds above, presumably dug for one or more of the engines, with the slight remains of a feeder leat. A large waste heap in the lower part of the belland yard is mostly of limestone from shaft sinking and driving an underground pumpway level; material from dressing appears to have been removed.

Below the belland yard there is a walled-round but blocked climbing shaft on a flat-topped platform and the footings of an adjacent probable coe. In the general area there are also other shaft sites and further east a blocked or aborted upper inclined level or shaft is approached by a mine road.

Plate 43: Sharp anticlinal fold in thinly bedded limestones, Dale Mine.

A low entrance near the river gives access to the long pumpway through the upper workings. One section has surviving but moved wooden lauders. Partway along this level a short branch leads to the main engine shaft from the surface features described above. Here there is a large engine/striking chamber which once contained a hydraulic water engine and also possibly a balance bob. A second chamber a short distance further along the level, now partially backfilled, is of unknown purpose. Near the current end of the main level, which had run in and has been recently been re-opened for some distance, walling on one side is supported on metal pins with reused iron firebars placed horizontally.

There is little to see at a second set of dressing floors, built in the 1860s on the hilltop, but the buried footings of a Cornish engine house may remain. Both dressing floors and their engines were supplied with water by a long leat from the north.

Ecology: Mountain pansy is locally common at the northern end of the site. The spoil heaps support patches of open calcareous vegetation (CG7) with hairy rock cress and thyme-leaved sandwort and a more species-poor acid-neutral community with harebell, sorrel and common mouse-ear that is typical of former lead mining sites.

293: 'Ecton Mines', SK 099580

Geology: The Ecton and Clayton Pipes from which the bulk of the ore mined at Ecton was extracted are unique in the orefield (Critchley 1979; Ford 2000). Unlike the typical pipes of the orefield which are sub-horizontal and follow the bedding of the limestone, the Ecton pipes are irregular, near vertical mineralised deposits that crosscut the bedding. The pipes at depth have been flooded for well over 100 years and so have not been subjected to modern geological study and these notes are based on examination of the worked out pipes that are still accessible and interpretation of previous information. They are associated with folding in the basinal facies limestones that form the host rocks at Ecton and there appears to be a correlation between zones of intense folding, and possibly the intersection of faults carrying minor mineralisation with the pipes, but this relationship is not clear. The pipes varied greatly in size and split and branched as they were followed. The mines were noted for their 'saddle' deposits (Porter, 2004) where mineralisation occurred in the crests of the anticlinal folds though such deposits are not recognisable in the workings currently accessible.

Mineralisation in the two pipes consists of replacement and void filling minerals comprising of fluorite, calcite and barite gangue minerals with chalcopyrite, sphalerite and galena. All these minerals are often found well crystallised and the mines were well known in the latter 18th century for mineral specimens, in particular calcite crystals enclosing and/or encrusted with chalcopyrite crystals. It is reported that when working copper values decreased towards the bottom (c. 300m below sough level approaching 450m below the summit of Ecton Hill) of the mine and lead and zinc values increased.

The upper parts of the pipes have common secondary mineralisation resulting from the weathering of the primary sulphide minerals. These include malachite, azurite, cerussite, auricalcite, pyromorphite and smithsonite.

Associated with the pipes are a number of more typical veins, in particular at shallow depth. While some of these have chalcopyrite and have been worked for copper, many of them were worked for lead and are typical of the smaller veins found in the orefield comprising mainly calcite, some fluorite, barite and galena. Most are developed in fault fractures but also in places follow the steep bedding, as at Waterbank and Dutchman Mines (more correctly called flats). In Salts Level galena mineralisation is unusually developed along the bedding of a thin clay wayboard horizon.

The Ecton pipes are within a geological SSSI designated for the hill's complex geomorphology.

Archaeology: This exceptional site was one of the most important copper mines in Britain in the second half of the 18th century; at that date it was the deepest mine in the country. The site has recently had a detailed appraisal by English Heritage and the National Park Authority, which has included detailed survey at surface and underground, and evaluation excavations (Barnatt 2013; Timberlake in press), building on work done previously (Barnatt, Rieuwerts and Thomas 1997; Barnatt and Thomas 1998; Porter and Robey 2000; Porter 2004; Barnatt 2002a).

There are extensive hillocks, associated with pipeworkings and small veins, some of which are well-preserved. The hill also has many capped/grilled shafts and several levels and pipe entrances. Some of the hilltop workings are of Bronze Age date and prehistoric hammer stones have been found at various locations. Archaeological evaluations have revealed intact Bronze Age surface workings at The Lumb with worked rock surfaces and radiocarbon dated antler and bone tools.

Later surface features of particular importance include a 1788 Boulton and Watt engine house with chimney base and plinth for the 19th century boiler; this is the oldest surviving mine winding engine house in the world. Nearby there is the exceptionally deep engine shaft, a balance shaft on a conical stone-retained mound, an atypically large gin circle, a crushing wheel (moved), and a small engine reservoir pond.

There are other ruined mine buildings on various sites, including those at Dutchman Level where there are the ruins of a 19th century horizontal engine house, smithy and carpenters' shop, and also a bouse teem. At Waterbank Mine there are also the ruins of a 19th century horizontal engine house, a small circular reservoir pond for this, and a smithy and carpenters' shop. There are footings of smelters in the valley bottom. On the hillside above Deep Ecton Level there is a large dressing floor

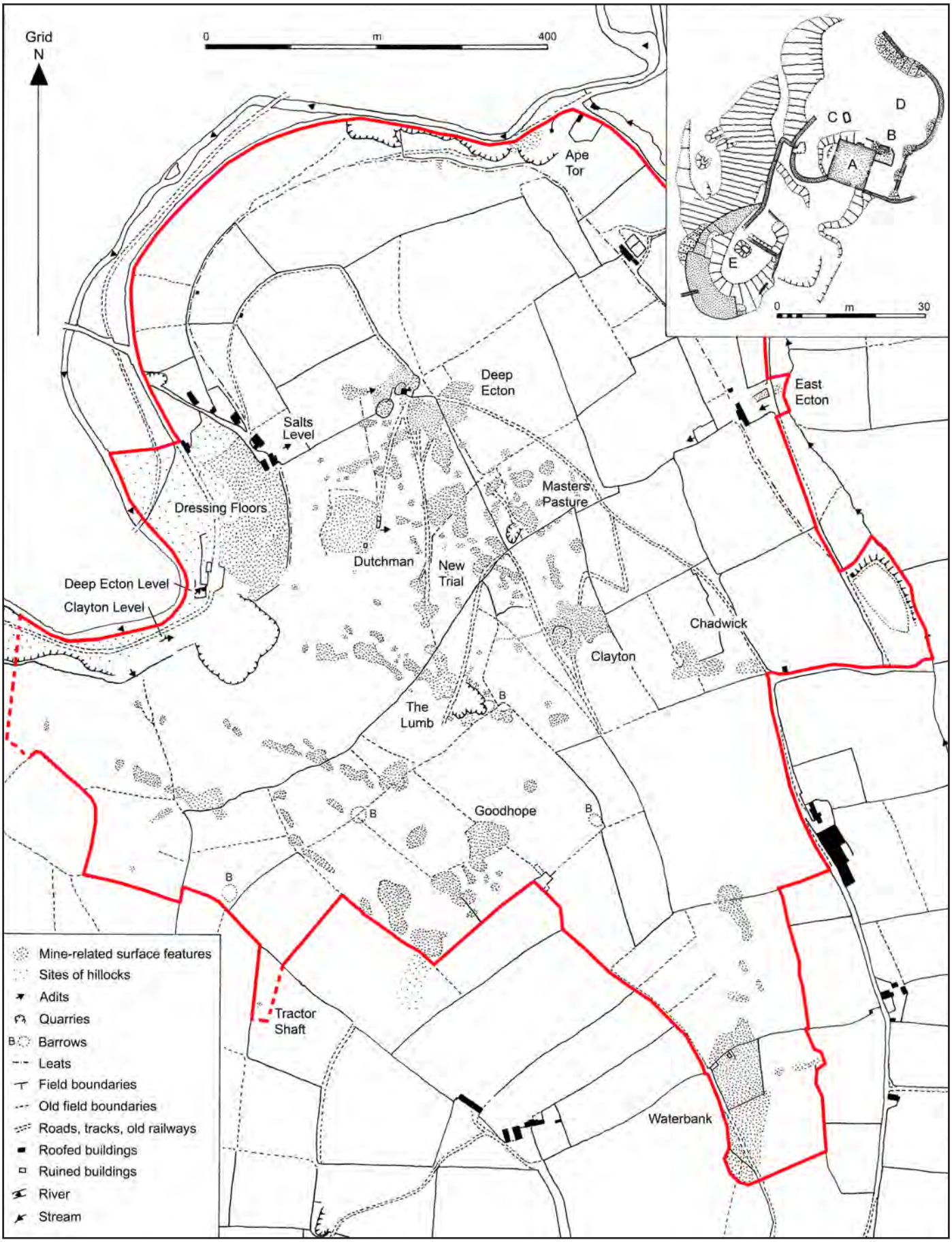


Figure 26: Site 293: The 'Ecton Mines', showing the distribution of surface features, with an inset showing the 1788 Boulton and Watt engine house and associated features (A: engine house, B: Later chimney and boiler plinth, C: Engine shaft, D: Gin circle, E: Balance shaft).

with vestiges of two circular buddles and nearby setting tanks, a launder, a jigging shed wall and the site of a horizontal engine house with heaps of demolition rubble. Further north, there is the mine office and saleroom, while below is the agent's house, all now used as dwellings.

Elsewhere there are also belland yards, five gin circles, including a fine example cut into a cliff at Ape Tor, access level/ sough portals, a large dressing-water reservoir with long leat comprising a stone channel and covering slabs, mine roads, one or possibly two powder houses, and a limekiln for burning mine waste-rock. A quarry is identified as the source of stone for the 1788 engine house.

The extensive accessible underground pipe workings are of exceptional interest. There are probable underground prehistoric workings at The Lumb, shotholes for rare 17th century continental-type powder work at Dutchman Mine, 18th to 19th century shafts and various soughs and levels.

Deep Ecton Level was driven as a sough and haulage/access level, that operated for a short period as a boat level, with notches for a later plankway and a floor for a 19th century tramway. Other detail includes plugs for fittings at the passage side. A level coming from Apes Tor brought water to an underground pumping engine in Deep Ecton Mine. Here there are engine chambers for a water-balance engine, a large gin/capstan and later a waterwheel. The large main pumping shaft was laced and the main winding shaft has good examples of garlands. There are also stone and timber dams, tramways, ladderways and 19th century ladders, rope wear grooves, striking chambers, a miner's inscription and bundings here and in other workings across the hill.

Salts Level is an early 19th century haulage/access level from the main pipeworkings and engine shaft, with sleeper blocks for a plateway or fish-bellied rails.

Clayton Level, with a fine portal and plugs for fittings at the passage side, was driven as a sough and haulage/access level. It leads to a chamber that had several steam engines and an earlier horse whim. There is a surviving large engine 'chimney' wall which supported vertical boilers. The engine beds for the latest three engines remain, comprising a winder/pump and others for compressed air and electric lighting. Earlier steam engines in the main chamber predate the 'chimney' wall and smoke was taken from a rock-cut boiler chamber to surface via different routes, with remains of flues visible, later walled across and an ore chute installed. Clayton Pipe can be entered, via a hatch in one of a complex series of blocking walls and air doors, leading upwards towards an impressive vertical pipe entrance at surface. The workings were used as a 'chimney' and are heavily coated with soot, and there is a 19th century chain ladder. High explosives were used for driving the 1880s underground link from Clayton Mine to Waterbank Mine with a compressed air drill rig. The in-situ iron tramway rails throughout the mine are also of this date. Other features include 19th century survey stations in levels, and cage guides and lacing stemples in the impressive main pumping shaft.

East Ecton Mine has an access level, a large diameter shaft, small stopes and a stowce frame. The New Trial (Fly Mine) has inclined stopes and 19th ladders. Chadwick Mine has an engine shaft, stopes and a coffin level sough. Goodhope Mine has spacious pipe/vein workings and a long access level below with ore chutes between the two. Waterbank Mine has a sough, pipe workings, mine ladders and bundings. Tractor Shaft to the south end of the hill has evidence for firesetting using coal and archaeological excavations have demonstrated its use elsewhere on the hill, some of which is medieval in date rather than 16th/ 17th century.

Ecology: This extensive and complex site contains significant ecological interest. Calaminarian grassland (OV37) is restricted to one area at the bottom of the west side of the hill, with the largest patch on a levelled-hillock area adjacent to the Manifold Trail, with frequent spring sandwort. Mossy saxifrage, limestone bedstraw, mountain pansy and devil's-bit scabious are also present. The many hillocks and hollows elsewhere on the site contain a mosaic of calcareous (CG7, CG10) acidic (U2, U4) and neutral (MG5) vegetation all of which are species-rich. Notable species include wood anemone, bilberry, mountain pansy, wavy hair grass, autumn gentian, mossy saxifrage, meadow saxifrage, small scabious, eyebright, limestone bedstraw, and hairy rock cress.

294: Botstone Mine, SK 092562

Ecology: A small levelled heap of dressing waste is present, associated with a shallow open-cut and shaft hollow on the other side of the road. It is thought that there was a large waterwheel for pumping close by but there are no obvious surface traces today. A very small area of calaminarian grassland with occasional spring sandwort, rare *Cladonia* lichens, and two patches of mountain pansy occurs on the levelled heap. On the western side of the road the bank below the open-cut contains frequent mountain pansy.

295: Bincliff, Oversetts and Highfields Mines, SK 116537

Archaeology: There are extensive surface workings above the steep daleside, mostly comprising limestone hillocks with infilled shafts down to workings on a number of veins, some with associated ruined coes and small walled belland yards. Highfields Mine to the south-east lies within a belland yard. Here there is an oval shaft with a well-preserved walled gin circle. A second possible gin circle within the belland yard lies near to a large ruined coe (recently reduced to footings) and a second smaller circular area that may be the site of a horse-drawn ore crusher.

A number of underground levels are accessible, with entrances at various points down the steep heavily-overgrown valley-side, some of which enter unstable stopes that originally linked to surface (Pedrick and Chapman 1974); shafts above give access to further workings (Critchley and Wilson 1975). Those just above river level are 19th century in date and have large spoil heaps. One has an arched entrance (part collapsed). Three levels higher up the slope have flat-topped waste hillocks, one with two ruined coes, the others with one.

Ecology: The majority of the eastern, upper part of the site lies within the Hamps and Manifold SSSI, where ash woodland, acid and calcareous grassland are associated with the various lead mine remains. The numerous shaft hillocks and mounds at Bincliff Mines and the large mound at Highfields Mine support species-rich calcareous communities, mainly CG7 with frequent eyebright, plus mossy saxifrage, rue-leaved saxifrage, meadow saxifrage, thyme, small scabious and limestone bedstraw. Elements of acid grassland (U4) are also present at Highfields Mine.

296: Thorswood Mine, SK 111470

Archaeology: Here there are extensive large hillocks in a discrete area on a complex pipe-vein deposit worked from surface to depth for lead, copper and zinc. Four or possibly five shafts/sites of shafts have gin circles on their upslope side terraced into the slope (one overgrown). This is an exceptional number of gin circles for such a small area. Two deep shafts are known to give access to deep underground workings but there is currently no archaeological documentation that allows their importance to be assessed, but they are likely to be of at least regional importance.

Ecology: The spoil heaps support a high quality and herb-rich calcareous grassland with species that are unusual in Staffordshire outside the National Park, including autumn gentian, salad burnet, crested hair-grass, and small scabious. Mountain pansy, frog orchid and moonwort are present in the surrounding grasslands. This site is managed by Staffordshire Wildlife Trust as a nature reserve.

SITES WHERE THE PRIMARY INTEREST IS UNDERGROUND

The Northern Orefield – Castleton, Bradwell, Eyam and Longstone.

U1: Old Tor Mine, SK 135827
Archaeology: A gated level leads to a rare example of a pipeworking, with blocked holes to surface, mined for both Blue John and lead ore.

U2: Speedwell Mine, SK 139827
Geology: The mine workings and cave system that make up Speedwell Cavern intersect a number of veins and pipes, the latter of two types comprising primary mineralisation filled cavities and caves filled with sediments containing residual ores.

Faucett Rake is well exposed in the Bottomless Pit (the end of the show cave boat trip into the cave). Here it is a wide (2-3m) vein comprised almost entirely of massive calcite. Closer to the surface, where the vein is seen in the Watricle Cavern, part of the Pilkington's Cavern section of the cave system, it is narrower (ca 1m) and comprises some fluorite and galena as well as the calcite and has been worked for its lead content. Small pipe cavities are present close to Faucett Rake in the inner part of the Whirlpool Passage part of the system. These consist of cavities up to about 2m in diameter lined with galena bearing calcite mineralisation and, in some cases, containing sandy sediments more recently deposited during active cave development.

New Rake is approximately followed by most of the active streamway and is seen in a number of locations in the cave, especially around Rift Cavern, Block Hall and Leviathan. While this is a strong galena bearing calcite rake vein, with some fluorite near the surface, at the depth of the streamway (c. 150m below the surface) it consists only of a series of en-echelon calcite-filled veins.

In addition to the primary mineral veins, Speedwell Cavern has a number of residual ore deposits. Large caverns of phreatic origin in the vicinity of the Pit Props Passage contain sand/silt/clay sediments with residual ore mineralisation including large (5+ cm) lumps of galena. These phreatic cavities extend to at least 30m above the level of the Far Canal and are developed in the vicinity of New Rake where there is some primary pipe mineralisation development at and above Far Canal level. These pipes consist of calcite, barite and fluorite with galena in small cavities and have been extensively modified by phreatic cave development and subsequent mining.

Active residual galena deposits are present in at least two parts of the Speedwell Cavern system. Where the stream from Cliff Cavern Passage enters the main streamway, near to the 'Miner's Toast' inscription, a small scrin occurs and in pockets in the cascade here small rounded grains (up 1cm) of detrital galena occur. In potholes in the Whirlpool Passage stream bed, and in the phreatic tube between Whirlpool Passage and the Assault Course, lumps (up to c. 4cm) of detrital galena occur. While the latter may possibly be the result of the miners dressing ore further up Whirlpool Passage, both occurrences are likely to be the result of active stream erosion of exposed mineralisation in these parts of the cave system. As far as the author (Richard Shaw) is aware this is the only location in the orefield where the active formation of residual/detrital lead ore deposits can be observed.

Archaeology: This show 'cave' includes a fine example of an 18th century underground boat level (Rieuwerts and Ford 1985). It is entered by a well-made stepped incline, the upper part arched. At the end of the show 'cave' there is a massive retaining wall that allowed the canal to pass across a high cavern part-way up its side. Along the full length of the canal there are wooden plugs for fittings at the passage sides.

Beyond this the level continues, with the remains of an original boat surviving at a wider section where boats could pass. Further along the canal, 'Pit Props Passage' leads to a probable ore chute running up through pipeworkings, with a large natural cavern at the top where extensive mineral-rich sediments have been removed. The canal ends in a natural streamway where there are notches for a large plankway running upstream to workings above. Further upstream there is the well-known 18th century 'Miner's Toast' inscription, now marred by modern graffiti. A branch passage (Whirlpool Passage) also has notches for a small plankway and there are small accessible vein workings at the end, before which is a small workshop area with stone-built working platform on a ledge, possibly used as a knockstone, with notches for a timber floor over the adjacent streamway and a rock cut pool nearby that was presumably used for washing ore.

Downstream, the streamway also has notches for a plankway and small areas of mine workings. One has a clay lined leat. Another has a stone-paved walkway over the stream. At the junction with the boat level there is a dam wall with a large wooden bung below an arch, originally used for draining the level for maintenance.

U3: Peakshole Sough, SK 148827
Archaeology: A gated sough with small vein and pipe workings above (Penney 1985). At the inner end of the sough are the rare remains of an intact timber plankway above the level of the water.

U4: Bird Mine, SK 157812
Archaeology: An oval engine shaft of large diameter, with fine limestone ginging, down to rake workings; surrounding hillocks have been removed.

U5: Moorfurlong Mine, SK 168812
Archaeology: A shaft in a hillock leads to extensive pipe workings with an underground dressing floor and what appear to be stone-lined sieving or buddling troughs.

U6: Calf Pingle North Mine, SK 209771
Archaeology: A shaft leads underground to deep vein workings (Beck 2004a/b; Barnatt and Worthington 2006), some with evidence for firesetting with coal, and extensive later mining. An internal shaft has an in-situ stowce.

U7: White Rake, SK 216763
Archaeology: A recently reopened shaft leads down to a narrow, part-choked stope with evidence for firesetting in two places.

U8: Great Cucklet Mine, SK 215759
Archaeology: A good example of a small mine level (often known as Nickergrove Mine) (Beck and Worley 1977). There are also two shaft entrances nearby and hillocks below. The level intersects natural passages and exploited small veins, and there are cross-cuts, small stopes and internal shafts. Digging a few years ago found wooden rails of an unusual type.

U9: Stub Scrin, SK 218760
Archaeology: A shaft leads to a narrow fireset scrin (Barnatt and Worthington 2006). This has evidence for ventilation control in the form of a 'fang', created by placing a false floor of slabs above the base of the working, with a passage for air between the two.

U10: Merlins Mine, SK 217759
Archaeology
A good example of a small mine level, with shaft entrance nearby and hillocks below (Rieuwerts 1960). The level intersects natural passages and leads to small vein workings, and there are cross-cuts, small stopes and an internal shaft. One of the cross-cuts has wear marks from the use of ore sleds.

U11: Watergrove Sough, SK 209759
Archaeology: An historically important sough to Watergrove Mine, the tail now blocked but with a section accessible via a nearby short shaft.

U12: Moorwood Sough, SK 232754
Archaeology: A long, historically important sough, with impressive stone stempling and fine examples of sandstone arching, leading to Glebe Mine and beyond.

U13: Northcliffe Sough, SK 237738
Archaeology: This extensive mine has recently been re-entered. There is a long cross-cut level and a variety of stopes, some large, some following veins that have very variable hade with parts almost horizontal. There is an inclined drift driven down what in effect is a hading 'flatting', with ore-passes dropping to this; these presumably date to the early-20th century when the mine was worked for fluorspar. Evidence for firesetting in the stopes has been postulated and there are 20th century compressed air shotholes where high explosives were used. Archaeological details include timber props and stemples, with impressive 20th century examples, evidence of tramways, a purposefully reverse written set of 18th century miner's initials and date, and a variety of artefacts.

The Central Orefield – Taddington, Monyash, Bakewell and Youlgreave.

U14: Greensward Rake (south-east), SK 166670
Archaeology: A fine example of an oval climbing/winding shaft with climbing stones in the ginging and rope-wear grooves below. This is now capped and there is a ruined coe nearby. There are two further small capped shafts in the same plantation. The accessible workings from all three are only limited in extent.

U15: Broadmeadow Mine - Shale Drift, SK 221644
Archaeology: A drift entrance, with a further section beyond a collapse entered via a nearby shaft, which took water from the river via pipes on a trestle to the entrance and through the drift to Broadmeadow Shaft (see Site 174), where there was a hydraulic engine chamber deep underground.

The South-Eastern Orefield – Winster, Matlock and Wirksworth.

U16: Cowclose Mine - Main Drawing Shaft, SK 224606
Archaeology: A shaft with a large hillock gives access to extensive underground pipe and vein workings that may well be of great interest (archaeological character of accessible workings currently poorly documented).

U17: Cowclose and Leadnams Mines, SK 226804
Archaeology: Shafts on a large hillock here give access to extensive underground pipe and vein workings that may well be of great interest (archaeological character of accessible workings currently poorly documented).

U18: Portaway Mine – Engine Shaft, SK 230618
Archaeology: A gritstone-lined engine shaft gives access to extensive underground pipe workings that may well be of great interest (archaeological character of accessible workings currently poorly documented).

U19: Portaway Mine - Fisher's Shaft, SK 231610
Archaeology: A shaft gives access to extensive pipe workings (archaeological character of accessible workings currently poorly documented). The large surface hillocks are still high in parts but are much disturbed.

U20: Wills Founder Mine, SK 234607
Archaeology: A sleepered shaft, on a flat-topped hillock that once had a gin, leads to interesting underground workings, including the site of a pumping engine that is now in the Mining Museum at Matlock Bath (Willies 1977; Heald 1978; Riley and Willies 1979.

U21: Placket Mines (north-west), SK 23761-
Archaeology: A deep engine shaft that give access to very extensive pipe and vein workings of great potential interest. Little detail of the archaeological character is yet recorded, but a long underground buddle has been noted.

U22: Placket Mines (south-east), SK 239608
Archaeology: A deep engine shaft that gives access to the same workings as U21.

U23: Upper Orchard Mine, SK 241604
Archaeology: A deep engine shaft, at the top end of a large hillock, which leads to extensive pipe and vein workings (archaeological character of accessible workings currently poorly documented).

U24: Upper Orchard Mine - Old Weston Shaft, SK 239603
Archaeology: A deep engine shaft, at a disturbed hillock, that leads to extensive pipe and vein workings; it is reported that there are underground dressing floors, a water channel, wagons and other artefacts (but archaeological character of accessible workings currently poorly documented).

U25: Old Millclose Mine and Millclose Sough, SK 260615
Geology: These mines worked a network of small veins that form part of the up dip extension of the Mill Close Mine vein structure (see Sites 200, 209); they are similar in character but are still accessible. As at Mill Close Mine the suite of mineralisation present is typical of the eastern side of the orefield comprising of fluorite, calcite and barite gangue minerals with galena. However, they have a significant difference from the 'modern' Mill Close Mine in that there has been extensive modification to the primary mineralisation by the extensive development of cave systems and caverns. Of particular interest is the extensive development of residual deposits that were easily exploited by the miners. These deposits are found within a network of natural cave systems and caverns, mainly of phreatic origin, comprising fills of sand and clay sediments that contain the insoluble minerals present in the veins and this includes galena. Because of their nature these sediments were easy to work and dress.

Archaeology: A series of shafts and a large sough bolt lead to different parts of this extensive series of pipe working and associated sough (Warriner 2000a; Rieuwerts 2000c). Shafts to the mine itself include lower parts at Limbreck (Shale) Shaft (SK 257614), and upper parts at Hamber Grove (Sleeper) Shaft (SK 260611) and Red Lion Shaft (SK 261610) (also see Sites 199 and 209).

The exceptional Old Millclose Mine workings contain many mine artefacts and inscriptions, clay fairy rings, coffin levels, an arched level, a railed tramway level, a paved level, barrow ways, stairways, ore chutes, packs of deads, ventilation walls sealed with clay, a walled fang or air duct, dressing floors, buddles, wooden launders, stone-built and clay-lined leats, a wooden pump barrel and an underground forge. In the upper workings there are rare paved levels, leats, buddles and a reservoir dam. The upper workings largely comprise natural cave passages where there is important evidence for extensive removal of mineral-rich natural sediments.

The sough has three enterable sections with entrance points given below. The outer cut and cover section (SK 265618), which can be entered a short distance from the tail, has a slabbed floor and roof, with notched gritstone uprights between. There are two short sections within with sweeping pickwork, a wooden launder at one point and various capped air shafts to surface. Air Shaft (SK 256615) with fixed ladders, gives access to a long central section of the sough and it is also possible to enter extensive workings of Old Millclose Mine from here. Valley Shaft (SK 253614), with fixed ladders, gives access to a long inner section of the sough, with surviving wooden launders in the sough, and pump pipes at Boltwood Shaft.

U26: Masson Sough, Old Jants Mine and Gentlewoman's Pipe, SK 295594
Geology: see U27.

Archaeology: A sough level, now entered via a manhole cover near the river (often known as Youds Level), leads to the longest accessible coffin level sough in the orefield, and then

to extensive pipe workings (Warriner *et al.* 1981). There are shafts to surface, including a good example with garlands; fine examples of pickwork in the sough; and various miners' inscriptions, a wooden hotching trough, miners' tools, etc.

U27: Nestus Pipes, Longtor Mines, and Bacon and Coalpit Rakes, SK 291590

Geology: Beneath Masson Hill an extensive network of veins, pipes and flats has been worked for lead and more recently, fluorspar. The majority of the mineralisation is hosted in limestone between the Upper and Lower Matlock Lavas and at the contact between dolomitised and unaltered limestone. Many of the veins show multi-phase fluorite, barite, calcite, galena mineralisation filling fault fractures typical of the orefield. The veins exhibit 'crustiform' banding with the galena largely occurring close to the walls and in the centre of the veins.

Flats are common with both cavity fill and replacement styles being present. A particularly large example of the latter is a fluorite replacement flat that occurred in and around the Masson Hill opencast but this has now been now largely worked out by underground and more recent surface mining for fluorspar. Several cavity fill type flats occur in the workings around Black Ox Shaft at the Nestus Pipes (Great Masson Cavern) and exhibit void fill multi-phase fluorite, barite, calcite, galena mineralisation often with the development of large crystals in the remaining vein cavity.

Mineralised pipes are a feature of the deposits worked under Masson Hill. Both primary pipes with a multi-phase fluorite, barite, calcite, galena mineralisation and sand filled caves containing residual and detrital galena occur. The inner surfaces of the pipe mineralisation often have large crystals present. Calcite crystals, sometimes with etched surfaces, up to about 30cm long are known in parts of the mine. In the Great Masson Cavern a small pipe mineralisation deposit has formed in a pre-existing cavity, the bottom of which contains a pre-mineralisation quartzose sedimentary deposit; this is one of the few examples known.

The cave systems filled with sediments are a particular feature of this mine and occur in many parts of the workings. These probably developed over the last one million years or so before the Derwent Valley was deeply incised to form the present gorge at Matlock Bath. Clay Shaft in Old Jant Mine has nearly 5m of sandy sediment in which evidence of palaeomagnetic reversal; from 'reversed' at the bottom to 'normal' (i.e. present day) at the top, suggesting deposition started before the last major reversal of the Earth's magnetic field about 780,000 years ago (Noel and Shaw 1984). Another large sediment filled cavity in the Nestus Pipes (Great Masson Cavern), narrowly missed by the Masson Hill opencast workings, contains a residual, galena-bearing layer at the bottom overlain with layered sands and silts. These are cut by a sand-filled fracture interpreted as evidence of ice wedging during a past cold climatic phase. Many of the sediments in these pipes show evidence of a fluvio-glacial origin and are probably largely derived from glacial outwash streams. These deposits contain detrital and residual galena and have been worked for lead in the past though some, in particular the sediments of the Clay Shaft and surrounding areas, do not contain any galena and have been left largely undisturbed by the miners.

Within the lower part of the Nestus Pipes, known as Rutland Cavern, a network of veins, pipes and flats associated with Bacon Rake have been worked for lead and zinc. The majority of the mineralisation is similar to that in the upper pipes.

Flats and pipe deposits are present with both cavity fill and replacement styles being present which frequently exhibit void fill multi-phase fluorite, barite, calcite and galena mineralisation, often with the development of crystals in the remaining vein cavity; Both smithsonite and auricalcite occur. A few small sand filled caves containing residual and detrital galena are also present.

The mineralisation at Coalpit Rake (Devonshire Cavern) is unusual in that a complex vertical rake, with a band of multiple interlinked veins with horses, has intermittent lateral displacement at the clay wayboards they pass through.

Figure 27: Site U27: Coalpit Rake, showing analysis of underground workings of different dates. Including 16th/17th century fireset work surrounding a medieval core, and 18th/19th century enlargements.

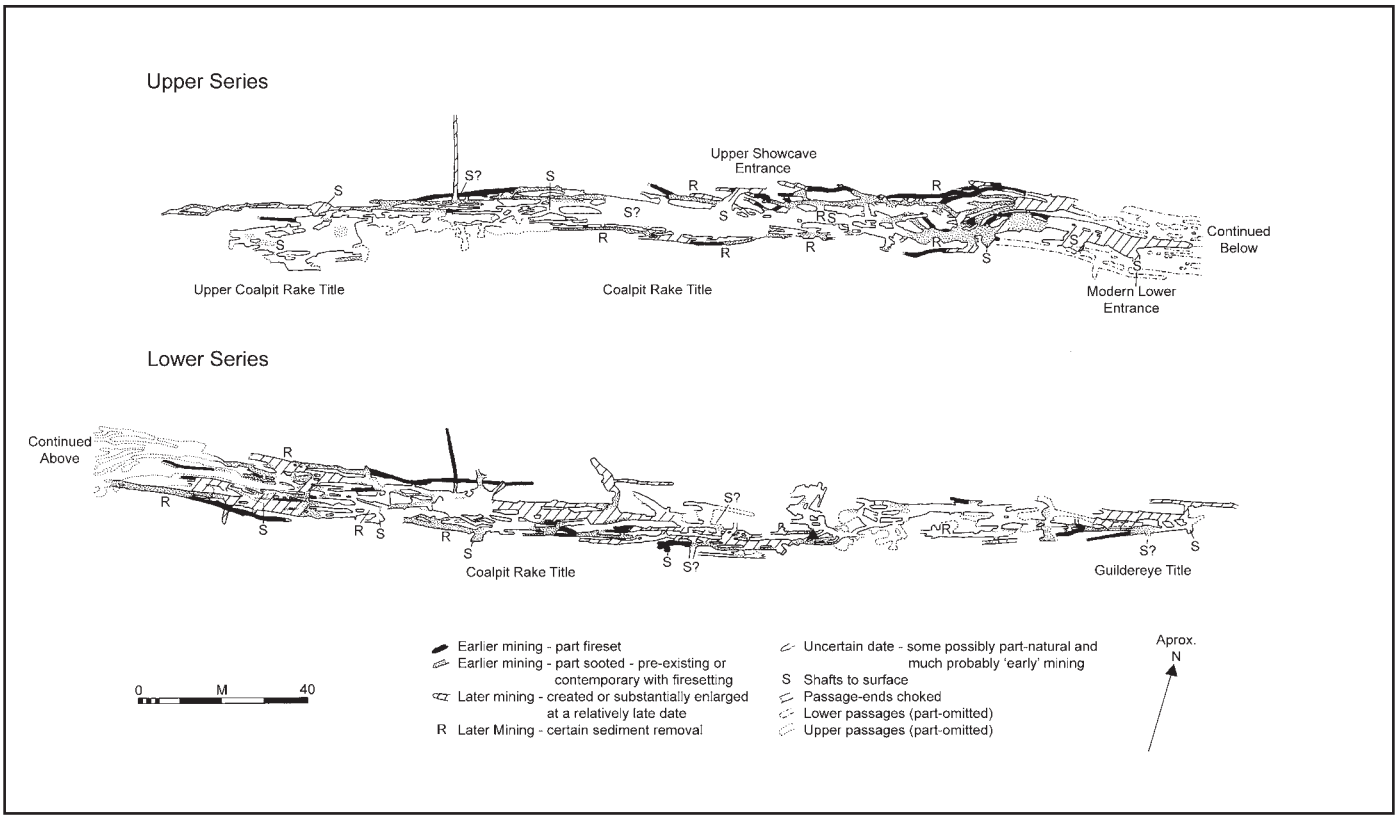


Plate 44: Masson Mine – Natural cavern filled with fine grained sediments. These include sediment filled cracks which are probably the result of the formation of ice wedges during a cold climatic phase. The ochre coloured basal layer is a residual deposit often characteristic of these sediment filled cavities in the Matlock area which contains lumps of detrital galena (Photo Dave Webb).

The workings at Longtor Mine intersect a variety of types of mineralisation including veins and pipe deposits that comprise both open void mineralisation and caves filled with sediments. The veins are largely fluorite rich, but have some calcite dominated gangue (and there are some larger masses of calcite in some of the pipe deposits), with minor galena present throughout and with some barite. In close proximity to the lava some of the vein mineralisation is heavily leached (by sulphuric acid resulting from pyrite oxidisation?) and there are also deposits of iron rich pyrite oxidation products. There are patches of fluorite replacement of limestone associated with some of the veins. Bedding in the limestone is very steep in places (sometimes near vertical) and has been exploited during vein emplacement. Basalt (almost certainly the Upper Matlock Lava) is exposed in the workings and this displays thick development of clays at its surface as a result of weathering following extrusion and alteration post burial.

Archaeology: At surface the remains comprise either hillocks and open-cuts along veins, only parts of which are still intact (see Site 223), or shafts down to pipe workings, many of which have now been sealed. The extensive underground workings at Nestus Pipes and Bacon Rake (Great Masson and Rutland Caverns) and Coalpit Rake (Devonshire Cavern), with adit entrances and a large number of hand-picked shafts from surface, are exceptionally important for their evidence of early mining. There is also extensive evidence for 18th to 20th century work where gunpowder was employed.

At the Nestus Pipes there are labyrinthine medieval (or perhaps earlier) pipe workings primarily identified from their distinctive 'woodpecker' pickwork (Flindall and Hayes 1976; Flindall *et al.* 1981; Barnatt and Rieuwerts 1998; Barnatt 2003a; Barnatt and Worthington 2006). Documentation shows that there was extensive working here and on Bacon Rake by 1467 (Rieuwerts 2010, pp. 151-60). There are fine fireset stopes in Rutland Cavern and further evidence in other parts of the Pipes. The Pipes also have probable medieval and later coffin levels, and two fine picked sets of dated initials from around 1700. In the northern parts of the pipes there was extensive 20th century reworking for fluorspar, with barrow ways and high packs; work extracting fluorspar in the same general part of the mines is documented as having started by the 1780s (Barnatt 2011b).

The complex vein workings at Coalpit Rake have extensive evidence for firesetting using coal in an interconnected network of stopes, and at shafts (Barnatt and Worthington 2006; 2009); this predates the use of gunpowder, probably dating from the mid-15th to 17th century; later work included reworking of deads and insertion of high walls of deads to hold these back. Documentation shows this mine was active by 1528, but an extensive core area of mine predates the firesetting and is likely to be earlier than the 16th century; the Coalpit Rake workings may well be the largest currently-accessible medieval mine in Britain.

There are further accessible important underground rake and pipe workings at Longtor Mine, with firesetting with coal and good examples of 19th-20th century work, including compressed air shotholes; Long Tor Top Mine, with firesetting with coal and later powder work; and Dark Hole Mine on Bacon Rake, with firesetting with wood and probably coal, and later powder work (Barnatt and Worthington 2006). There is further minor evidence for firesetting at a short working on Newthole Vein.

U28: Side Mine, SK 296588
Archaeology: A good example of a pumpway level that contained flat rods, with vein stopes containing fine examples of stone stemples, an underground pumping chamber and flooded winzes.

U29: Owlet Hole and Temple Mine, SK 292580
Geology: Temple Mine contains a number of pipe deposits and replacement flats at the contact between dolomitised and unaltered limestone. The latter are largely composed of granular crystalline fluorite while the latter comprise fluorite with minor amounts of barite, calcite and galena. The mine is particularly noteworthy for a number of sand/clay filled cavities. These are developed adjacent to and partly within the older primary mineralisation and contain a residual basal layer that may be galena bearing (not proven) and contain some detrital fluorite throughout. One of the sections clearly shows undulating sedimentary bedding.

Archaeology: Owlet Hole is small mine with both vein and pipe workings, the latter worked for fluorspar in the 20th century. Older workings include powder work in small levels and stopes, and a fine example of a small level driven by firesetting with coal (Barnatt and Worthington 2006). Temple Mine was created as a fluorspar mine in the 20th century and today is a show mine. Its main conservation interest is its geology.

U30: Hagg Mine, SK 296577
Archaeology: A pumpway/coffin level that contained flat rods, with mineral workings that are now mostly flooded. The entrance to this level has been walled up.

U31: Wapping Mine and Cumberland Cavern, SK 292576

Geology: Wapping Mine initially worked a galena bearing fluorite rich vein hosted in partially dolomitised limestone. 20th century fluorspar workings significantly enlarged stopes on the vein and exploited extensive replacement flat deposits between smaller veins. Accessory minerals include barite and calcite and some secondary lead minerals are present in this near surface deposit. The vuggy nature of the mineralisation means that euhedral crystals of the suite of minerals present are often found in the cavities. Large (c. 30cm) calcite crystals are present in some areas together with secondary carbonate minerals.

Archaeology: Wapping Mine is an impressive example of 20th century fluorspar rake and pipe working, with large stopes and high packs of deads, with evidence of earlier small-scale lead vein working, including evidence for firesetting and powder work (Flindall and Hayes 1972b; Barnatt and Webb 2002; Barnatt and Worthington 2006).

Cumberland Cavern, entered via Wapping Mine, is a good example of a small mine in largely natural caverns. Various surface shafts and the blocked adit entrance to Cumberland Cavern once gave access to minor vein and pipe workings.

U32: Moletrap Vein, SK 296575

Archaeology: The vein workings here have impressive stopes, the main one easily accessible, but the workings beyond are partially flooded. The entrance stope has evidence for firesetting with coal and later mining (Barnatt and Worthington 2006).

U33: Allen's Hill Mine, SK 296568

Archaeology: This small mine is one of the most intact examples of a pipe working developed using firesetting with coal; at one part the sooting overlies early shotholes (Barnatt and Worthington 2006; 2009).

U34: Middleton Stone Mine, SK 276557

Geology: The extensive modern workings of Middleton Limestone Mine intersect a number of small mineral veins, and both primary and sediment filled pipes.

The veins comprise multiphase, 'crustiform' fluorite, calcite, barite and galena mineralisation typical of the orefield. Some have not been worked previously where intersected by the limestone workings which provide good exposures of the mineralisation.

The pipe mineralisation tends to be small and of limited conservation value, however, the more recent sediment filled pipes are more interesting. In a number of locations the limestone mine workings intersect cave cavities infilled with a range of sedimentary deposits. These range from sandy deposits containing pebbles derived from the Triassic Sherwood Sandstone Group rocks now only exposed to the south of the orefield, bedded silt deposits of fluvio-glacial origin and fine clays of loessic origin all of which have been washed into solution cavities in the limestone. Where associated with mineral veins these pipes also often contain a residual basal layer containing galena.

Archaeology: The extensive stone mine, whilst active, periodically cut into mine workings. Shortly before closure this included a stretch of vein workings at Quarry Vein that contained, stone stemples, an iron-railed narrow-gauge tramway, several tubs, sundry other artefacts and miners clog prints.

U35: Haslowfield Level, SK 260561

Archaeology: A level, often known as Spinney Level, with *in-situ* wooden rails, leads to workings on a vein with fine stone stemples.

Plate 45: A galena rich barite flat vein in Golconda Mine. Field of view approximately 35cm.

U36: Golconda Mine, SK 249551

Geology: The extensive workings of Golconda Mine demonstrate many of the main Peak District orefield ore body styles. These include veins but the mine is best known for the development of pipes and flats. These are mainly developed at the base of a basin shaped zone of dolomitisation (Ford and Jones 2007). These comprise mainly of multi-phase void fill and replacement type deposits that have developed at the interface between the limestone and much more permeable dolomite. The mine was worked primarily for lead and, later, for barite.

Many of the minerals present in the orefield occur in the deposits worked by the mine including fluorite, barite, calcite and galena together with sphalerite, chalcopyrite, and pyrite. Because of the vuggy nature of the mineralisation the minerals are often well crystallised. In addition secondary minerals are common, including smithsonite, hemimorphite, cerussite and auricalcite.

The mine is noted for its large natural caverns associated with the earlier mineralisation and also largely developed at or close to the base of the dolomitised limestone. These contain re-deposits of residual mineralisation left behind as phreatic cave development dissolved the dolomite/limestone and surface derived sands and silts were introduced from the Mio-Pliocene Brassington Formation.

Archaeology: A deep shaft gives access to extensive pipe workings of great interest, worked for lead and barytes from the mid-19th century into the 20th century (archaeological character of accessible workings currently poorly documented). Most surface features have been removed, but there is a coe in good condition at the shaft top that survives within a modern building.

U37: Bage Mine, SK 291550

Geology: This mine consists of extensive workings on a network of veins. The suite of mineralisation present is typical of the eastern side of the orefield comprising of fluorite, calcite and barite gangue minerals with galena. It is particularly noted for the occurrence of unusual lead secondary minerals, formed by

the near surface alteration of the primary galena mineralisation. These include cerussite and anglesite as well as cromfordite and matlockite which were named after their discovery in the mine in the early 19th century. (Ford 2005).

Archaeology: A deep shaft gives access to extensive vein workings, long levels and cross-cuts below the shale (Warriner 1982). Details include tramway rails, trap doors, a ventilation wall, miners' inscriptions and artefacts.

U38: Cauton Vein, SK 280539
Archaeology: A series of small vein workings where phreatic cave passages have been enlarged, that are entered via shallow shafts and from a quarry face. They contain examples of mining employing firesetting with coal and later powder work (Barnatt and Worthington 2009).

The South-Western Fringes – Hartington and Parwich.

U39: Hartington Level, SK 145611
Archaeology: A good example of a long mid-19th century haulage level, to small workings at the end where lead and ironstone are documented as mined.

The Staffordshire Mines – Warslow, Wetton and Stanton.

U40: Royledge Mine and Sough, SK 045591
Geology: The workings of this mine are of geological interest because a 'saddle' type pipe deposit is accessible, of a type historically described in the general Ecton area (Watson, 1860). This consists of an anticlinal structure in basinal facies limestone which has been mineralised with chalcopyrite bearing calcite. Where worked this is about 60cm thick and parallel to the bedding of the limestone. While this does not exactly conform to the saddles described by Watson it does appear to be very similar. Small veins of chalcopyrite bearing calcite are also present. These are vertical and appear to be emplaced in faults with a small displacement. Malachite is common in the accessible workings and may have been the principal copper ore worked.

Archaeology: A re-opened sough leads to copper mine pipe workings above (Kirkham 2006); artefacts have now been placed in the Peak District Mining Museum.

U41: West Ecton Mine, SK 091580
Archaeology: This is an important example of mining associated with the main Ecton complex nearby, which were worked in the hope of finding further rich deposits. A level leads to a flooded inclined working below, a choked working above, and to trials. A second entrance, high on the daleside above, leads to the top of a large stope, which once connected with the level below, and to a shaft from surface going to depth.

U42: Robin's Shaft Mine, SK 135527
Archaeology: An unusual steeply inclined shaft at a small but deep copper mine with various levels, stopes and natural chambers to a depth of 90m.

Appendices

Appendix 1: The Inventory: Summary Table and Location Maps

KEY

A: Inventory Number.

B Old Inventory Number – As published in 2004 and 2005, with all entries added in Barnatt 2005 prefixed by 'N'.

C: Site Name (using traditional mine names where known – where a site is large and there are many known names the most important mines are named here).

D: Location – approximate centre.

E: Area of site to the nearest hectare (very small sites are listed as 1ha even when they are less than 0.5ha in area). It should be noted that these stated areas include wide buffer zones and the actual extent of metal mining remains.

F: Significant Interest – Geology - Type.
- V: Vein mineralisation.
- P: Pipe, flat and replacement mineralisation.

G: Significant Interest – Archaeology - Categorisation:

First Entry – Mineral Hillocks (Common Types)
- A: Exceptional condition or good/average condition but extensive, and also including smaller but good examples of unusual hillocks and various representative examples of more typical types of hillock found in the orefield.
- B: Good/average condition but of moderate or small extent.
- C: Poor or unknown condition.

Second Entry – Other Relatively Common Features at Surface
- A: Including several common and rare features that collectively comprise relatively intact mine complexes.
- B: Single/a few features in relatively good condition.
- C: Single/a few features in poor or unknown condition.

Third Entry - Rare or Special Features at Surface, Early Mines and Relatively Complete Mine Complexes.
- A: All extant examples.
- B. Ruined or removed examples.

Fourth Entry - Underground Features
- A: Accessible workings of extensive or special character.
- B: Accessible workings of only limited or unknown extent.
- C: Workings not accessible due to blocked or flooded shafts/levels.

NOTE: Any site that scores an 'A' is classified as of high priority – those with more than one A are no more important than those with only one.

H: Significant Interest – Ecology – Categorisation:
- A: Grassland of high ecological value.
- B: Grassland of moderate ecological value.
- C: Grassland of limited ecological value.
- I: Improved.
- U: Unsurveyed.
- (W): Outside the National Park at least part of the site is designated as aWildlife Site, or, inside the National Park, listed as a provisional Wildlife Site. An asterisk indicates a potential Wildlife Site in Derbyshire outside the National Park.

I: Statutory designation – Scheduled Monument or Listed Building for archaeological, historical and/or architectural interest.
- S Scheduled Monument.
- L Listed Building.

J: Statutory designation –Special Area of Conservation and/or Site of Special Scientific Interest for biological or geological interest.
- SAC Special Area of Conservation.
- B Biological SSSI.
- G Geological SSSI.
- O Other SSSI not giving protection to metal mining interest.

I/J: Symbols Used
- X Whole of 'Important Metal Mining Site' within designated area.
- (X) Only part of 'Important Metal Mining Site' within designated area.
- ((X)) Only small part of 'Important Metal Mining Site' within designated area.

Main Sites

The Northern Orefield – Castleton, Peak Forest, Bradwell, Eyam and Longstone.

A	B	C	D	E	F	G	H	I	J
1	1	Odin Mine, Knowlegates and Engine Soughs, Blue John and Treak Cliff Mines/ Caverns, and Old Miller Vein	SK 131833	37	P	B/A/A/A	A (W)	(S)	(B/G)
2	2	Peakshill Sough	SK 117829	2	-	-/-/A/C	C	S	((B/G))
3	3	Oden Sough	SK 145832	4	-	-/-/A/B	U	-	-
4	4	Faucet, Slack Hole and Longcliff Rakes, with Rowter, Oxlow and Maskhill Mines	SK127821	36	-	A/A/A/A	A (W)	(S)	G
5	5	New Rake	SK 137820	8	-	A/A/A/A	A (W)	(S)	B/G
6	10	Coalpithole Rake	SK 099811	8	-	A/A/A/A	C	S	(B/G)
7	11	Gautries Rake	SK 102808	6	-	A/A/A/B	C	S	-
8	9	Linacre, Slitherstones, Eldon Bent, Burning Drake, Wrangling Rake, Portaway, Eldon Vein, Jowle Grove, Watts Grove, Smiler, White Rakes and Hurdlow End Mines	SK 120811	108	-	A/A/A/A	A (W)	(S)	(B/G)
9	8	Wham and Wrangling Rakes, with Penny Mine	SK 132811	11	-	B/B/B/B	A (W)	-	((G))
10	7	Hazard Mine	SK 137812	1	-	C/B/A/B	A	-	-
11	12	Oxlow and Daisy Rakes	SK130804	15	-	A/A/A/B	A (W)	(S)	(B)

12	6	Dirtlow Rake, Pindale Side and Redseats Veins, with How Grove and Siggate Head Mines	SK 155820	27	V/P	B/A/A/B	A (W)	(S)	(G)
13	B1	Ashton's Mine	SK 163826	1	-	C/C/A/C	U	(L)	-
14	-	Pindale Sough	SK 163829	1	-	C/C/A/C	U	-	-
15	17	New Venture West End	SK 147809	4	-	A/A/-/B	A (W)	-	-
16	18	New Venture Mine	SK 154810	1	-	B/A/A/A	A	-	-
17	19	Long Rake Founder and Shack Pit	SK 153808	1	-	C/B/-/A	A	-	-
18	20	'Smalldale Mines'	SK 166815	2	-	C/C/-/C	A	-	-
19	14	Cop Rake and Starvehouse Mines	SK 132800	9	-	A/A/A/B	A (W)	(S)	-
20	13	Boggart Hole Vein, Hills Venture and Royal Oak Mines	SK 127794	9	-	B/A/A/B	A (W)	(S)	-
21	15	Moss Rake West End	SK 136796	9	-	A/A/A/B	A (W)	(S)	-
22	16	Moss Rake, with Raddlepits, Hugh Grove and Rakehead Mines, and New Rake Bottom	SK 148802	23	V	C/A/A/A	A (W)	-	-
23	B3	Hartledale Mine	SK 159805	1	-	C/B/A/B	U	-	-
24	24	Lambpart Mines	SK 159804	2	-	B/C/-/C	A (W)	-	-
25	21	Moss Rake – Southfield Mines	SK 169809	1	-	C/-/-/C	A (W)	-	O
26	B2	Co-op Sough	SK 174811	1	-	-/-/A/B	U	-	-
27	22	Lambpart Vein	SK 153799	1	-	C/B/-/C	A	-	-
28	23	Berrystall and Scrin Rakes, with Chance Mine	SK 158800	8	-	C/B/-/C	A (W)	-	-
29	25	Earl and Hill Rakes, Nall Hole Mine, Cow Hole and Hazlebadge Cave	SK 170802	6	-	A/A/A/A	A (W)	-	O
30	B4	Windy Knoll Mine	SK 152796	1	-	C/C/A/C	U	-	-
31	26	Intake Dale Mine and Shuttle Rake	SK 162797	4	-	B/C/A/C	A (W)	-	-
32	N122	Shuttle Rake (east)	SK 174798	1	-	B/B/-/C	A	-	-
33	28	Maiden Rake – Heath Bush Mine	SK 143784	1	-	B/C/A/C	U	-	-
34	29	Maiden Rake	SK 150785	1	-	C/B/-/C	A	-	-
35	30	Tideslow, High and Washers Rakes, Beech Grove and Hilltop Mine	SK 161779	27	-	A/A/A/A	A (W)	(S)	(B)
36	B5	Old and New Milldam Mines	SK 176780	2	V	C/C/A/A	U	-	-
37	N123	New Edge and Have At All Mines	SK 182780	3	-	-/A/A/C	A	-	-
38	N124	Hucklow Edge Vein	SK 185780	1	-	-/C/-/C	A	-	-
39	N125	Silence, Old Grove and New Grove Mines	SK 187778	4	-	-/C/A/C	A (W)	-	-
40	31	Old Grove Sough	SK 190776	8	-	-/-/A/C	U	-	-
41	N126	Slater's Engine Mine	SK 192778	1	-	-/C/B/C	A	-	-
42	N127	Bradshaw Engine Mine	SK 195778	1	-	-/C/C/C	A	-	-
43	N128	Black Engine Mine	SK 197777	1	-	-/C/C/C	A	-	-
44	B6	Old Twelve Meers Mine	SK 204775	1	-	-/B/A/B	C	-	-
45	N129	Top Twelve Meers Mine	SK 206776	1	-	-/C/C/C	A	-	-
46	N130	Broadlow Mine	SK 210775	2	-	-/C/C/C	A	-	-
47	B7	Ladywash Mine	SK 219775	1	-	-/A/A/A	U	-	-
48	33	New Engine Mine	SK 224774	1	-	-/A/A/B	A (W)	(L)	-
49	34	Magclough Sough and Engine	SK 235776	4	-	-/-/A/B	U	-	-
50	32	Little Pasture Mine	SK 207772	1	-	-/A/A/B	U	-	-
51	N131	Dusty Pit Mine	SK 207770	1	-	B/C/-/C	A	-	-
52	N132	Old Pasture Mine and Little Pasture Sun Vein	SK 209772	1	-	-/C/A/C	A	-	-
53	N133	Haycliffe Mine	SK 212771	1	-	-/C/B/C	A (W)	-	-
54	N134	Brookhead Mine	SK 221767	1	-	-/C/C/C	A	-	-
55	36	Little Brookhead Mine	SK 222766	1	-	-/A/A/B	A	-	-
56	37	Stoke Old Engines	SK 229768	1	-	-/A/A/B	U	-	-
57	38	Stoke Sough	SK 239766	1	-	-/-/A/A	U	-	-
58	N135	Cross Low Vein	SK 182767	2	-	B/C/-/C	A (W)	-	-

59	39	Watergrove Mine	SK 191758	9	-	A/A/A/B	A	(L)	-
60	N138	Coal Flats Head Vein	SK 197761	1	-	C/C/-/C	A	-	-
61	N136	Brushfield Rake	SK 205760	1	-	C/C/-/C	A (W)	-	-
62	N141	'Middleton Moor Mines (north-west)'	SK 196751	2	-	B/C/-/C	A	-	-
63	N139	White Rake	SK 204758	1	-	B/C/-/C	A (W)	-	-
64	N143	'Middleton Pasture Rake Side Veins (west)'	SK 210752	1	-	C/C/-/C	A	-	-
65	N144	'Middleton Pasture Rake Side Veins (east)'	SK 215754	2	-	C/C/-/C	A (W)	-	-
66	-	Tideswell Torrens	SK 144771	1		-/-/A/-	U	-	-
67	27	Edge Rake Mine	SK 134765	1	-	A/A/A/B	A	-	-
68	N137	Red Butts Mine	SK 145753	1	-	A/A/A/C	A	-	-
69	-	Thornhill Slack Vein (west)	SK 153745	1	-	C/C/-/C	A	-	-
70	-	Thornhill Slack Vein (east)	SK 156744	2	-	B/C/-/C	A	-	(SAC/B)
71	-	'Litton Edge Veins'	SK 165755	1	-	C/C/-/C	A	-	-
72	40	Arbourseats Veins and Sough, Wardlow Sough, Nay Green Mine and Washing Floors	SK 173747	21	-	A/A/A/A	A	S	(SAC/B)
73	41	White Rake (west)	SK 178747	3	-	A/B/-/C	A	-	-
74	42	White Rake (east) and Old Seedlow Mine	SK 186748	5	-	A/A/A/B	A (W)	-	-
75	N142	Seedlow Rake	SK 194747	3	-	C/C/-/C	A	-	-
76	N140	'Wardlow Hey Mines'	SK 174742	3	-	B/C/-/C	A (W)	-	(SAC/B)
77	-	'Wardlow Hey Mines (south)'	SK 174742	9	-	C/C/-/C	A	-	B
78	44	Cackle Mackle Mine, Blakeden Great Vein and 'Stadford Hollow'	SK 193740	38	-	A/A/A/A	A (W)	S	(B)
79	N145	'Middleton Moor Mines (south-east)'	SK 207743	1	-	C/C/-/C	A	-	-
80	N146	Highfields Mines	SK 213743	3	-	B/C/-/C	A (W)	-	(B)
81	N147	'Longstone Moor Mines'	SK 213738	1	-	C/C/-/C	A (W)	-	-
82	46	Enterprise and Shepherds Mines, Sallet Hole, Unwin Vein and Talbot Holes	SK 221742	14	-	A/A/A/B	A	-	(B)
83	43	Mootlow, Cowslip and Crossdale Head Veins	SK 182732	12	-	A/A/A/C	A (W)	-	-
84	N148	Mootlow Vein (east)	SK 191729	6	-	C/C/-/C	A (W)	-	-
85	B8	Ash Nursery Mine	SK 197728	1	-	C/C/A/C	C	-	-
86	45	Longstone Edge, Hard Shaft and Silver Hillocks Veins, with Silver Hillocks Mine	SK 208730	42	-	C/A/A/B	A (W)	((S))	(B)
87	N149	Ash Nursery Vein	SK 201726	1	-	B/C/-/C	A	-	-
88	N150	Hassop Sough Vein (west)	SK 202723	1	-	C/C/-/C	A (W)	-	-
89	N151	Hard Rake, Ash Nursery and Hassop Sough Veins	SK 206724	6	-	B/C/-/C	A	-	-
90	49	Brightside, Middle Engine, Evans Gin, Harrybecca, Bacon's and White Coe Mines	SK 222732	21	V	C/B/A/A	A (W)	((S))	-
91	B9	Muse Mine	SK 230739	1	-	C/B/A/B	U	-	-
92	47	Catsall Rake	SK 235738	1	-	C/A/A/B	U	-	-
93	-	Red Rake	SK 236740	3	-	B/A/A/B	U	-	-
94	48	Red Rake Mine and Newburgh Level	SK 239740	1	-	C/C/A/B	U	(S)	-
95	B10	Brightside Sough	SK 242744	1	-	-/-/A/C	U	-	-

The Central Orefield – Taddington, Monyash, Bakewell and Youlgreave.

A	B	C	D	E	F	G	H	I	J
96	-	St Peters Mine	SK 130731	1	-	C/C/-/C	A	-	-
97	52	Maury Mine and Sough	SK 146729	10	-	A/A/A/A	A	(S)	(SAC/B)
98	-	'Maury Vein'	SK 156733	3	-	B/C/-/C	A	-	(SAC/B)
99	51	Lees and Dove Rakes, Booth Lee Pipes and Sterndale Sough	SK 156727	23	-	A/A/A/A	A	S	(SAC/B)
100	53	Dove Rake and Bulltor Title	SK 152724	5	-	B/B/-/C	A	-	(SAC/B)
101	-	Windy Low Pipe	SK 168721	2	-	B/C/-/C	A	-	-

102	-	Clocker Mine	SK 175719	1	-	C/C/-/C	A (W)	-	-
103	-	'Brushfield Veins'	SK 165716	1	-	B/C/-/C	A	-	-
104	-	Middle Pasture Rake and Break Blast Vein	SK 167715	2	-	B/C/-/C	A	-	-
105	50	Putwell Hill Mine	SK 174717	4	V	A/A/A/A	A (W)	S	(SAC/B)
106	54	Grove Rake	SK 118704	1	-	A/B/-/C	A (W)	-	-
107	N152	'Middlehill Rake'	SK 128711	1	-	B/C/-/C	A (W)	-	-
108	N153	Wham Rake	SK 133710	5	-	B/B/-/C	A (W)	-	-
109	-	Glory Mine	SK 133717	1	-	B/C/A/C	A	-	-
110	-	Horsesteads Vein	SK 142715	2	-	A/A/A/B	A	-	-
111		Edge Top Mine	SK 150714	1		B/A/B/-	U	-	-
112	-	Swine Rake	SK 152713	1	-	B/C/-/C	A	-	-
113	-	Tapistone Vein	SK 161710	1	-	C/C/-/C	A	-	-
114	57	Sheaths Pipe	SK 155703	2	-	A/A/-/C	A (W)	-	-
115	58	Crotie Rakes	SK 155698	4	-	A/B/-/B	A (W)	-	-
116	N155	'High Stool'	SK 127690	1	-	B/C/-/C	A	-	-
117	55	Upper Hubbadale – Water Engine Shaft	SK 137702	1	-	B/B/A/C	A	-	-
118	N154	Field Head Vein	SK 140699	1	-	C/C/-/C	A (W)	-	-
119	56	Hubbadale Pipe – Dressing Floors, Fidler's and Sough Forefield Shafts	SK 140697	1	-	A/A/A/B	C (W)	-	-
120	B12	Hubbadale Pipe – Two Gins Shaft	SK 142694	1	-	B/C/A/C	C	-	-
121	B13	Hubbadale Pipe – Crotie Gin Shaft	SK 147695	1	-	B/C/A/C	U	-	-
122	B14	Hubbadale Pipe – Ralph White Close Shaft	SK 147693	1	-	B/C/A/C	U	-	-
123	59	Whale Rake	SK 154693	4	-	A/B/B/B	A	-	-
124	60	Whale Sough	SK 160694	1	-	-/-/A/A	A	-	-
125	61	Shake Rope and Sun Veins	SK 159690	12	-	A/B/-/B	A	-	((SAC/B))
126	63	Hard and Glead Rakes, with 'High Low Mines'	SK 156683	44	-	A/A/A/B	A (W)	-	-
127	62	Fieldgrove Vein	SK 167697	2	-	A/A/A/A	A (W)	-	((SAC/B))
128	N156	Singlow Common Vein	SK 168692	1	-	B/C/-/C	A (W)	-	-
129	64	Magpie and Dirty Redsoil Mines, with Talbot Holes	SK 171681	15	-	A/A/A/A	A (W)	(S)	-
130	65	Trueblue Mine	SK 178680	1	-	B/A/A/B	A (W)	S	-
131	B11	Magpie Sough	SK 179696	1	P	A/-/A/A	C	-	-
132	N157	Kirkdale Rake and Woodfurlong Vein	SK 179689	3	-	B/C/-/C	A	-	-
133	N159	'Kirkdale Mine (south-east)'	SK 182685	1	-	B/C/-/C	A (W)	-	-
134	N158	Arrock Vein	SK 189692	3	-	B/C/-/C	A (W)	-	-
135	74	'Sparklow Mines'	SK 128658	28	-	A/-/-/C	A (W)	-	-
136	70	'Hutmoor Butts Mines'	SK 135670	26	-	A/B/B/B	A (W)	-	-
137	73	'Tagg Lane Mines'	SK 140661	4	-	B/C/-/B	A	-	-
138	69	Crimbo and Whalfe Pipe Mines	SK 144674	7	-	A/A/A/A	A	-	G
139	68	Brecks Mine	SK 149677	1	-	C/B/-/C	A	-	G
140	67	'Bagshaw Dale Mines'	SK 156666	2	-	B/-/-/C	A (W)	-	-
141	66	Great Greensward Mine	SK 164672	1	-	B/A/A/A	A	-	-
142	-	Old Beck Mine	SK 169671	1	-	B/B/A/A	A	-	-
143	N160	Mandale Rake (north-west)	SK 169675	4	-	C/C/-/C	A	-	-
144	-	Long Rake	SK 130647	1	-	C/C/-/B	A	-	-
145	75	Cotesfield Mine	SK 136647	1	-	C/B/A/C	A	-	-
146	-	'The Street Mines'	SK 142648	3	-	C/C/-/C	A	-	-
147	79	'Summerhill Mines'	SK 154644	5	-	B/B/B/B	A	-	-
148	80	'One Ash Moor Mines' and Water Icicle Close Mine	SK 159643	16	-	B/B/A/A	A	-	((G))
149	72	Pasture/Hole Rake	SK 158656	2	-	B/B/-/C	A (W)	-	-
150	71	'Ferndale Mines'	SK 159659	1	-	C/-/-/C	A	-	-

151	77	Mandale Rake	SK 186665	4	-	A/B/A/C	A	-	-
152	78	Mandale and Lathkill Dale Mines, Soughs and Veins, with Sideway and Gank Hole Veins	SK 194659	55	V	A/A/A/A	A	(S)	(SAC/B)
153	B15	Long Rake Mine	SK 187642	1	-	C/C/A/C	-	-	-
154	81	Long Rake Open-cuts	SK 196646	2	V/P	C/A/-/A	A	-	-
155	N161	'Lomberdale Mines (west)'	SK 190641	4	-	B/C/-/C	A	-	-
156	N162	'Crossflat Mines'	SK 187637	1	-	B/C/-/C	A	-	-
157	N163	Spar Rake and Fryday Vein	SK 189633	4	-	B/C/-/C	A	-	-
158	N164	Beet Need Vein	SK 194639	2	-	B/C/-/C	A	-	-
159	N165	Soft Rake	SK 195641	1	-	B/C/-/C	A	-	-
160	N166	'Lomberdale Mines (east)'	SK 200643	4	-	B/C/-/C	A	-	-
161	N167	'Lomberdale Mines (south-east)'	SK 202641	1	-	C/C/-/C	A	-	-
162	N171	Timperley, Alma and Cobbler Mines	SK 201635	9	-	B/C/-/C	A	-	-
163	N172	Calton Hill Pipe	SK 208638	1	-	C/C/-/C	A	-	-
164	N173	Wenley Hill Vein	SK 208636	1	-	B/C/-/C	A	-	-
165	N174	Mawstone Mine	SK 211633	1	-	-/A/A/C	A	-	-
166	N175	Black Shale Pitts and Pienet Nest Veins	SK 215638	1	-	-/C/B/C	A (W)	-	-
167	N176	Bacon Close Vein and Page's Shaft	SK 218638	2	-	-/A/A/C	A (W)	-	-
168	82	'Bradford Dale Mines'	SK 216641	3	-	B/B/B/C	A (W)	-	-
169	N170	'Bradford Dale Mines (north)'	SK 217643	1	-	B/C/-/C	A (W)	-	-
170	N177	Prospect Mine (south)	SK 223641	2	-	B/C/-/C	A	-	-
171	B22	Prospect Mine	SK 223642	1	-	-/C/A/C	I	-	-
172	N168	'Youlgreave Fields Mines (west)'	SK 211648	1	-	B/C/-/C	A	-	-
173	N169	'Youlgreave Fields Mines (east)'	SK 216646	2	-	B/C/-/C	A	-	-
174	B21	Broadmeadow Mine	SK 224643	1	-	-/C/A/C	-	L	-
175	83	Blith Forefield Mine	SK 225643	1	-	-/C/B/B	A	-	-
176	N178	Wheels Rake Mine and Shining Sough	SK 228648	2	-	B/B/A/C	U	-	-
177	B19	Bowers Rake Goit	SK 236651	1	-	-/-/A/-	U	-	-
178	84	Thornhill's Sough and Bowers Rake	SK 237649	1	-	B/-/A/C	U	-	-
179	B18	Rainster Sough	SK 238653	1	-	-/-/A/C	U	-	-
180	B17	Black Sough	SK 241657	1	-	-/-/A/C	U	-	-
181	B20	Stanton Sough	SK 250656	1	-	-/-/A/C	U	-	-
182	85	Hillcarr Sough	SK 259637	1	-	-/-/A/A	U	S	-
183	B23	Hillcarr Sough – Brown Bank Shaft	SK230630	1	-	-/-/A/C	B	-	-
184	N179	'Kenslow Mines'	SK 184627	2	-	C/C/-/C	A	-	-
185	N180	Limekiln Rake	SK 182624	1	-	C/C/-/C	A	-	-
186	N181	Wood Top Vein	SK 184622	1	-	B/C/-/C	A	-	-
187	N182	'Bolderstone Mines (west)'	SK 176609	1	-	C/C/-/C	A	-	-
188	N183	'Bolderstone Mines (east)'	SK 180608	1	-	B/C/-/C	A	-	-
189	N185	Umber Mine	SK 190612	3	-	C/C/-/C	A	-	-
190	N186	'Gratton Mines'	SK 200613	1	-	B/C/-/C	A (W)	-	-
191	N184	Long Rake	SK 190603	5	-	A/C/-/C	A	-	(SAC/B)
192	86	Mouldridge Mine	SK 194595	3	P	A/A/A/A	A	-	SAC/B

The South-Eastern Orefield – Winster, Matlock and Wirksworth.

A	B	C	D	E	F	G	H	I	J
193	87	Dunnington and Hardbeat Mines, Rath and Cowlica Rakes, and Rath Rake Sough	SK 211605	25	-	A/A/A/B	A (W)	(S)	-
194	88	Rainslow Scrins	SK 220603	14	-	B/A/A/B	A (W)	(S)	-
195	89	Portaway Mine	SK 230611	1	-	C/B/-/A	A	-	-
196	91	Brown Edge, White Great Rake and Lickpenny Mines	SK 234601	6	-	A/B/A/B	C	-	-
197	B24	Winster Ore House	SK 237601	1	-	-/-/A/-	-	-	-

198	90	Yatestoop Mine	SK 244614	5	-	-/B/A/A	U	-	-
199	B25	Old Millclose Mine – Watt's Engine House	SK 258618	1	-	C/B/A/A	A	S	B
200	B26	Millclose Mine	SK 258623	1	V/P	C/B/A/A	-	-	-
201	B27	Yatestoop Sough	SK 264626	1	-	-/-/A/A	-	-	-
202	92	Hadland and Delf Veins	SK 241603	1	-	B/C/B/B	A	-	(G)
203	94	'Longtor Mines'	SK 248600	8	-	C/A/A/B	A (W)	-	-
204	93	Winster Pitts, Drummers Venture, Horsebuttocks and Burning Drake Mines	SK 247603	6	-	A/A/A/A	A	(S)	-
205	95	Wet Sough, Limekiln and Painterway Veins	SK 244609	3	-	B/B/A/A	A	-	-
206	96	Bithoms Veins, Innocent Mines and Weet Sough	SK 249607	12	-	A/B/A/B	A	-	-
207	N187	Shakersdale Mines (north)	SK 253606	1	-	B/B/-/C	A	-	-
208	97	Watterings Close and Shakersdale Mines	SK 254603	2	-	A/A/A/B	A	-	-
209	98	Davis and Mount Pleasant Mines, Basrobin Sough, and Old Millclose Mine	SK 259607	35	V/P	A/A/A/A	A	(S)	-
210	99	Old Ash, Lords and Ladies, Northern Dale Pipe, Hit and Miss and Tearsall Mines, with Snitterton Park Fire Engine	SK 267605	34	V/P	A/A/A/A	A	(S)	-
211	100	Oxclose, Lee Wood, Lee Close, Ash Plantation and Noon Nick Mines, with Crowholt Level and Lee Close/White Hillocks Sough	SK 272598	63	V/P	A/A/A/A	A	((S))	((G))
212	N189	Hunger Hill Vein and Naylor Yate Mines	SK 281595	4	-	B/C/-/C	A	-	-
213	B28	Orchard Sough	SK 281608	1	-	-/-/A/A	-	-	-
214	101	Old Kennill Grove	SK 252597	1	-	C/-/-/C	A	-	-
215	N188	Slack Mines	SK 258599	7	-	B/C/-/C	A	-	-
216	102	Gorseydale, Hangworm, Beans and Bacon, Slack Breaks and Fiery Dragon Mines	SK 255592	36	-	A/A/A/A	A (W)	(S)	-
217	103	'Whitelow Mines' (west)	SK 252581	7	-	A/A/A/B	A (W)	-	-
218	104	'Whitelow Mines' (east)	SK 257583	10	-	C/A/A/B	A (W)	-	-
219	105	'Horsedale Mines' (north-west)	SK 264585	4	-	B/B/B/B	A (W)	-	-
220	106	'Horsedale Mines' (south-east) and Horsedale Sough	SK 267581	10	-	A/A/A/B	A	-	-
221	107	'Bonsall Lees Mines'	SK 267573	55	-	A/A/A/B	A (W)	(S)	(B) Bonsall Leys; ((SAC/B)) Via Gellia
222	NB38	Low Mine	SK 281585	2	-	C/A/A/C	U	-	-
223	-	Dovedale and Sparhole Mines	SK 290585	3	-	A/B/-/B	Wood	-	B
224	-	The Upper Nestus Pipes	SK 290589	5	-	C/C/B/-	A	-	-
225	B29	Masson Farm Level	SK 292590	1	-	C/C/A/B	-	-	-
226	111	High Tor Mines	SK 297589	5	-	C/A/A/A	A (W)	(S)	((SAC/B))
227	-	Jackdaw and Station Quarry Veins	SK 296582	1	-	C/C/-/C	A (W)	-	-
228	-	'Marks Dale Mines'	SK 251561	12	-	A/A/A/B	U	-	-
229	-	Red Rake	SK 255560	2	-	B/C/-/C	A (W)	-	-
230	-	'Ible Wood Mines'	SK 255565	7	-	B/A/A/B	B	-	SAC/B
231	114	Snake Mine	SK 261555	1	-	A/A/A/A	A	S	-
232	113	Black Rakes, Welshmans Venture Mine, Bondog Hole Mine, with Merry Tom and Thumper Sitch Levels	SK 265562	36	V	A/A/A/A	A	S	(SAC/B)
233	112	'Via Gellia Mines'	SK 278572	91	V/P	A/A/A/A	A	-	(SAC/B) Via Gellia; B Rose End Meadows
234	B30	Carnhill Wifes Sough	SK 292573	1	-	-/-/A/A	-	-	-
235	B32	Cromford Sough	SK 295568	1	-	-/-/A/A	-	S	-

236	B31	Bullestree Sough	SK 303573	1	-	-/-/A/B	-	-	-
237	-	Rose Rake and Slintor Great Vein	SK 291566	3	-	B/C/-/C	A	-	B
238	-	'Hallicar Lane Mines (East)'	SK 281566	2	-	C/C/-/C	A (W)	-	-
239	-	'Hallicar Lane Mines (West)'	SK 278566	1	-	B/C/-/C	A (W)	-	-
240	-	'Burrows Mine area'	SK 274564	9	-	C/C/-/C	A	-	(B)
241	-	'Stichen Mine area'	SK 279562	2	-	C/C/-/C	A	-	(B)
242	B33	Godbehere Vein and Cromford Moor Mine	SK 290556	2	-	B/B/A/A	A (W)	-	-
243	115	Gang Mine	SK 286557	14	-	A/A/A/B	A (W)	-	(SAC/B)
244	-	Gang Vein	SK 283556	3	-	C/C/-/C	A (W)	-	-
245	-	Magpie Scrins	SK 282560	2	-	C/C/-/C	A (W)	-	-
246	B34	Ratchwood Mine – Founder Shaft	SK 283552	1	-	B/A/A/A	U	-	-
247	116	Ratchwood and Rantor Mines	SK 284549	6	-	-/A/A/B	A (W)	S	-
248	-	'Colehill Quarry Veins'	SK 287551	1	-	C/C/-/C	A	-	G
249	B37	Meerbrook Sough	SK 326552	1	-	-/-/A/A	-	S	-
250	B35	Meerbrook Sough Mine	SK 288545	1	-	C/A/A/C	-	L	-
251	-	Yokecliffe Rake (East)	SK 275537	3	-	B/C/-/C	A (W)	-	-
252	117	Dream Hole, Fox Holes and Sand Hole Mines	SK 273531	14	-	A/A/B/A	A	-	-
253	-	'Intake Quarry South Veins'	SK 270546	4	-	C/C/-/C	A	-	-
254	-	'Intake Quarry North Veins'	SK 271550	8	-	C/C/-/C	A	-	-
255	118	Yokecliffe Rake, with Quickset, Old Gells/ Ash Tree, Shining Cloud and Nile Mines	SK 265539	27	-	A/B/-/A	A (W)	-	-
256	119	'Carsington Pasture', with Great Rake, Nickalum and Perseverance Mines	SK 244542	171	-	A/A/A/A	A	(S)	-
257	120	Roundlow Mine	SK 238548	3	-	A/B/A/B	A (W*)	-	-
258		'Kings Hill Mine'	SK 232546		-	C/C/-/C	A	-	-
259	121	'Rainster Rocks and Suckstone Mines'	SK 223547	62	-	A/B/A/B	A (W)	-	-
260	-	Ballington Wood Mine	SK 211547	2	-	A/A/A/B	U	-	-
261	-	'Ballidon Oldfields Veins'	SK 204551	4	-	C/C/-/C	A	-	-

The Eastern Outliers - Ashover and Crich.

A	B	C	D	E	F	G	H	I	J
262	N191	Blackwell and Spencers Rakes	SK 353621	1	-	C/A/-/A	U	-	-
263	N192	Wakebridge Mine	SK 339557	1	-	C/B/A/C	U	-	-
264	B36	Fritchley Sough	SK 358534	1	-	-/-/A/A	-	-	-

The North-Western Fringes – Buxton.

A	B	C	D	E	F	G	H	I	J
265	-	'Upper Edge Veins'	SK 075689	2	-	B/C/-/C	A (W)	-	-
266	-	'Greensides Mines'	SK 071685	2	-	C/C/-/B	A	-	-
267	-	Gingerbread Rake	SK 077682	3	-	C/C/-/C	A (W)	-	-
268	-	Fortunate Vein	SK 088678	2	-	C/C/-/C	A	-	-
269	-	'Hitter Hill Veins'	SK 087667	5	-	B/B/-/C	A (W)	-	-

The South-Western Fringes – Hartington and Parwich.

A	B	C	D	E	F	G	H	I	J
270	-	'Carder Low North Vein'	SK 127627	1	-	C/C/-/C	A (W)	-	-
271	-	Carder Low Vein	SK 129624	1	-	C/C/-/C	A (W)	-	-
272	76	Horsesteps Vein (west)	SK 133628	2	-	A/A/A/B	A	-	-
273	-	Horsesteps Vein (east)	SK 137626	1	-	B/C/-/C	A	-	(SAC/B)
274	-	Lean Low Rakes	SK 148626	5	-	C/C/-/B	A	-	-
275	-	'Greenhead Vein'	SK 157587	1	-	B/C/-/C	A	-	-

276	-	White Rake and Cobseats Vein	SK 159583	1	-	B/C/-/C	A	-	-
277	-	'Lees Barn Veins (north)'	SK 157572	3	-	B/C/-/C	A (W)	-	-
278	-	'Lees Barn Veins (south)'	SK 156567	3	-	C/C/-/C	A	-	-
279	-	Ramshorn Vein	SK 163675	1	-	C/C/-/C	A	-	-
280	-	Alsop Moor Ironstone Mine	SK 166573	2	-	A/B/A/C	A (W)	-	-
281	-	'Parwich Upper Moor Veins'	SK 171574	4	-	B/C/-/C	A	-	-
282	-	'Parwich Middle Moor Veins'	SK 178561	2	-	C/C/-/C	A	-	-
283	-	'Roystone Rocks Vein'	SK 196568	1	-	B/C/-/C	A	-	-
284	-	'Minninglow Grange Veins'	SK 204577	2	-	C/C/-/C	A (W)	-	-
285	-	'Minninglow Vein'	SK 207575	1	-	C/C/-/C	A	-	-
286	-	'Ballidon Moor Veins (north)'	SK 208567	4	-	B/C/-/C	A	-	-
287	-	'Ballidon Moor Veins (south-west)'	SK 207564	2	-	B/C/-/C	A	-	-
288	-	'Ballidon Moor Veins (south-east)'	SK 211562	1	-	B/C/-/C	A	-	-
289	-	'Green Low Mines'	SK 231582	1	-	B/C/-/C	A	-	-
290	-	'Parwich Hill Veins'	SK 186551	2	-	C/C/-/C	A	-	-
291	-	Rushycliff and Nancy Consuls	SK 177531	4	-	A/B/-/B	A (W)	-	-

The Staffordshire Mines – Warslow, Wetton and Stanton.

A	B	C	D	E	F	G	H	I	J
292	108	Dale Mine	SK 094586	7	P	A/A/A/A	A	-	G
293	109	'Ecton Mines'	SK 099580	77	V/P	A/A/A/A	A	(S)	(B) Hamps and Manifold;/ (G) Ecton Copper Mines
294	-	Botstone Mine	SK 092562	2	-	B/B/B/C	A	-	B
295	110	Bincliff, Oversetts and Highfields Mines	SK 116537	30	-	A/A/A/A	A	-	(SAC/B)
296	N190	Thorswood Mine	SK 111470	8	-	A/B/A/A	A (W)	S	-

<u>Sites where the Primary Archaeological Interest is Underground</u>

The Northern Orefield – Castleton, Peak Forest, Bradwell, Eyam and Longstone.

A	B	C	D	E	F	G	H	I	J
U1	U1	Old Tor Mine	SK 135827	1	-	C/B/-/A	-	-	G
U2	U2	Speedwell Mine	SK 139827	1	V/P	C/B/-/A	-	-	G
U3	U3	Peakshole Sough	SK 148827	1	-	-/-/B/A	-	-	G
U4	U4	Bird Mine	SK 157812	1	-	C/B/-/A	-	-	-
U5	U5	Moorfurlong Mine	SK 168812	1	-	B/B/-/A	-	-	-
U6	NU38	Calf Pingle North Mine	SK 209771	1	-	C/C/-/A	-	-	-
U7	-	White Rake	SK 216763	1	-	C/B/-/A	-	-	O
U8	U6	Great Cucklet Mine	SK 215759	1	-	B/B/-/A	-	-	O
U9	NU39	Stub Scrin	SK 219760	1	-	C/C/-/A	-	-	-
U10	U7	Merlins Mine	SK 217759	1	-	B/B/-/A	-	-	O
U11	U8	Watergrove Sough	SK 209759	1	-	-/-/B/A	-	-	O
U12	U9	Moorwood Sough	SK 232754	1	-	-/-/B/A	-	-	-
U13	-	Northcliffe Sough	SK 237738	1	-	C/C/-/A	-	-	-

The Central Orefield – Taddington, Monyash, Bakewell and Youlgreave.

A	B	C	D	E	F	G	H	I	J
U14	U10	Greensward Rake (south-east)	SK 166670	1	-	C/B/-/A	-	-	-
U15	U11	Broadmeadow Mine – Shale Drift	SK 221644	1	-	-/-/-A	-	-	-

The South-Eastern Orefield – Winster, Matlock and Wirksworth.

A	B	C	D	E	F	G	H	I	J
U16	U12	Cowclose Mine – Main Drawing Shaft	SK 224606	1	-	B/B/-/A	-	-	-
U17	U13	Cowclose and Leadnams Mines	SK 226804	1	-	B/B/-/A	-	-	-
U18	U14	Portaway Mine – Engine Shaft	SK 230618	1	-	C/B/-/A	-	-	-
U19	U15	Portaway Mine – Fishers Shaft	SK 231610	1	-	C/B/-/A	-	-	-
U20	U16	Wills Founder Shaft	SK 234607	1	-	B/B/B/A	-	-	-
U21	U17	Placket Mines	SK 237610	1	-	C/B/-/A	-	-	-
U22	U18	Placket Mines	SK 239608	1	-	C/B/-/A	-	-	-
U23	U19	Upper Orchard Mine	SK 241604	1	-	B/B/-/A	-	-	-
U24	U20	Upper Orchard Mine – Old Weston Shaft	SK 239603	1	-	C/B/-/A	-	-	-
U25	U21-25, NU40	Old Millclose Mine and Millclose Sough	SK 260615	44	V/P	C/B/B/A	-	-	-
U26	U29	Masson Sough, Old Jants Mine and Gentlewoman's Pipe	SK 295594	1	V/P	-/-/C/A	-	-	G
U27	U30	Nestus and Longtor Mines, and Bacon and Coalpit Rakes	SK 291590	36	V/P	B/B/-/A	-		(G)
U28	U31	Side Mine	SK 296588	1	-	C/C/ -/A	-	-	-
U29	U32	Owlet Hole and Temple Mine	SK 292580	1	P	C/C/-/A	-	-	-
U30	U33	Hagg Mine	SK 296577	1	-	C/B/-/A	-	-	O
U31	U34	Wapping Mine and Cumberland Cavern	SK 292576	3	V/P	C/C/-/A	-	-	G
U32	NU42	Moletrap Vein	SK 296574	1	-	C/B/-/A	-	-	-
U33	-	Allen's Hill Mine	SK 296568	1	-	C/C/-/A	-	-	-
U34	-	Middleton Stone Mine	SK 276557	1	V/P	C/C/-/A	-	-	-
U35	U36	Haslowfield Level	SK 260561	1	-	C/B/-/A	-	-	O
U36	U37	Golconda Mine	SK 249551	1	P	C/A/-/A	-	-	-
U37	U35	Bage Mine	SK 291550	1	V	C/C/-/A	-	-	G
U38	-	Cauton Vein	SK 280539	1	-	C/B/-/A	-	-	-

The South-Western Fringes – Hartington and Parwich.

A	B	C	D	E	F	G	H	I	J
U39	U27	Hartington Level	SK 145611	1	-	B/B/-/A	-	-	-

The Staffordshire Mines – Warslow, Wetton and Stanton.

A	B	C	D	E	F	G	H	I	J
U40	U26	Royledge Mine and Sough	SK 045591	1	P	-/-/B/A	-	-	-
U41	NU41	West Ecton Mine	SK 091580	1	-	C/B/-/A	-	-	-
U42	U28	Robin's Shaft Mine	SK 135527	1	-	C/B/-/A	-	-	-

Note: Other mines with significant underground interest are listed in the table of Main Sites above (sites 1, 4, 5, 6, 8, 16, 17, 22, 29, 35, 36, 47, 57, 72, 78, 90, 97, 99, 105, 124, 127, 131, 138, 141, 142, 148, 152, 154, 182, 192, 195, 198, 199, 200, 201, 204, 205, 209, 210, 211, 213, 216, 226, 231, 232, 233, 234, 235, 242, 246, 249, 252, 255, 256, 262, 264, 292, 293, 295, 296).

Appendix 2: The Role of RIGGS

Regionally Important Geological and Geomorphological Sites (RIGGS) (also known as Regionally Important Geological Sites (RIGS) are locally designated sites of local, regional and national importance for geodiversity (geology and geomorphology) in the UK. They are locally designated for their value to earth science, and to earth heritage in general, but may also include cultural, educational, historical and aesthetic resources. They do not have the statutory protection enjoyed by Sites of Special Scientific Interest (SSSIs).

Currently there is little overlap between RIGGS in the Peak District orefield and those sites listed here as of geological interest. The geological notes provided in this report largely relate to mineralisation and related features that can be observed underground. RIGGS do not normally cover underground sites that are inaccessible or lost, nor related to surface quarrying activities. RIGGS that have interesting mineralisation which fall into the last category, and thus not included here, include Arbor Low (stalactitic barite), Donkey Pastures, Winster (acicular barite), quarry near Miners Arms, Winster (acicular barite), Glory Mine, Crich ('Crich Spar') and Smalldale Pipe (Hope Quarry).

Appendix 3: Criteria for Assessment of Archaeological Importance

Overview: The Project archaeological assessment of metal mining remains has quantified the varied archaeological character of the resource and identified the locations of a wide range of features which survive. A brief overview is given here, while a catalogue of important features by specific feature-type is given in tabular form below. In determining what sites to include in the Inventory a series of 165 distinct types of interest have been identified; these fall into seven overarching categories which are described below. Unlike the ecological interest, which can be assessed under a small number of vegetation community types, with some sites taking on additional interest because of their more general wildlife potential, the archaeological features are significantly more disparate in character. Thus it would be wrong to prioritize specific feature-types in terms of relative importance; it is the variety itself which is a key factor in the conservation interest.

Hillocks: The eight common types of hillocks found varies according to geological and historical factors. Representative examples in good condition of all defined types have been identified and given Category A status (following Appendix 1, column G and table below). These include a number of examples of hillocks at rake veins of various sizes. While many of the very largest of these have been extensively reworked for gangue minerals, two fine examples survive at Tideslow Rake near Great Hucklow and Oxlow Rake above Peak Forest. Also a sample of hillocks at isolated small veins has also been included as Category A to ensure this once common type of feature is represented. Another common type of hillock comprises examples where, while each is individually relatively-small, there are large numbers in small areas because many small veins occur together and/or where there are complex pipeworkings underground. In both cases survival to today has been relatively good because of the difficulty of improving such land for agricultural purposes. These workings are particularly common in the southern half of the orefield. Rarities include small hillocks at outcropping pipes, and at mineralisation in limestone joints known as blockwork. Large vein workings at depth under shale overburden occur as distinctive, often large, spaced hillocks; similar mounds occur at sough airshafts. With both, surviving examples are again relatively rare compared with vein workings at surface.

Reworking of hillocks for previously discarded ore was very common, particularly in the 16th and 18th centuries with radical improvements in smelting technology, and in the 19th century when rich ore sources underground were becoming scarce. A small number of sites have been highlighted as category A where evidence for such practices are particularly clearly seen. Early fluorspar extraction concentrated on the richest deposits and hillocks were often not fully removed, nor were sites 'restored'. Two examples have been included that represent this activity particularly well.

Other Common Features: Of the ten types of common surface features found at many mines, a number of sites have open-cuts that have not been fully backfilled by lead or gangue miners. In a few cases these are particularly deep with rock walls, as for example at Odin Mine and Dirtlow Rake, both near Castleton, and at the High Tor Mines above Matlock. The grass-covered open-cuts at Tideslow Rake near Great Hucklow are exceptionally large, while there are rare pipeworking opencasts at the Dunnington and Hardbeat Mines at Elton. While there are many shafts remaining, despite the majority having been lost, nearly all are now capped with old railway sleepers or concrete slabs and thus not easily visible. However, a range of engine and climbing shafts can be viewed in safety at the grilled examples at Magpie Mine. Further good examples of grilled engine shafts exist at Jowle and Watts Groves on Eldon Hill, and at Old Seedlow Mine near Wardlow. Unusual shafts include that for the Dakeyne Engine at Bateman's House in Lathkill Dale and those with climbing stones at Greensward Rake near Monyash. Mine access levels were always less common than shafts and are usually found on steep dalesides, as for example flanking the Via Gellia west of Cromford and at the Ecton Mines.

Coes, often at or near shafts and levels, are usually small and ruined, although there are also examples of 18th and 19th century date that are relatively large. Some stand to nearly full height, as at How Grove on Dirtlow Rake, at the Fieldgrove Vein near Sheldon and at Jacobs Dream Mine in the Via Gellia. Virtually all mines once also had dressing floors adjacent to their shaft tops or level entrances. However, many have been disturbed by later mining and hillock reworking. Notable exceptions include small examples on Bonsall Lees, Black Rakes and Snake Mine all above the Via Gellia, and late reworking floors at How Grove on Dirtlow Rake, at Maury Mine near Priestcliffe, and at Great Rake Mine above Carsington. Associated with many dressing floors there are water storage ponds, together with ore-dressing ponds and pits. This aspect of the surface archaeology has previously been little studied, but it is clear after fieldwork for the Lead Legacy Project that these features are relatively common and very varied in type. There are complex suites of such features on Oxlow and Tideslow Rakes and many simpler arrangements elsewhere. In the Winster and Wensley area there are good examples of leats for water that was drawn up shafts from underground. Many mining sites were walled out, in enclosures known as belland yards, to keep stock away from the toxic waste heaps. In some cases these appear to have been created late, when commons were enclosed, in some instances perhaps after the mines were abandoned. Some mine enclosures are integrated with the general field layout, as for example at Tideslow Rake and at Magpie Mine, while other belland yards lay within larger enclosures, as at the Linacre/ Slitherstones/Eldon Hill area above Peak Forest and at the High Low Mines near Sheldon.

Rare/Special Features: These are too numerous in type to fully describe here; 61 separate sets of features have been identified. Amongst the highlights are engine houses, with a particularly early example at Ecton and large Cornish-type engine houses at Magpie Mine near Sheldon, at Mandale Mine in Lathkill Dale and at Old Millclose Mine near Darley Bridge. The simpler horse-gins frequently left a footprint in the form of a gin circle. There are a number of well-preserved examples of these, including particularly large ones at Ecton and one on a high platform at High Rake near Great Hucklow. A relatively rare type of gin circle comprises those terraced into slopes as opposed to being set on hillock tops, which is the norm. A further set of distinctive circular features is horse-drawn ore crushers, with surviving horse tracks and/or crushing wheels. These include the well-known atypical example at Odin Mine and an exceptionally well-preserved one at How Grove. Other ore-dressing features include rare banks of bouse teems for ore washing and small, stone-lined buddling troughs. The best survival of the former is at Brightside Mine near Hassop, while there are particularly interesting examples of the latter at Winster Pitts and Bonsall Lees. Atypical circular

buddles have been excavated and conserved at How Grove. Notable examples of sough entrances include those at Magpie Sough by the River Wye, Mandale Sough in Lathkill Dale and Meerbrook Sough by the River Derwent.

Archaeological and Documentary Evidence: One exceptional site is the Ecton Mines, where archaeological evaluation has demonstrated prehistoric copper mining dating to about 3500-4000 years ago. The visible surface mining features of all types at the majority of sites may well be mostly post-medieval in date, although many hillocks may have earlier origins and/or mask medieval or even Roman mining features. In a few cases rare documentary evidence allows medieval origins to be confirmed, although, with the current absence of archaeological excavation, identifiable physical evidence at surface remains elusive (in contrast, recent research underground has identified several medieval/early post-medieval mines).

Some sites are particularly important as the hillocks have direct relationships with medieval and earlier agricultural features such as strip lynchets and field banks, and thus give information on the relative age of the mining. While the hillocks often overlie such features, in one case at least, on Carsington Pasture, there are strong indications that some of the mining is earlier.

Mine Complexes: Some mining sites take on additional importance because they include relatively complete complexes of features and thus tell us much about how mining was organised. These range from the exceptionally large and complete site at Magpie Mine to a small walled dressing floor with only a drawing shaft, a climbing shaft, a coe and a stone-lined buddling trough at Black Rakes. Between these two extremes there is a wide variety of sites, including a broad range of features; this makes all these sites valuable as they illustrate the complexity of the archaeological evidence. 20th century examples are rarer than those of 19th century and earlier date.

Underground Remains - Types of Working, Common Features, Rare/Special Features, Early/Late Mines: The first of these two categories include 7 types of interest and there are also 51 types of rare and special features; again listed below. The features included in both underground lists are accessible to explorers with specialist equipment and training. There may well be further underground features that await discovery at a significant number of sites where access is currently difficult. This said, the majority of the thousands of miles of mine passages that once existed have now undoubtedly collapsed or their entrances to all intents and purposes irrevocably sealed.

Types of Category A Archaeological Interest at Sites in the Inventory: The following table lists all important examples of the wide variety of features of conservation interest found at Peak District metal mines. With hillocks and common features, only important representative examples are given. With each of the 165 types of interest, specific key sites are identified – given in bold and underlined in the table below. These are selected because they are particularly instructive or well preserved examples of the specific type of interest, or are chosen to cover a range of variation (see Barnatt 2004 for analysis). Other sites listed below, which are not in bold nor underlined, are described in the Inventory and the specific interest is still of Category A importance; However, these mines are included in the Inventory because they have other types of interest at the key site level. There are also less important Category B features of interest noted in the Inventory texts as part of the group value; these are not listed in the table below.

Important Surface Remains - Hillocks

Feature type	*Sites (numbered following the Inventory)*
Rakes	**4**, 5, **6**, **7**, **8**, 14, 19, **21**, 29, 33, 35, 67, **73**, 74, 78, 83, **97**, **99**, 105, **106**, 110, **123**, **126**, 127, **129**, 151, 152, 178, **191**, 193, **223**, **255**, 256, 260, 272.
Particularly large rakes	**11**, **35**.
Smaller veins – fewer/single type	4, **15**, 19, 68, 82, **125**, 231, 233, 280, 293, **296**.
Smaller veins – multiple, closely-spaced, type	**8,** **72**, **115**, **126**, **135**, **136**, **206**, 208, **209**, **210**, 216, 217, 220, **221**, 228, 230, **232**, 233, **243**, **252**, 255, **256**, **259**, 295.
Pipes/flats (often with veins) – mined underground	36, 59, 117, 119, 120, 121, 122, 192, **193**, 196, **204**, 206, **209**, 210, **211**, 216, 233, 257, 292, **293**, **296**.
Pipes/flats (often with veins) – mined at surface	29, **99**, **114**, **138**, **193**, **210**, 211, **291**, 293.
Noteworthy examples of pre-20th century hillock reworking	7, 8, **11**, 19, **35**, **97**, **129**, 209, 272.
Noteworthy examples of early gangue reworking	**83**, **93**, **218**.

Important Surface Remains - Common Features

Open-cuts - deep with rock sides	**1**, **12**, **16**, **22**, 72, **90**, **92**, 93, **152**, **154**, **226**, **262**.
Open-cuts – Grass-covered sides but particularly large	**35**, **193**.
Open-cuts – shallow (some with rock sides)	4, 6, 7, **8**, 11, 12, 15, **19**, **21**, 74, 82, 83, 97, 99, 105, 106, 125, 126, 129, 154, **194**, 203, 209, 218, 221, 222, 243.
Shafts visible at surface – engine shafts (noteworthy examples only)	6, **8**, 10, 12, 22, **35**, 47, 48, 56, 59, **74**, **129**, **152**, **167**, **200**, 203, **293**.
Shafts visible at surface – climbing/drawing shafts (noteworthy examples only)	12, **110**, **129**, **141**, **221**, **230**, **232.**
Access level entrances	72, 82, 90, 93, **152**, **192**, 216, 221, **228**, 230, **231**, **232**, **233**, 293, 295.

Coes (noteworthy examples only)	4, 8, 11, **12,** 15, 19, 20, 21, 22, **35,** 67, 72, 74, 78, 82, 83, **86,** 90, **97**, 99, 111, **127**, **129**, **130**, 138, **152**, 192, 193, 203, 204, 208, 210, **211**, 216, **220**, **221**, **228**, 230, **231**, **232**, **233**, 243, 246, 247, 250, 252, 255, **256**, 260, 272, 295, **U36**.
Dressing floors and working platforms	1, 5, 6, 7, 8, 11, **12**, **15**, 16, 20, **22**, **35**, 50, 55, 68, 72, 78, 97, 126, 127, **129**, 130, 152, 192, **204**, 210, 217, **220**, **221**, 231, **232**, **247**, 255, 256, 292, **293**.
Water storage and ore-dressing ponds, and dressing pits	**6**, **7**, **8**, **11**, 12, 16, 20, 21, 22, **35**, **37**, 67, 68, **72**, 74, 78, 82, 97, **99**, **111**, **127**, **129**, 130, 136, **152**, 193, **204**, 210, 221, 232, **256**, 272.
Belland yards	5, **6**, **7**, **8**, **11**, 12, 15, 16, 19, 20, 21, **29**, 35, 48, 50, 59, 67, 72, 74, 83, 92, 97, **99**, 106, 111, 114, 127, **126**, **129**, **130**, 138, 152, 154, 192, 221, 232, 233, **256**, 292, 293, 295.

Important Surface Remains - Rare/Special Features

Hillocks from mining under shale	1, 39, 47, **48**, 50, 55, **56**, 166, 167, **198**, **246**, **247**.
Blockwork hillocks	**217**.
Streamside dressing hillocks	**66**
Pipe working entrances	**99**, **211**, **293**.
Blue John opencasts	**1**.
Sough hillocks	1, **2**, **3**, 14, **40**, **49**, **56**, **57**, 97, **99**, 124, 131, **178**, **182**, 193, 206, 210.
Soughs and pumpways – open tails	**57, 131**, **152**, **182**, **201**, **209**, **211**, **225**, 232, **233**, **235**, **236**, **249**, **264**, 292, **293**.
Soughs – bolt tails	1, **3**, 14, **26**, 49, **95**, **124**, **152**, **193**, **213**, 220.
Soughs – leats and goits	**72**, 97, **152**, **179**,**180**, **181**, **182**.
Sough jetty	182.
Large arched haulage level entrances	**90**, **94**, **293**.
18th and early 19th century Newcomen engine houses	29, **59**, 126, 198, 210, **211**, 232.
1788 Boulton and Watt engine house	**293**.
19th century Cornish engine houses, miners drys, boiler houses, flues and chimneys	**35**, **48**, **129**, **152**, **199**, **200**, **263**, 292.
19th century horizontal and other smaller engine houses, boiler houses, engine bases, flues and chimneys	6, 11, **13**, **36**, **39**, **47**, 48, 67, 90, **129**, 138, **141**, 199, **250**, 293.
Engine house reservoirs	35, **59**, **129**, 263, 292, **293**.
Balance shaft and conical retaining mound	**293**.
Balance-bob pit	**176**
Balance-bob platform	**50**.
Balance-rocker pit	**39**
Capstan sites	**35**, 199.
Coal yard	**35**.
Coal storage hoppers	**59**.
Mine offices/reckoning houses/overseers houses/ smithies, dressing sheds, etc.	**6**, **35**, **36**, **50**, **59**, **90**, 94, 105, **126**, **127,** **129**, **151**, **152**, 165, **174**, 199, **200**, 208, 243, 247, 256, 263, **293**.
Powder houses	**13**, 93, **129**, 152, 165, **171**, 232, 256, **293**.
Smelters at mine sites	293.
Ore house	**197**.
Waterwheel pits and other associated features	6, **152**, **176**, **177**.
Waterwheel reservoir	**6**, **176**.
Long leats to waterwheels and dressing floors, with reservoirs/header ponds	**152**, 292, **293**.
Aqueduct	**152**.
Tunnel for waterwheel leat	**152**.
Leats for water raised by pumping	**117**, **129**.
Water blasts and associated features	1, **183.**
Ventilation fire house – possible example	208.

Gin circles – atypically large	**35**, **293**.
Gin circles – on hillock or less-commonly on flat ground (possible examples excluded)	1, 4, **8**, **10**, **23**, **33**, 50, 55, **68**, 72, 74, **78**, 85, 90, 91, **96**, 99, **119**, **120**, **121**, **122**, 126, **127**, **129**, **130**, 138, 142, 145, 152, 193, **196**, 204, **209**, 216, 231, **232**, 246, 256, **257**, **260**, 272, 282, 293, **295**.
Gin circles – contoured into slope	**4**, **31**, **37**, **44**, **52**, 90, 110, 205, 228, 256, **293**, **296**.
Gin circles – possible cog and rung type	117, **221**.
Gin circle walls	**10**, 72, 74, 78, 85, **91**, **97**, 126, **127**, **129**, **130**, 152, **232**, 272, **295**.
Crushing circles/wheels	**1**, **8**, 11, **12**, **20**, 21, 23, **30**, **35**, **50**, 293.
Knockstones	1, **86**, 97.
Bouse teems	**11**, **82**, **90**, **99**, 247, **260**, **293.**
Ore washing ponds	**72**.
Ore storage bins	**4**, **5**, **8**, 16, **22**, 97.
Dressing floor plinths, paving, retained banks, lined pits, etc.	**35**, 152.
Trunk buddles/leats, from shafts to buddles or buddle dams, or associated with ponds	**11**, 12, **35**, **72**, 82, **99**, 111, **129**, 193, 194, **196**, **204**, **209**, 210, **211**, 256, 272.
Surface drains	**129**.
Buddles – stone-lined rectangular troughs	**7**, 196, 203, **204**, 208, 210, **211**, 217, **221**, 228, 230, **231**, **232**, 233, 256, 260.
Buddles – circular and D-shaped	**12**, 210, **293**.
Slime ponds and settling tanks	**6**, 11, **21**, 74, 83, **129**, 256, **292**, 293.
Buddle dams	7, 8, **11**, 22, **74**, 83, **97**, **99**, 129, **193**, **194**, **196**, **203**, **204**, 206, 208, **209**, **210**, **211**, 247, **256**.
Spaced shaft mounds (noteworthy examples only)	**4**, **193**
Extensive open-cut pickwork	**12**, **22**.
Vein walling	**8**, **16**, 19.
Vein causeway	19.
Open potholes and dolines on veins	**8**, **16**, **17**, 22.
Beehive caps	20, 56, **59**, **148**, 208, **221**, 247.
Walled shafts	8, 193, **194**, 217, 232, **292**.
Barrow runs (or raised launders)	**93**, **99**, **193**, **208**, **209.**
Wooden launders	293.
Water diversion leats	**1**.
Mine roads	1, **7**, 8, 51, **60**, 99, **292**, **293**.
Paved access route	**182**.
Tramways	**7**, **36**, **97**, **129**, 211.
Loading bay	**7**, **152.**
Limekilns and quarries used for mine building construction or processing waste rock	**129**, 182, **292**, **293**.
Meerstones	**90**, **99**, **152**.
Sough marker stone	**180**.
Late-19th and 20th century metal mine buildings and other structures	**12**, **129**, **165.**
Late 19th and earlier 20th century gangue-processing buildings, inclines, loading bays, other structures and workings	1, 47, 82, 83, **90**, **93**, **105**, **109**, 154, **165**, 211, **221**, 242.
20th century haematite working	**280**.
20th century headgear	**129**, **153**.
20th century crab winches and cranes	**129**, **218**.

Early Mines – Archaeological and Documentary Evidence

Prehistoric copper mining	**293**.
Documented medieval/early post-medieval metal mines	**1**, **13**, **19**, **35**, **92**, **93**, **126**, **145**, **151**, **152**, **210**, **211**, **217**, **218**, **221**, **226**, **233**, **243**, **256**, **U27**.

Clear relationships with medieval and earlier field and settlement earthworks – with the mining earlier	**256.**
Clear relationships with medieval and earlier field and settlement earthworks – with the mining later	**205**, **206**, **209**, **210**, **211**, **220**, **256**, **259.**

Important Surface Remains - Relatively Complete Mine Complexes

Larger metal mines with several features	1, 8, 11, **12**, 21, **35**, 36, **39**, **48**, 50, **55**, 56, **59**, **67**,74, **90**, 97, 99, 105, 120, **129**, **130**, **152**, **176,** 199, **204**, **231**, 232, 247, **256**, **260**, **292**, **293**, 295.
Smaller metal mines with few features (noteworthy examples only)	4, 7, **8**, **12**, 15, 16, 22, 72, 82, 83, **97**, 119, 126, 129, 192, **220**, **221**, **232**, **233**, **272**.
20th Century Mines	83, 90, **93**, **105**, **129**, **218**, **222**, **256**.

Important Underground Remains – Types of Working and Common Features

Vein stopes, levels, winzes and trials, mined for lead	**1**, **4**, **5**, 6, 8, 16, **17**, 22, 72, 78, 90, 97, 105, 127, 129, 131, 138, 148, **152**, 211, 216, **226**, **232**, **233**, **242**, 246, 252, **255**, 256, 262, 293, 295, U2, U3, U4, U6, U7, U8, U9, U10, **U13**, **U27**, **U28**, U29, U31, **U32**, U34, U35, **U37**, U38, U41, U42.
Pipe/flat workings mined for lead and copper (often also with veins)	36, 90, 99, **138**, **192**, 198, **204**, 205, **209**, **210**, **211**, 216, **233**, 252, **255**, 256, 292, **293**, U1, U2, U3, **U5**, U16, U17, U18, U19, U20, U21, U22, U23, U24, **U25**, **U26**, **U27**, U29, U31, **U33**, **U36**, U38, **U40**.
Shafts (noteworthy examples)	**6**, **8**, **12**, **35**, **78**, **129**, **138**, **141**, **142**, **152**, **192**, **200**, **210**, **293**, **U4**, **U14**, **U26**, **U27**, **U42**.
Cartgates, haulage and access levels	**1**, 22, 57, 72, 90, **138**, 152, 192, 204, 211, **232**, **233**, 246, **293**, 295, U1, **U8**, **U10**, **U13**, **U25**, U27, U31, U35, **U37**, **U39**, U41.

Important Underground Remains – Rare/Special Features

Caves mined for mineral rich sediments	205, **209**, **U2**, **U25**.
Stopes and caves mined for ochre	**152**, **252**.
Pipe/flat workings mined for Blue John (banded fluorspar)	**1**, **U1**.
Caves mined for stalagmites	**148**.
Packs of deads (noteworthy examples only)	**97**, **192**, **210**, **233**, **U25**, **U27**, **U31**.
Stone roof stemples (noteworthy examples only)	**1**, **233**, **U12**, **U25**, **U28**, **U34**, **U35**.
Ashlar shaft lining	**35**.
Ladderways and ladders	5, **293**.
Stemple climbing way (noteworthy examples only)	**232**.
Stairways	**22**, U2, U25.
Bundings	**293**.
Striking chambers	152, **293**.
Stowces	293, **U6**.
Rope wear (noteworthy examples only)	**57, 293**, **U14**.
Lacing	35, **293**.
Garlands	**201**, **293**, **U26**.
Engine chambers – steam	**293**.
Chimney and flues	**293**.
Barrel-vaulted chamber (uncertain function)	**152**.
Engine chambers – water engines (various types)	174, **292**, **293**, U20, U28.
Engine chambers – horse whim/capstan	**293**.
Underground pumps, pump rods and pump pipes	**141**, **201**, U25.
Balance-bob chambers	**201**, 292.
Use of compressed air and high explosives	**131**, **293**, U13, U27.
Use of electricity	**293**.
Coffin levels (also see soughs)	**138**, 204, **233**, U25, **U27**.
Inclined level	**U2**, U13.

Boat levels	**131**, **182**, **293**, **U2**.
Boat level retaining wall	**U2**.
Canal boat	**U2**.
Soughs (including some of coffin level type) and shalegates/pumpway levels	**57**, 72, **97**, 124, **131**, **152**, **182**, **201**, **205**, 209, **211**, 213, **233**, 234, **235**, **249**, 264, **292**, **293**, **U3**, U11, **U12**, **U25**, **U26**, **U28**, **U30**, U40.
Water ingress levels	205, **293**, U15.
Lock gates	**131**.
Dams	**57, 293**, **U2**, **U25**.
Cage guides	141, **201**, **293**.
Tramways and tubs	22, **97**, 204, **211**, **232**, **233**, 246, **292**, U8, U13, **U25**, U34, **U35**, **U37**.
Alcoves	**57.**
Sleeper blocks for plateway or fish bellied rails	**293.**
Stone rail-tub guides	**233**.
Sledways	**210**, **233**, **U10**.
Plankways	**90**, 131, **201**, **293**, **U2**, **U3**.
Barrow ways	**U25**.
Paved walkways/levels	**U2**, **U25**.
Ore chutes	**255**, **293**, U2, U25.
Trap doors	**U37**.
Ventilation control walls/ ducts/ fanging/ pipes/ hooks	**57, 127**, **210**, **U9**, **U25**, U37.
Ventilation/water control chambers and doors	**57, 293.**
Water channels, launders, hotches, buddles, etc.	**57, 204**, **209**, 210, 211, 233, 292, U2, **U5**, U21, U24, **U25**, **U26**.
Wall plugs for access level fittings	**182**, **293**, 233, **U2**.
Dressing floors	4, 5, **204**, U5, U24, U25.
Miners workshops/forges	**5**, U2, **U25**.
Survey stations/markers	**233**, **293**.
Miners artefacts (noteworthy examples only)	22, 36, 127, **204**, 209, 246, U13, U24, **U25**, U26, **U34**, U37.
Clay fairy rings	**U25**.
Miners inscriptions (noteworthy examples only)	57, 204, 209, **211**, **233**, 235, 293, **U2**, U13, **U25**, **U26**, **U27**, **U37**.

Important Underground Remains – Early Mines

Prehistoric workings	**293**.
Medieval (and possibly earlier) workings	**226**, 293, **U27**.
Early woodpecker pickwork	**U27**.
16th-17th century fireset workings	**90**, 138, 152, **210**, 211, 226, 233, 252, 255, 262, **293**, U6, U7, **U9**, U13, **U27**, **U29**, U31, U32, **U33**, U38.
17th century continental-type powder work	**293**.
Other 17th century powder work	**235**, U33.

Important Underground Remains – Late Mines

20th century workings	22, **36**, 82, **90**, **105**, 131, **154**, 192, **211**, **255**, 262, **U13**, **U27**, U29, **U31**, **U34**, U36.

Levels of Archaeological Assessment: The majority of sites with known archaeological interest have been evaluated in the field, if often only rapidly, by the National Park archaeological staff. However, there is a minority of sites, where enough is known about them to confidently place them in the Inventory for their archaeological interest, but where a surface or underground visit of all parts by the PDNPA archaeological staff has not taken place. Thus, it may be that further specific features of interest exist to be added to these site descriptions. These sites are:

Surface: Sites 111, 121, 122, 123, 135, 142, 178, 203, 216, 225, 236, 255.

Underground: Sites 4, 5, 6, 8, 16, 17, 22, 29, 36, 72, 78, 90, 105, 124, 127, 138, 141, 195, 199, 204, 205, 209, 210, 211, 213, 216, 231, 242, 246, 249, 256, 264, 295, 296, U4, U6, U9, U13, U15, U16, U17, U18, U19, U20, U21, U22, U23, U24, U25, U26, U30, U36, U37, U42.

There are other un-assessed underground sites that have not been entered in the Inventory for their underground interest because too little is known about them; at some it is believed that there is a good possibility that inspection may lead to them being given Category A interest for this (e.g. sites 10, 193, 223, 230). Other sites that are currently blocked or choked, if ways were found to re-enter them, could well have underground features of interest.

At all surface sites in the inventory, there is no preclusion of the possibility that further features of interest will be found in the future. In some cases this may well result from detailed fieldwork evaluation, especially where features are small or slight and thus easily overlooked during rapid assessment. Further features of interest will undoubtedly be identified by archaeological excavations should these take place, or through the recognition of new types of identifiable feature as our understanding of metal mining archaeology advances.

Appendix 4: Sites where Interest has been Substantially Lost Since 2004

Glebe Mine. Original Inventory Number: 35, Location: SK 219765.
At the time the Inventory was presented in 2004 there was ecological surface interest on large 20th century buddle-dams/waste-heaps, while below there was a fine grilled 19th century engine shaft sunk through shale to 20th century and earlier workings, and extensive concrete platforms at the site of the large 20th century dressing plant. In 2005 the site was redeveloped, with the waste heaps and concrete platforms completely removed and the shaft collar sealed.

Blith Forefield Mine. Original Inventory Number: 83, Location: SK 225643
A ruined two-storey building that may have been a mine building, perhaps a mine office or reckoning house, was removed after 2004.

Glossary of Geological and Mineralogical Terms

Blockwork: A rare form of mineralisation, where natural vertical joints in the limestone (as occasionally seen at surface as limestone pavement) have been enlarged by the acidic mineralising fluids and then filled with the usual suite of ore minerals.

Barite (Barytes): A gangue mineral, barium sulphate, abundant in veins and pipes; known to miners as barytes. Barite is the mineral name for pure barium sulphate while barytes is frequently used to refer to the mined barite rich concentrate that is used as the industrial feed stock. The main current use is in heavy drilling mud for oil wells. Other uses include paint manufacture, glossy paper, barium meals and as a source of barium for the chemical industry.

Basalt: A fine grained extrusive igneous rock with a basic composition (less than 20% quartz) of which the Carboniferous lava flows in the Peak District are composed. The same rock intruded at shallow depths is known as dolerite. Both were known as toadstone by the miners. Sometimes these rocks are found in decomposed form, as clays.

Botryoidal Mineralisation: Rounded masses of mineralisation resembling bunches of grapes..

Breccia: A rock composed of angular fragments of broken rock or mineral cemented together by a matrix. In the case of the Peak District mineral veins the fragments may be either of the host rocks (limestone, basalt) and/or mineral vein material cemented by later deposition of the ore mineral suite.

Calcite: A gangue mineral, calcium carbonate, commonly found in veins and pipes. Present uses include terrazzo flooring, pebbledash wall coverings and grave ornamentation.

Clay Wayboards: Layers of volcanic ash, from a few millimetres to a metre or more thick, are common in the limestone succession of the Peak District. These have often been altered to clays and were known as wayboards by the miners.

Crustiform Banding: Many of the veins in the Peak District display banding of different minerals known as crustiform banding. This is where the different minerals were deposited as veins grew to create the multiple layers.

En-Echelon Veins: Veins (or faults) are rarely simple linear structures but frequently consist of a set of staggered shorter linear features that partially overlap, or they are staggered in a line that runs obliquely to the strike of the individual features. Commonly as one individual feature dies out the next adjacent one strengthens.

Euhedral Crystals: Well-formed crystals, with sharp edges and faces, that have usually grown into open cavities.

Flats: Ore deposits formed by open space mineralisation of open bedding planes and cavities developed along the bedding of the rocks. They may also be formed by replacement of certain beds. They follow the bedding and in the Peak District are usually near-horizontal in character but may be much steeper, such as at Ecton.

Fault: a planar fracture or discontinuity in the rock, across which there has been displacement along the fracture as a result of earth movement.

Fluorite (Fluorspar): A gangue mineral, calcium fluoride, abundant in veins and pipes; known to miners as fluorspar. Fluorite is the mineral name for pure calcium fluoride while fluorspar is frequently used to refer to the mined fluorite rich concentrate that is used as the industrial feed stock/ flux. Common current uses include making hydrofluoric acid and other chemicals, anaesthetics, the fluorination of water supplies and toothpaste, refrigerant gasses, linings for non-stick pans and processing iron and steel slag. It was formerly very important as a flux in steel making.

Fluvio-Glacial Deposits: Sedimentary deposits laid down by the melt water streams formed as glaciers melt.

Galena: This mineral, lead sulphide, is by far the commonest lead ore found in the region (also see Lead).

Gangue: The local miners' term for the waste minerals found with lead ore and usually discarded by metal miners, either in surface hillocks or underground. The common gangue minerals are calcite, barites and fluorite. In the last 100 years these have become more sought after than the lead.

Geomorphology: The study of landforms and the processes that shape them.

Hade: The slope of a vein away from the vertical.

Horses: Masses of country rock (e.g. limestone) within a vein completely surrounded by the vein mineralisation; also known as riders. They vary in size from small (a few metres in vertical and lateral extent and tens of centimetres thick) to very large (hundreds or more metres in vertical and lateral extent and tens of metres thick). They are formed as successive fault movement separates masses of rock from the walls which then become enclosed in vein mineralisation.

Host Rocks: The rocks within which the mineral veins have been deposited. In the cases of the Peak District these are mainly limestones and basalts of Carboniferous age. They include, features relating to the rocks containing the mineralisation or materials worked, such as chert and black marble, as well as lavas and their contacts with adjacent rock units, faults, shale beds, fossiliferous layers, etc.

Hydrothermal Water: Warm groundwater heated by the rocks through which it passes when circulating at depth. The warm springs at Matlock Bath and Buxton are examples of hydrothermal water currently reaching the surface.

Lead: A toxic heavy-metal, the main ore of which is Galena in the Peak District. In the past lead has had a wide range of important uses, including roofing, guttering, plumbing, pewter, musket balls and lead shot, and the manufacture of pigments and paints. Today, while most of these uses have gone, it is still of some importance for the manufacture of batteries, alloys such as leaded-bronze, lead-solder, leaded petrol and as shielding against radiation.

Loessic Deposits: Mainly silt-sized sediment, which is formed on land surfaces by the accumulation of wind-blown dust, subsequently carried into cave systems by streams and deposited.

Mineralising Fluids: When circulating through large volumes of rock, hydrothermal water dissolves small amounts of metals and other minerals, which are then carried in solution. When groundwaters with different chemistries mix and/or react with the wall rocks, for example when passing through limestone, the dissolved minerals may be deposited as veins, pipes or flats.

Open Void Mineralisation: Where mineral deposition occurs in open cavities, whether in caves (pipes) or between the walls of faults or joints (veins) and bedding planes (flats).

Phreatic Caves: These are caves formed while completely full of water, allowing dissolution of the limestone to occur in all directions.

Pipes: Ore deposits formed by open space mineralisation of vertically or horizontally orientated linear features. Includes 'Ecton type' pipes, irregular solutionally formed mineralized pipes and sediment filled caves.

Replacement Deposits: Ore deposits formed by replacement of the host rock by mineralisation rather than by mineralisation of open voids. Includes fluoritisation of wall rocks adjacent to veins, replacement of certain beds of host rock, etc.

Slickensides: Polished rock surfaces caused by frictional movement between rocks along the two opposing sides of a fault. The surfaces are normally striated (scratched) parallel to the direction of movement.

Toadstone: Both basalt lavas and dolorite intrusions were known as toadstone by the miners.

Veins: Ore deposits formed by open space mineralisation of, for example, faults, joints, etc. Includes typical veins (rakes and scrins) that tend to be steeply hading.

Vugs: Cavities in the rocks or veins. They vary in size from millimetres to tens of metres and frequently contain euhedral crystals growing from the walls into the centre of the cavity.

Glossary of Mining Terms

Peak District metal mining has many specialist and dialect terms. Texts that describe it inevitably use many of these. Brief explanations of those used here are included below (for further details see Rieuwerts 1998a; Ford and Rieuwerts 2000).

Adit: A level entering a mine from surface, usually horizontally, which gave access to workings and allowed ore to be removed.

Balance Bob: A rocking beam similar to the type at, for example, Cornish pumping engines, but in this case with a large box containing scrap iron at one end of the beam, with the other attached to pump rods. The balance bob acted as a counterweight, reducing the effort needed when the steam or water-powered engine lifted the pump rods, thus allowing the engine to work more efficiently.

Balance Rocker: A rocking arm with attached counterbalance box that kept rods under tension. The rods in the Peak District example in the Inventory led from a steam engine to a shaft top, where a second rocker was attached to the top of pump rods going down the shaft.

Barmote Court: Lead mining in Derbyshire has traditionally been overseen by the miner's Barmote Courts, each with its steward, a barmaster appointed by the Crown or Liberty owners, deputies and jurymen. These courts met regularly and frequent inspections of mines were made to execute routine court business. They commonly presided over ore measurement, the collection of lot and cope, and the freeing of newly found or unworked veins. When necessary they gave verdicts on deaths in mines, disputes over title, payment of mineral debt and forfeiture of shares.

Barrow Run: A raised causeway used to transport ore to a dressing floor or buddle dam using a wheelbarrow.

Beehive Cap: A traditional method of sealing a shaft at surface was to build a domed drystone cover that resembled a beehive. Most of these have now collapsed and either been replaced with railway sleepers, concrete caps and metal grills, or the shafts have been backfilled.

Belland Yard: Many mines have a wall around their waste heaps, which prevented stock in the surrounding area grazing them and being poisoned. Belland is a dialect term for the finely powdered lead ore, while poison stock was said to be bellanded. Archaeologically, belland yard is the area defined by a wall that surrounds a mine.

Blue John: A decorative form of fluorspar, with banded purple and colourless spar, found around Castleton and use for ornamental objects such as vases and jewellery from the 18th century onwards.

Boat Level: A few large 18th century mines adapted drainage soughs, or drove purpose-built levels, for removing the ore from mines by underground canal. These were usually referred to by the miners as boat levels.

Boiler House – see Engine House.

Bolt – see Sough.

Boulton and Watt Engine: see Engine House.

Bouse Teem: A stone semi-circular hopper of 19th century date into which undressed ore (known as bouse) was tipped when it came out of the mine to await preliminary washing. Very few examples survive in the Peak District and they are more common in the Yorkshire Dales and Northern Pennines. In Wales they were known as 'ore slides'.

Buddle: Wooden or stone-lined troughs of various designs used to concentrate the ore, where water was mixed with finely-crushed bouse. Lead and copper ores were heavier than the gangue minerals with which they occurred and thus by passing the mixed material through flowing or agitated water, the heavier ore settled first while lighter material was flushed away. In the Peak District buddles surviving today usually comprise rectangular slab-lined pits and channels. Ecton and one other site in the region (at How Grove) are exceptional in that they contain surviving late-19th century circular buddles similar to those more common elsewhere, for example in Cornwall.

Buddle Dam: Flat-topped hillocks made up predominantly of clay and sometimes of large dimension. Buddle dams were carefully made so that small quantities of ore missed in earlier stages of the dressing process could be recovered by slowly running water mixed with finely-crushed mineral or clay from underground pipeworkings over a near-flat surface. The heavy ore dropped first and was thus concentrated and could be removed for rebuddling from the upslope end of the dam, while the gangue remained in-situ, hence the mound increased in height with use. Often the buddle dams have low banks at the mound-top edges to control the speed of run-off.

Bunding: An underground working platform, often of wood, above floor level within mine workings, or in shafts where they supported ladderways.

Cage Guides: Timber guides running up shafts that stopped a cage or ore-skip from swaying when in use.

Capstan: At Peak District mines, usually a man-operated winding machine, usually placed at shaft tops and used for precision lowering down of heavy plant down the shaft. the rope was wound around a central post/drum and men wound the capstan using long arms protruding from the central post.

Cartgate: A large horizontal level through rock or along a vein, which gave access to workings and allowed ore to be removed in wagons.

Clay Fairy Rings: Rings of clay, usually about five centimetres across, left by miners in old workings. These are thought to relate to superstitions regarding making offerings to the 'old man' within workings.

Climbing Shaft: A small diameter shaft used by miners to enter underground workings. These usually had foot-holes or stemples that acted as ladders. Climbing shafts were often no more than about 20m deep. If deeper workings were to be accessed, there tended to be a succession of such shafts, each slightly offset from the last.

Coe: A small stone shed, either over a climbing shaft or nearby, used for changing, for providing shelter for ore dressers, for storing tools and ore, and/or for protection of the mine entrance.

Coffin Level: A carefully-made type of level, usually driven through limestone or shale, which was just large enough to pass through in relative comfort. Coffin levels were dressed with sweeping pickwork to create smooth sides with no sharp obstacles. The name derives from their shape in section, with the widest part at shoulder height, narrowing above and below for head and legs.

Cog and Rung Gin: A relatively rare type of horse gin where there was a winding drum over the shaft, with the horse walking around the shaft rather than to one side as with the more common horse-whim.

Cope: A price per load of lead, traditionally collected from lead merchants who purchased the ore from the miners and paid to the Crown or the lessee in return for them not exercising their right of pre-emption on the purchase.

Cornish Engine: see Engine House.

Crab Winch: A hand winch with winding drum in an iron frame and winding handle. A cog on the axle with a pivoted claw-shaped arm (the 'crab') that when engaged stopped the winding drum going into reverse and letting out the winding cable.

Crushing Circle: In the 19th century some larger mines crushed ore prior to buddling using a large stone wheel (of similar appearance to a large grindstone). Usually this was shod with an iron tyre. The wheel had a long axle timber that, at the centre of the crushing circle, was attached to a pivot on a low post set in the ground. A horse attached to the other end of the axle walked round outside the crushing

circle operating the crusher, drawing the wheel in a circle over a ring of stone slabs or a cast-iron bed. Lumps of ore were shovelled onto the bed and the crushed material later removed. A few large mines from the 19th century onwards had mechanised crushers of very different design.

Deads: Pieces of mined bedrock or mineral that did not contain enough lead ore for processing. Deads were discarded, either stacked within the workings or placed on the surface hillocks.

Drawing Shaft: A shaft used to remove (draw) ore, stone and water from a mine, with the aid of either a stowce or an engine.

Dressing Floor: Mines usually had a prepared working area adjacent to the engine shaft or level entrance where the ore was processed; this treatment was known as dressing and comprised separating metal ore from the gangue mineral and adhering rock. Two basic operations took place on the dressing floor in order to prepare an ore concentrate ready for removal to the smelters. Firstly, crushing the lumps of ore/gangue brought from the mine, either by hand or with a mechanised crusher. Secondly, separating out the ore by washing, sieving and buddling. Archaeological features commonly found associated with dressing floors include engine shafts, gin circles, engine houses, crushing circles, ore-dressing ponds and pits, buddles, slime ponds, buddle dams and water storage features. In some cases underground dressing floors also existed where sufficient water was available in the mine for this purpose. In some cases this was a preferable option as it reduced the amount of material to be drawn to the surface. Sometimes water at surface was in short supply, while it could be more readily obtained below ground.

Engine Chamber: Some large mines had pumping and winding engines underground, placed in purpose-made chambers. These included a variety of water-powered and steam engines.

Engine House: Usually the building surrounding a steam engine. These were usually used at mines for pumping water or winding ore up an engine shaft. They were occasionally also employed to drive mechanised ore-dressing equipment. The earliest steam engines were developed in the 18th century and are commonly known as Newcomen Engines. Design improvements were made by Boulton and Watt in the late-18th century and one of their engine houses stands at Ecton. In the 19th century significantly more-powerful high-pressure beam-arm engines were developed, often known as Cornish Engines. From the mid-19th century onwards less powerful horizontal engines were used for pumping, winding and ore processing. All 19th century engines had attached boiler houses with flues to tall adjacent chimneys, or more rarely had boilers placed outside (except at coal mines where this was common).

Engine Shaft: A shaft used in conjunction with an engine (horse-, water- or steam-powered) for haulage and/or pumping. Such shafts are typically of relatively large diameter and deeper than climbing shafts. In some instances large engine shafts were partitioned and also had a climbing way.

Fang: An artificial ventilation duct, made in stone and clay, wood or iron, used to bring air to workings with poor air, often a blind headings or in unfinished shafts.

Fines: A mining industry term for mineralised material that has been crushed to a fine gravel or sand.

Firesetting: Before the introduction of gunpowder in the second half of the 17th century, the only effective way of mining through hard rock such as limestone was to light fires against it, which fractured its surfaces. It was a slow and difficult process and this often inhibited mining where the ore source was not rich or was difficult to access. Firesetting was also dangerous as the workings would rapidly fill with smoke and thus fires could only be lit at the end of the working day.

Fish-bellied Rails: Early iron tramway rails with a flat top and curved bottom which is wider at the centre compared with the ends. Usually fastened to stone sleeper blocks.

Flat: A miner's term for an ore deposit that lies roughly horizontal, following the limestone bedding. Often found underground running from the sides of veins.

Forefield: The underground working face of a stope or level.

Gangue: The local term for the waste minerals found with metal ores and usually discarded by metal miners, either in surface hillocks or underground. The common gangue minerals are calcite, barytes and fluorspar. Occasionally uses were made of these minerals, as with fluorspar used for smelting, including at the lead smelter at Ecton, or with barytes which was used in paint manufacture. All three of the common gangue mineral became more valuable due to an increased variety of uses in the 20th century.

Garland: A rock-cut channel in a shaft designed to draw off water from the shaft side into a level or sump, made in order to help keep the shaft ropes dry and thus minimise their weight.

Gin: A commonly used form of winding engine of 17th to 19th century date. The common type was the whim gin, which comprised a large wooden drum for the shaft winding rope, set horizontally, adjacent to the shaft and headgear (also see cog and rung gins). This drum was turned by a horse (or horses in larger examples), the animal walking in a circle and pulling the drum around. Gins were used to draw up ore, stone and water in tubs or kibbles. A gin circle is the flat circular area around which a horse walked to work the gin.

Ginging: Drystone walling that lines the upper parts of shafts where they are sunk through unstable ground.

Goit: An open drain at surface, in a mining context usually taking water from a sough to a stream or river.

Gunpowder – see powder.

Haulage Level – see Level.

Headgear: A frame above a shaft, traditionally of wood but in more recent times of metal, which supported the pulleys for the winding rope, and sometimes capstan sheerlegs.

Hillock: A heap of mine waste material at surface, usually comprising gangue mineral and/or stone, either as it came out of the mine or dumped after it had been crushed and dressed.

Horse-Drawn Ore Crusher – see Crushing Circle.

Horse Gin – see Gin.

Hotch: A hotch was commonly a sieve for ore processing, usually on a frame within a rectangular tank, with a pole to hand operate it. Mechanised versions are referred to as hotches and jigs.

Jigging Shed: A shed at a dressing floor where ore was processed mechanically using jigs or hotches.

Kibble: An iron or iron-hooped wooden bucket or tub used for lifting mineral and stone up a shaft.

***Knockstone*:** A block, usually of stone, upon which ore was hand-dressed with a hammer.

Ladderway: An underground route in a mine that allowed ladder-access to workings, either in a shaft or a steeply inclined pipe or stope.

Lacing: Boarding in an engine shaft which subdivided it into haulage and pumping parts, and sometimes also a ladderway.

Launder: An open-topped artificial water channel, usually made of wood, and common on dressing floors and underground where water needed to be carefully channelled to prevent flooding.

***Leat*:** An artificial channel for conveyance of water. In some cases these brought water to ore-dressing sites, either from ponds or from shafts where the water was drawn from underground. Sometimes crushed ore was refined by placing it in the flowing water where the heavy ore fell to the base (see buddle); these are called trunk buddles. In other cases leats were used to convey excess water well away from mines, for if released nearby it would re-enter the mine and flood the workings.

Level: A horizontal passage through rock, or driven along a vein, which gave access to workings and allowed ore to be removed on sleds or wagons. Levels that enter the mine from surface are alternatively known as adits.

Lot: A fraction of the dressed ore traditionally paid by lead miners to the owner of the mineral rights.

Meer: In mining, a linear measurement of ground, usually along a vein, used for allocating mining titles. In Derbyshire lead mining practice it varied between 27yd (81ft/24.7m) and 32yd (96ft/29.25m) in length.

Meerstone: In a few instances mine boundaries and mining liberty boundaries (the boundaries between different mineral rights areas) were marked by small vertically-set stones known as meerstones.

Mine Office – see Reckoning House.

Mine Road: A metalled track or road built specifically to give access to a mine.

Miners Dry: At large mines with steam engines, there was sometimes an adjacent building with hot pipework where miners working clothes could be dried (and where miners also no doubt congregated in cold and wet weather).

Newcomen Engine: see Engine House.

Open-cut: A mined opening that follows the line of a vein or pipeworking downwards from surface, of variable width and depth. Where deep, these often have vertical rock sides.

Ore Chute: A sloping chute, often of wood, into which ore was dropped from workings above, usually with a 'door' in a wall, that could be opened to fill tubs or wheelbarrows.

Ore-dressing: The process of separating metal ore from the gangue mineral and adhering rock. For much of the history of metal mining in the Peak District this was laboriously done by hand. At surface much work was done by women and children, with men helping with the more strenuous tasks (see Dressing Floor).

Ore-dressing Pond/Pit: Many mine sites have small ponds and pits that were used for ore-dressing, but it is often unclear without archaeological excavation whether there were used for water storage, washing, sieving or buddling. These features represent only a small percentage of the ore-dressing that took place; much was undertaken in above-ground wooden tubs and troughs that have left no obvious archaeological trace.

Ore House: A building used to store ore before removal from larger mines. In one surviving instance at Winster there was an ore house to hold the proportion of ore given to the owner of the mineral rights and the church as tithe, gathered from all the mines in the area.

Ore Storage Bin**:** A small container at surface, often built in stone, for the storage of ore at the mine. A few are freestanding while others are found as internal recesses in the walls of coes.

Overseers House**:** At several larger mines the overseer or manager lived at the mine at a purpose-built house or cottage. Thus, he was conveniently placed to always be on call and to oversee the security and good-running of the mine.

Pack: A carefully placed heap of deads retained by a drystone wall of limestone and/or gangue.

Pickwork: The distinctive linear scars left in underground passages and in open-cuts by the use of a miners' pick.

Pipe: A miner's term for an ore deposit that often lies roughly horizontally and which is also long and narrow. In many cases 'pipes' comprised ancient cave passages that had been filled by mineralised deposits, either at the time of mineralisation or by the redeposition of eroded sediments.

Plankway: Some underground levels were dual purpose, with water flowing at their base, with a raised plank floor to allow miners dry access to workings and to remove ore along them.

Plateway: A type of 18th and earlier-19th century tramway where wagons commonly ran on cast iron rails of L-shaped cross-section, the upright part forming a flange, fixed to stone sleeper blocks.

Powder: The term often used by miners for black powder, more commonly known today as gunpowder, which was used underground in the Peak District from the 1660s onwards to blast rock and mineral. From the late-19th century onwards high explosives have also been used.

Powder House: Small buildings, often of 19th century date, found at larger mines and usually set aside from other buildings. They were used to store the gunpowder and later high explosives used for blasting. Typically they have stout walls but a flimsy roof, designed so that in the case of accident, the blast is directed upwards.

Pump Pipes: Large cast iron pipes used to bring pumped water up shafts.

Pump Rods: large timber rods placed in shafts to link steam or water-powered engines at the shaft top with pumps down the shaft, both at the shaft base and at cisterns placed at intervals up the shaft.

Pumpway: A horizontal level, usually just above the water table (the driving of which may have reduced the water to this level), where water could be removed from the mine in the same way as a sough, but where water has been pumped from deeper in the workings. Miners often used the terms sough and pumpway interchangeably.

Rake: A local miners term for the main type of mineral deposit found in the region. These deposits are found at geological faults in the limestone that have been filled by mineral deposits. They are sometimes several metres wide and run in lines across the landscape, often for several kilometres. Each vein drops near-vertically for hundreds of metres, but often with most of the profitable ore confined to the top 100-200 metres.

Reckoning House: Some larger mines had purpose-built mine offices, often known as reckoning houses. Here accounts were kept of ore produced, payments made to miners for ore, wages and other general mine business.

Rolls Crusher: A mechanical device for crushing ore, used commonly at larger 19th century mines where ore was fed between two or more revolving stone rollers, powered by a steam engine or waterwheel.

Scrin: A local miners term for a minor mineralised fault fracture, often of no great length. While there is no hard and fast limiting dimension to distinguish between a scrin and a rake, the former term was usually used for veins under about half a metre in width. Often they are only a few centimetres wide.

Shaft Collar: The top of a shaft, at ground surface, where it is normally ginged.

Sheerlegs: A tall attachment to a headframe, with pulley on top attached to a capstan, used to position and lower heavy/long objects such a pump rods and pump pipes down the shaft.

Shotholes: The distinctive drilled holes made by miners into which powder was placed in order to remove rock and mineral by blasting.

Sledway: A horizontal underground passage used for transporting ore on sleds, today sometimes with wear grooves on the floor from this activity.

Sleeper Blocks: Stone blocks used at early tramways, instead of wooden sleepers, to secure the tramway rails to the ground. These had the advantage that there was nothing between the rails to impede the horses used to draw the wagons.

Slime Pond: At some larger mines the final stage in the dressing process, used to collect small amounts of ore missed, was to place finely-crushed material in a settling, sludge or slime pond.

Smelter: The vast majority of lead smelting was carried out away from mine sites; surviving remains of these smelters are not considered in this report. The one known exception is at Ecton, where there were 18th century smelters on site. Across the orefield as a whole early smelting took place in large bonfires known as boles, often placed on hilltops. In the 16th century smelting was radically improved with the introduction of water-powered bellows at ore hearths. Further significant changes occurred in

the 18th century with the development of reverberatory furnace or cupola. With each of these improvements, ore previously discarded as unsmeltable could be recovered and this led to extensive reworking of mine hillocks and renewed mining activity underground.

Sough: A horizontal adit driven specifically to drain those parts of a mine below the natural water table. In a significant number of cases these were driven through solid rock as opposed to along a vein. The surface entrance to a sough was known as the tail, or when arched, the portal. In many instances, where the tail was some distance from the nearest stream, the water was conveyed in a low covered drain known as a bolt. Open drains were known as goits.

Stemple: A piece of wood, or less commonly stone, wedged across a working or vein. These were used for supporting stacked deads, as roof and bunding supports, and as rungs in ladderways.

Stope: The space left when the vein mineral has been removed, creating a vertical chamber sometimes many metres in length and height. These voids were often filled with 'deads' supported on wooden or stone stemples. The act of creating stopes is known as stoping.

Stowce (Stowe): A wooden windlass, usually hand operated, used to wind materials and water up and down shafts.

Striking Chamber: At the head or foot of underground shafts, small chambers were sometimes made, known as striking chambers. These created enough room for winding gear and the loading and unloading of ore (known as striking) to and from the kibble.

Tail – see Sough.

Tramway: An underground level of 18th or 19th century date with rails of wood or iron, where ore and waste rock was moved in wheeled wagons. These were usually pushed by hand and were often of narrow gauge. They were also used at surface to take ore to and around dressing floors.

Trunk Buddle – see Leat.

Ventilation Control Wall: In some cases the problem of poor air underground was overcome by building walls sealed with clay or moss, or by using sealed ducts, which controlled air flow. This was particularly necessary at early mines that employed firesetting.

Ventilation Fire House: A small building over a shaft-top that contained a 'furnace' that created an updraft and thus helped ventilate a mine. There are documented 18th century examples in the Peak District. Early steam engines were also known by miners as fire houses.

Water-Balance Engine: A machine for pumping water with a rocking beam similar to those used at Cornish type steam engines, also with one end attached to the pump rods in the shaft, but with the other with a large bucket which was filled with water at the top of the beam stroke, with this tipped out at the bottom of the stroke.

Water Blast: A documented 18th century method of ventilation which entailed dropping water down a pipe in a shaft in such a way that air was forced out at the shaft base, where it was directed into further pipes that led to the area of the mine being worked where there was insufficient air flow.

Water Storage Pond: On the limestone plateau surface water was often scarce and this had to be collected in ponds at mine sites, as water was essential for the ore-dressing process. These usually held rainwater and sometimes were fed by catchment leats, or by leats from other ore-dressing sites situated uphill from the mine.

Waterwheel Pit: In the 17th to 19th centuries, waterwheels were occasionally used both at surface and underground to drive pumps. At surface they were usually set within a long but deep pit.

Whim Gin – See Gin.

Winze: An internal shaft within a mine.

Woodpecker Pickwork: A modern nickname for a type of pickwork found at Matlock Bath with a multitude of very small scars made by a small pick or chisel and thought to be early in date.

Glossary of Ecological Terms

Calaminarian Grassland: The term used by ecologists for vegetation that contains metallophyte species (metal-tolerant plants).

Calcicole: Plants that are lovers of, or tolerant of, lime rich soil.

Closed sward: Grassland that covers all the ground so there is no bare ground

Improved: Grassland that has been made very productive, normally consisting of rye grass and white clover with no other herbs in the sward.

Metallophyte: Plants that are tolerant of heavy metals such as lead in the soils.

Nationally scarce: The most widely established assessment system for rarity and scarcity is based around presence of species in the hectads of the Ordnance Survey National Grid. Nationally Rare is conventionally defined as species which are found in 15 or fewer hectads. Nationally Scarce (also termed Nationally Notable) relates to species which are found in between 16 and 100 hectads. This category is subdivided into Nationally Scarce (Nationally Notable) A — species found in 16 to 30 hectads, and Nationally Scarce (Nationally Notable) B - species found in between 31 and 100 hectads. A status of Local is also sometimes used, referring to species found in between 101 and 300 hectads. (N.B. A hectad is a 10km by 10km square on the Ordnance Survey National Grid).

Nationally threatened: Any species (including animals, plants, fungi, etc.) which are vulnerable to endangerment in the near future. The World Conservation Union (IUCN) is the foremost authority on threatened species, and treats threatened species not as a single category, but as a group of three categories, depending on the degree to which they are threatened; vulnerable, endangered or critically endangered.

Natural Vegetation Classification (NVC): Nationally recognised classification of semi-natural plant communities in Britain.

Open grassland: Grassland that is sparse with more bare or open ground than vegetation.

Red data book species: The IUCN Red List of Threatened Species (also known as the IUCN Red List or Red Data List), founded in 1963, is the world's most comprehensive inventory of the global conservation status of biological species. A series of Regional Red Lists are produced by countries or organizations, which assess the risk of extinction to species within a political management unit.

Semi-improved: Grassland that has partially been made more agriculturally productive by the addition of fertilisers and farm yard manure.

Special Areas of Conservation (SAC): The highest nature conservation designation, protecting sites of international importance, via the EU Habitats and Species Directive (1992) and the Habitats Regulations 1994. Article 3 of the Habitats Directive requires the establishment of a European network of important high-quality conservation sites that will make a significant contribution to conserving the 189 habitat types and 788 species identified in Annexes I and II of the Directive (as amended). The listed habitat types and species are those considered to be most in need of conservation at a European level.

Acknowledgements

The geological assessment has benefited from discussions with a number of people, in particular Trevor Ford and Jim Rieuwerts, all of whom are thanked for their thoughts and comments. However the final selection of sites included in this inventory is Richard Shaw's and errors and omissions are his. Phil Wolstenholme is thanked for information on Raddlepits Mine and Phil Wolstenholme and Dave Webb thanked for the use of their photographs.

Particular thanks go to Jim Rieuwerts, Chris Heathcote, Phil Shaw, Dave Williams and Terry Worthington for their support and hard work over many years in helping compile the archaeological assessment. This report in its present form would not have been possible without their extensive knowledge. It also draws heavily upon lists of sites for conservation/scheduling drawn up from PDMHS and English Heritage that were compiled over many years by Jim Rieuwerts and Lynn Willies, which created firm foundations from which the subsequent Lead Legacy work grew.

Many other people have also helped with archaeological assessment, identifying sites for consideration, making comment on sites, and carrying out or helping with fieldwork and underground assessments. These include: Mat and Niki Adlam-Stiles, John Beck, Paul Deakin, Trevor Ford, Keith Gregory, Jon Humble, John Hunter, Len Kirkham, Paul Mortimer, the late Roy Paulson, Les Riley, Adam Russell, Richard Shaw, Paul Smith, Andy Tickle, Steve Thompson, Clive Waddington, Dave Webb, Nick Willers, Lynn Willies, John Wilmot, Phil Wolstenholme, John Wood and Terry Worthington. Archaeological field survey and assessment was carried out by John Barnatt, Bill Bevan, Phil Sidebottom, Heidi Taylor and Alice Ullathorne. There are many short notes in the PDMHS Newsletter which are not individually referenced in the bibliography – many thanks to the authors who provided this information. Any errors and omissions are John Barnatt's.

Ecological field surveys and analysis were carried out by Helen Buckingham, Pat Curry, Margaret Dixon, James Frith, Kieron Huston, Alistair Jump, Amanda Marler, Dave Mallon, Rebekah Newman, Esther Pawley, Rebecca Penny, Barry Soames and Jonathan Winn.

The surveys would not have been possible without the co-operation of many farmers and landowners who kindly allowed access and often gave encouragement and advice. The land managers in particular have not only been helpful in allowing access to their land but also helping us to understand the nuances of grazing management of lead mining sites and how variable it can be. Without the sympathetic management by these land managers we would have lost much of the ecological resource to agricultural improvement. Thanks also to The National Trust, Natural England, The Ecton Mines Education Trust, Derbyshire Wildlife Trust, Staffordshire Wildlife Trust, Peak District Mines Historical Society and the Peak District National Park Authority for their help in achieving this inventory.

The maps were largely prepared by Angela Johnson, with background detail on the maps used under licence from the Ordnance Survey (Licence No. LA 100005734 2009). The aerial photographs are from National Monuments Record, English Heritage (Plates 2, 4, 11, 36, 40, 42) and Derek Riley Collection (Plates 39, 41). Figures 3, 18, 19, 20, 26 and 27 are by John Barnatt The plates are by: John Barnatt (Cover, 1, 3, 5, 12-18, 33, 35), Bec Penny (20-27, 29-30, 32), Dave Mallon (28), Richard Shaw (6-8, 10, 38, 43, 45), Barry Soames (31), Dave Webb (9, 44) and Phil Wolstenholme (34),

Information on designated sites came from English Heritage and Natural England and both organisations have given their support to the 'Lead Rakes Project', both as partners and financially.

References

Aitkenhead, N., Chisholm, J. I. and Stevenson, I. P. 1995 *Geology of the Country Around Buxton, Leek and Bakewell.* Keyworth: British Geological Survey Memoirs.

Amner, R. and Naylor, P. J. 1973 Goodluck Mine, Via Gellia. *Bulletin of the Peak District Mines Historical Society* 5.4, pp. 217-40.

Beck, J. S. and Worley, N. E. 1977 Nickergrove Mine, Eyam, Derbyshire. *Bulletin of the Peak District Mines Historical Society* 6.5, pp. 175-79.

Barker, I. and Beck, J. S. 2010 *Caves of the Peak District* (7th Edition). Hucklow: Derbyshire Caving Association.

Barnatt, J. 1999a Prehistoric and Roman mining in the Peak District: present knowledge and future research. *Mining History* 14.2, pp. 19-30.

Barnatt, J. 1999b Peak National Park: A Changing Landscape. In: G. Fairclough (ed.) *Historic Landscape Characterisation: Papers Presented at an English Heritage Seminar, 11 December 1998*, pp. 41-50. London: English Heritage.

Barnatt, J. 2000 *Lead Rakes in the Peak District: Hillock Today, Gone Tomorrow. Unpublished report for English Heritage.* Bakewell: Peak District National Park Authority Cultural Heritage Team archive - unpublished report.

Barnatt, J. 2002a The Development of Deep Ecton Mine, Staffordshire, 1723-1760. *Mining History* 15.1, pp. 10-23.

Barnatt. J. 2002b Excavations and Conservation at How Grove, Dirtlow Rake, Castleton, Derbyshire. *Mining History* 15.2, pp. 1-40.

Barnatt, J. 2003a The Lower Nestus Pipe re-entered. *Mining History* 15.3, pp. 15-21.

Barnatt, J. 2003b *A Landscape Through Time: the Historic Character of the Peak District National Park Landscape – Aims, Methods and User Manual.* Bakewell: Peak District National Park Authority Cultural Heritage Team archive - unpublished report.

Barnatt, J. 2004 *An Inventory of Regionally and Nationally Important Lead Mining Sites in the Peak District: Archaeological Importance* (2 vols.). Bakewell: Peak District National Park Authority Cultural Heritage Team archive - unpublished report.

Barnatt, J. 2005a *Updated Inventory of Regionally and Nationally Important Lead Mining Sites in the Peak District – November 2005.* Bakewell: Peak District National Park Authority Cultural Heritage Team archive - unpublished report.

Barnatt, J. 2005b *Lathkill Dale National Nature Reserve: Over Haddon, Monyash and Youlgreave Parishes, Derbyshire.* Bakewell: Peak District National Park Authority Cultural Heritage Team archive – Unpublished report.

Barnatt, J. 2009 The Lead Legacy: Recent Archaeological Research and Conservation Initiatives at Peak District Mines. *Mining History* 17.4, pp. 1-27.

Barnatt, J. 2011a High Rake Mine, Little Hucklow, Derbyshire: Excavations and Conservation at an Important Nineteenth Century Mine. *Mining History* 18, 1 and 2, pp. 1-217.

Barnatt, J. 2011b Early fluorspar mining: Critchman (Knowles) Mine, Masson Hill, Matlock, Derbyshire. *Peak District Mines Historical Society Newsletter* 138, April 2011, pp. 5-6.

Barnatt, J. 2012 Silence Mine, Grindlow, Derbyshire: Investigating an 1870s Steam Engine House. *Mining History* 18.4, pp.1-55.

Barnatt, J. 2013 *Delving Ever Deeper: The Ecton Mines through Time.* Bakewell: Peak District National Park Authority.

Barnatt, J. and Heathcote, C. 2003 The Maury and Burfoot Mines, Taddington and Brushfield, Derbyshire. *Mining History* 15.3, pp. 45-49.

Barnatt, J. and Penny, R. 2004 *The Lead Legacy: The Prospects for the Peak District's Lead Mining Heritage.* Bakewell: Peak District National Park Authority.

Barnatt, J. with Rieuwerts, J. H. 1995 *The Lead Mine Affected Landscape of the Peak District.* Bakewell: PDNPA Cultural Heritage Team archive - Unpublished report for English Heritage.

Barnatt, J. with Rieuwerts, J. H. and Roberts, J. G. 1996 *The Lead Mine Related Landscape of the Peak District, Part 1 - Smelting Sites, Fuel Sources and Communications.* Bakewell: Peak District National Park Authority Cultural Heritage Team archive - unpublished report.

Barnatt, J., Rieuwerts, J. and Thomas, G. H. 1997 Early use of gunpowder in the Peak District: Stone Quarry Mine and Dutchman's Level, Ecton. *Mining History* 13.4, pp. 24-43.

Barnatt, J. and Rieuwerts, J. 1998 The Upper Nestus Pipes: an ancient lead mine in the Peak District of Derbyshire. *Mining History* 13.5, pp. 51-64.

Barnatt, J. and Smith, K. 2004. *The Peak District; Landscapes Through Time* (Second Edition). Bollington: Windgather Press.

Barnatt, J. with Stroud, G. 1996 *The Lead Mine Related Landscape of the Peak District, Part 2 – Settlement, Population and Miner/Farmers.* Bakewell: Peak District National Park Authority Cultural Heritage Team archive - unpublished report.

Barnatt, J. and Thomas, G. H. 1998 Prehistoric mining at Ecton, Staffordshire: A dated antler tool and its context. *Mining History* 13.5, pp. 72-78.

Barnatt, J. and Vernon, R. 2007 Geophysical survey at Magpie Mine near Sheldon to identify the position of the 1840 winding house and its boiler house. *Mining History* 16.5, pp. 24-31.

Barnatt, J. and Webb, D. 2002 *Cumberland Cavern and Wapping Mine.* Derbyshire Caving Association.

Barnatt, J. and Worthington, T. 2006 Using coal to mine lead: Firesetting at Peak District mines. *Mining History* 16.3, pp. 1-94.

Barnatt, J. and Worthington, T. 2007 Post-Medieval firesetting in British metal mines: the archaeological evidence. *British Mining* 83, pp. 4-20.

Barnatt, J. and Worthington, T. 2009 Metal mines through time: Unravelling archaeological evidence at long-worked mines in the Peak District. *Mining History* 17.3, pp. 1-124.

Baumbach, H. 2012. Metallophytes and Metallicolous Vegetation: Evolutionary Aspects, Taxonomic Changes and Conservational Status in Central Europe, In: Prof. John Tiefenbacher (Ed.) *Perspectives on Nature Conservation - Patterns, Pressures and Prospects*. InTech.

Beck, J. 1978 The caves, mines and soughs of the Wardlow Basin and Cressbrook Dale. *Bulletin of the Peak District Mines Historical Society* 7.2, pp. 106-15.

Beck, J. 2004a Progress at Calf Pingle. *Descent* 178, p. 10.

Beck, J. 2004b Yet another lead at Calf Pingle. *Descent* 179, p. 14.

Beck, J. and Noble, M. 2012 The Wet West Adventure. *Descent* 224, pp. 34-36.

Bird, R. 1972 Putwell Hill Lead Mine, Monsal Dale. *Bulletin of the Peak District Mines Historical Society* 5.1, pp. 54-60.

Brossler, A. 1998 A Survey of Surface Features at Fool's Venture Mine, Bonsall Leys, Derbyshire. *Mining History* 13.5, pp. 65-71.

Brown, I. J. and Ford, T. D. 1971 *The Magpie Mine.* Peak District Mines Historical Society.

Buckingham, H. and Penny, R. 1997 *Bonsall Moor: Lead Rakes Project Ecology Technical Report*. Bakewell: Peak District National Park Authority Natural Environment Team archive - unpublished report.

Buckingham, H., and Penny, R. 2000a *Castleton Moor and Peak Forest: Lead Rakes Project Ecology Technical Report.* Bakewell: Peak District National Park Authority Natural Environment Team archive - unpublished report.

Buckingham, H. and Penny, R. 2000b *Bradwell Survey Area: Lead Rakes Project Ecology Technical Report.* Bakewell: Peak District National Park Authority Natural Environment Team archive - unpublished report.

Buckingham, H. and Penny, R. 2001a *Winster Survey Area: Lead Rakes Project Ecology Technical Report.* Bakewell: Peak District National Park Authority Natural Environment Team archive - unpublished report.

Buckingham, H. and Penny, R. 2001b *Elton Survey Area: Lead Rakes Project Ecology Technical Report.* Bakewell: Peak District National Park Authority Natural Environment Team archive - unpublished report.

Buckingham, H. and Penny, R. 2001c *Monyash: Lead Rakes Project Ecology Technical Report*. Bakewell: Peak District National Park Authority Natural Environment Team archive - unpublished report.

Buckley, R. and Howard, M. 1995 Greensward Mine and its pumps, Monyash, Derbyshire. *Bulletin of the Peak District Mines Historical Society* 12.6, pp. 68-81.

Bull, C. The Clay Vein extension in Goodluck Mine, Via Gellia, Cromford, Derbyshire. *Bulletin of the Peak District Mines Historical Society* 7.4, pp. 206-07.

Burt, R. 1984 *The British Lead Mining Industry.* Redruth: Dyllansow Truran.

Butcher, N. J. D. 1971 Some recent surface and underground observations at Magpie Mine. *Bulletin of the Peak District Mines Historical Society* 4.6, pp. 403-12.

Chatburn, H. E. 1962 The surface remains on Dirtlow Rake. *Bulletin of the Peak District Mines Historical Society* 1.7, pp. 22-26.

Chisholm, J. I., Charsley, T. and Aitkenhead, N. 1988 *Geology of the Country Around Ashbourne and Cheadle.* Keyworth: British Geological Survey Memoirs.

Cooper, E. 1997 *Summary Descriptions of the National Vegetation Classification Grassland and Montane Communities.* Peterborough: Joint Nature Conservation Committee.

Cope, F. W. 1998 *Geology Explained in the Peak District.* Cromford: Scarthin Books.

Critchley, M. F. 1979 A geological outline of the Ecton Copper Mines, Staffordshire. *Bulletin of the Peak District Mines Historical Society* 7.4, pp. 177-191.

Critchley, M. F. and Wilson, P. J. 1975 A survey of the shafts of Bincliff, Oversetts and Highfields Mine, Wetton, Staffs. *Bulletin of the Peak District Mines Historical Society* 6.2, pp. 73-82.

Dixon, M. and Mallon, D. 2010 *Bakewell: Lead Rakes Project Ecology Technical Report.* Bakewell: Peak District National Park Authority Natural Environment Team archive - unpublished report.

Dixon, M., Mallon, D. and Soames, B. 2010 *Middleton & Youlgreave: Lead Rakes Project Ecology Technical Report*. Bakewell: Peak District National Park Authority Natural Environment Team archive - unpublished report

Dunham, K. C. 1990 *Geology of the Northern Pennine orefield. Volume 1, Tyne to Stainmore: economic memoir covering the areas of 1:50000 and one-inch geological sheets 19 and 25 and parts of 13, 24, 26, 31, 32 (England and Wales)* (2nd edition). British Geological Survey.

Dunham, K. C. and Wilson, A.A. 1984 *Geology of the Northern Pennine Orefield. Volume 2: Stainmore to Craven. Economic memoir covering the areas of one-inch and 1:50,000 geological sheets 40, 41 and 50, and parts of 31, 32, 51, 60 and 61, New Series (England and Wales).* British Geological Survey.

Earp, J. R. 1958 Mineral veins of the Minera-Maeshafn district of North Wales. *Bulletin of the Geological Survey of Great Britain* 14, pp. 44-69.

Eavis, R. 2012 The Doom Project. *Descent,* 229, p. 12.

Fletcher, G. and Willies, L. 1975 Brightside Mine, Hassop. *Bulletin of the Peak District Mines Historical Society* 6.1, pp. 33-39.

Flindall, R. B. and Hayes, A. J. 1971 The adit workings on the north side of the Via Gellia. *Bulletin of the Peak District Mines Historical Society* 4.6, pp. 429-50.

Flindall, R. B. and Hayes, A. J. 1972a A survey of Good Luck Mine and adjacent levels in Via Gellia. *Bulletin of the Peak District Mines Historical Society* 5.1, pp. 61-80.

Flindall, R. B. and Hayes, A. J. 1972b Wapping Mine and Cumberland Cavern, Matlock Bath. *Bulletin of the Peak District Mines Historical Society* 5.2, pp. 114-127.

Flindall, R. B. and Hayes, A. J. 1973 The mines east of Hoptonwood Quarries, Via Gellia. *Bulletin of the Peak District Mines Historical Society* 5.3, pp. 137-48.

Flindall, R. B. and Hayes, A. J. 1976 *The Caverns and Mines of Matlock Bath. 1: The Nestus Mines*. Moorland.

Flindall, R. B., Hayes, A. J. and Rieuwerts, J. H. 1977 Mines in the Slingtor Wood area, Cromford. *Bulletin of the Peak District Mines Historical Society* 6.6, pp. 263-79.

Flindall, R.B., Swain, J. and Hayes, A.J. 1981 A survey of the Masson cave-cum–mine complex. *Bulletin of the Peak District Mines Historical Society* 8.2, pp. 103-08.

Ford, T. D. 2000 Geology of Ecton and other North-East Staffordshire Mines. *Mining History* 14.4, pp. 1-22.

Ford, T. D. 2001 The geology of the Matlock mines: a review. *Mining History* 14.6, pp. 1-24.

Ford, T. D. 2002a *Rocks and Scenery of the Peak District.* Ashbourne: Landmark.

Ford, T. D. 2002b Calcite mining in the Peak District. *Mining History* 15.1, pp. 29-37.

Ford, T. D. 2004 Geology of the lead mines around the Stanton Syncline, Derbyshire. *Mining History* 15.6, pp. 1-26.

Ford, T. D. 2005 The geology of the Wirksworth mines. *Mining History* 16.2, pp. 1-42.

Ford, T. D. 2008 The geological setting of the lead mines in the Lathkill Dale and Wye Valley area, Derbyshire. *Mining History* 17.2, pp. 11-47.

Ford, T. D. 2010 The geological setting of the lead mines in the northern part of the White Peak, Derbyshire. *Mining History* 17.5, pp. 1-49.

Ford, T. D. 2012 The geological setting of the lead mines of the Hucklow, Eyam, Stoney Middleton and Longstone Edge area, Derbyshire. *Mining History* 18.3, pp. 1-22.

Ford, T.D. and Jones, J.A. 2007 The geological setting of the mineral deposits at Brassington and Carsington, Derbyshire. *Mining History* 6.5, pp. 1-23.

Ford, T. D. and Rieuwerts, J. H. 1976 Odin Mine, Castleton, Derbyshire. *Bulletin of the Peak District Mines Historical Society* 6.4, pp. 1-54.

Ford, T. D. and Rieuwerts, J. H. 2000 *Lead Mining in the Peak District (Fourth edition).* Matlock Bath and Ashbourne: Peak District Mines Historical Society and Landmark Publishing.

Ford, T. D., Sarjeant, W. A. S. and Smith, M. E. 1993 Minerals of the Peak District. *Bulletin of the Peak District Mines Historical Society* 12.1, pp. 16-55.

Gill, D. W. and Beck, J. S. 1991 *Caves of the Peak District* (6th Edition). Clapham: Dalesman.

Great Hucklow, Parishioners of. 2009 *Lead in the Veins*. Hucklow Publishing, for the Great Hucklow & District Community Spirit Committee.

Gregory, N. and Tune, N. 1967 Ore buddles at Snake Mine, Hopton and at Bonsall Leys. *Bulletin of the Peak District Mines Historical Society* 3.4, pp. 253-55.

Grime, J.P., Hodgeson, J. G. and Hurst, R. 1988 *Comparative Plant Ecology*. Oxford: Oxford University Press.

Heathcote, C. 2001a A history and gazetteer of the mines in the Liberty of Peak Forest, Derbyshire, 1605-1878. *Mining History* 14.5, pp. 1-28.

Heathcote, C. 2001b Surface remains of the Pindale area, Castleton, Derbyshire. *Mining History* 14.6, pp. 35-41.

Heathcote, C. 2002 Surface remains of the Castleton/Peak Forest area, Derbyshire. *Mining History* 15.1, pp. 43-48.

Heathcote, C. 2007a The history of Coalpithole Vein in Peak Forest and Chapel en le Frith Liberties, Derbyshire: 1705-1880. *Mining History* 16.5, pp. 36-73.

Heathcote, C. 2007b A gazetteer of the lead mines within Castleton and Hope Liberties: 1748-1898. *Mining History* 16.6, pp. 1-30.

Heathcote, C. 2008 A gazetteer of the lead mines in Buxton, Fairfield and Wormhill 'Out' Liberties in north-west Derbyshire. *Mining History* 17.2, pp. 1-10.

Heathcote, C. 2010 A history and gazetteer of the lead mines within Bradwell Liberty, Derbyshire. *Mining History* 17.5, pp. 56-84.

Heathcote, C. 2012 A history and gazetteer of the lead mines within Hartington Liberty, Derbyshire. *Mining History* 18.3, pp. 23-62.

Heald, D. 1978 The exploration of the Wills Founder Mine, Winster. *Bulletin of the Peak District Mines Historical Society* 7.2, pp. 51-66.

Hooson, W. 1747 *The Miners Dictionary*. Wrexham.

Hurt, L. 1970 A survey of Ball Eye Mines, Bonsall. *Bulletin of the Peak District Mines Historical Society* 4.4, pp. 289-305.

Ineson, P. R. and Ford, T. D. 1982 The South Pennine Orefield: its genetic theories and eastward extension. *Mercian Geologist* 8.4.

Jones, D.G., Plant, J.A. and Colman, T.B. 1994 The genesis of the Pennine mineralization of Northern England and its relationship to mineralization in central Ireland. In: Fontbote, L. and Boni, M. (ed's), *Sediment-hosted Zn-Pb ores*. Berlin: Springer-Verlag; (Special Publication Society for Geology Applied to Mineral Deposits no. 10), pp. 198-218.

Kiernan, D. 1989 *The Derbyshire Lead Industry in the Sixteenth Century*. Chesterfield: Derbyshire Records Society Vol. XIV.

Kirkham, L. 2006 Royledge and New York copper mines, Elkstones, Staffordshire. *Mining History* 16.4, pp. 38-42.

Kitchen, G. and Penney, D. 1973 New pumps for old. *Bulletin of the Peak District Mines Historical Society* 5.3, pp. 129-36.

Lambinon, J. and Auguier, P. (1964): La flore et lat vegetation des terrains calaminaires de la Wallonie septentrional et de la Rhenanie aixoide. *Natura Mosana*16, pp. 113-130

Mallon, D. 2006 *Wensley: Lead Rakes Project Ecology Technical Report*. Bakewell: Peak District National Park Authority Natural Environment Team archive - unpublished report.

Mallon, D. 2008a *Chelmorton: Lead Rakes Project Ecology Technical Report*. Bakewell: Peak District National Park Authority Natural Environment Team archive - unpublished report.

Mallon, D. 2008b *Ecton & Manifold: Lead Rakes Project Ecology Technical Report*. Bakewell: Peak District National Park Authority Natural Environment Team archive - unpublished report.

Mallon, D. 2010a *Tideswell, Taddington and Wheston: Lead Rakes Project Ecology Technical Report*. Bakewell: Peak District National Park Authority Natural Environment Team archive - unpublished report.

Mallon, D. 2010b *Hartington, Ballidon & Parwich: Lead Rakes Project Ecology Technical Report*. Bakewell: Peak District National Park Authority Natural Environment Team archive - unpublished report.

Nixon, D. A. and Warriner, D. 1997 The connection of James Hall's Over Engine Mine to Peak and Speedwell Caverns. *Mining History* 13.3, pp. 57-67.

Noble, M. 2012 Far from Doomed. *Descent* 228, pp. 19-21.

Noel, M. and Shaw, R. P. 1984 A palaeomagnetic reversal in Early Quaternary sediments in Masson Hill, Matlock, Derbyshire. *Mercian Geologist* 9.4, pp. 235-242.

Palmer, M. and Neaverson, P. 1989 The comparative archaeology of tin and lead dressing in Britain during the nineteenth century. *Bulletin of the Peak District Mines Historical Society* 10.6, pp. 316-353.

Palmer, M. and Neaverson, P. 1992 Gazetteer of tin and lead ore dressing sites in Great Britain. *Bulletin of the Peak District Mines Historical Society* 11.5, pp. 261-63.

Pearce, A., Ludditt, R., Straw, M., Taylor, W., Watson, J. and Watson, R. Mouldridge Mine, Pikehall, Derbyshire. *Bulletin of the Peak District Mines Historical Society* 9.2, pp. 108-22.

Pedrick, P. D. and Chapman, G. J. 1974 A preliminary survey of the Bincliff lead mines. *Bulletin of the Peak District Mines Historical Society* 5.5, pp. 258-70.

Penney, D. 1985 Peakshole Sough, Castleton. *Bulletin of the Peak District Mines Historical Society* 9.3, pp. 171-85.

Penney, D. and Dixon, E. M. 1990 Horsebuttocks and Winster Pitts Mines, Winster. *Bulletin of the Peak District Mines Historical Society* 11.2, pp. 63-71.

Penney, D, and Dixon, E. M. 1999 Horsebuttock, Shack, Little, Drake and Pitts Mines, Winster. *Mining History* 14.2, pp. 45-56.

Penny, R. 2009 An introduction to the Ecology of Lead Mining Remains in the Peak District. *Mining History* 17.4, pp. 28-31.

Pickin, J. 1975 The mines of Hassop Common. *Bulletin of the Peak District Mines Historical Society* 6.2, pp. 96-99.

Pickin, J. 1982 Watts Engine House, Old Millclose Mine. *Bulletin of the Peak District Mines Historical Society* 8.4, pp. 240-42.

Porter, A. 1990 Exploration of Cromford Moor Mine, Steeplegrange, Wirksworth. *Bulletin of the Peak District Mines Historical Society* 11.1, pp. 23-24.

Porter, L. 2004 *Ecton Copper Mines under the Dukes of Devonshire: 1760-1790*. Ashbourne: Landmark.

Porter, L. and Robey, J. 2000 *The Copper and Lead Mines Around the Manifold Valley, North Staffordshire*. Ashbourne: Landmark.

Quirk, D. G. 1993 The origins of the Peak District orefield. *Bulletin of the Peak District Mines Historical Society* 12.1, pp. 4-15.

Rieuwerts, J. H. 1960 The Merlin Mine, Eyam Dale, Derbyshire. *Bulletin of the Peak District Mines Historical Society* 1.3, pp. 3-6.

Rieuwerts, J. H. 1978 The Inquisition or Quo Warrento of 1288. *Bulletin of the Peak District Mines Historical Society* 7, pp. 41-49 and pp. 96-98.

Rieuwerts, J. H. 1983 Cromford Sough and the early use of gunpowder. *Bulletin of the Peak District Mines Historical Society* 8.5, pp. 315-29.

Rieuwerts, J. H. 1987 *History and Gazetteer of the Lead Mine Soughs of Derbyshire.* Sheffield: Privately published.

Rieuwerts, J. H. 1992a *Bonsall Lees Mines.* Bakewell: Peak District National Park Authority Cultural Heritage Team archive - unpublished report.

Rieuwerts, J. H. 1992b *Gorseydale Mines.* Bakewell: Peak District National Park Authority Cultural Heritage Team archive - unpublished report.

Rieuwerts, J. H. 1993a *The Alport Mining Field.* Bakewell: Bakewell: Peak District National Park Authority Cultural Heritage Team archive - unpublished report.

Rieuwerts, J. H. 1993b *The Whitelow Mines, Bonsall Moor.* Bakewell: Peak District National Park Authority Cultural Heritage Team archive - unpublished report.

Rieuwerts, J. H. 1993c *Ashton's Mine, Pindale Side and the Nether Dirtlow Mines.* Bakewell: Peak District National Park Authority Cultural Heritage Team archive - unpublished report.

Rieuwerts, J H 1994 The Early history of Stoke Sough and Magclough Sough, 1724-1738. *Bulletin of the Peak District Mines Historical Society* 12.4, pp. 43-50.

Rieuwerts, J H 1996 *Lead Rakes: Surviving Archaeological Features and Destroyed Sites.* Bakewell: Peak District National Park Authority Cultural Heritage Team archive - unpublished report..

Rieuwerts, J. H. 1997 *The Lead Mines of Bonsall Moor.* Bakewell: Peak District National Park Authority Cultural Heritage Team archive - unpublished report.

Rieuwerts, J. H. 1998a *Glossary of Derbyshire Lead Mining Terms.* Matlock Bath: Peak District Mines Historical Society.

Rieuwerts, J. H. 1998b *Lead Mining Remains on Bradwell Moor.* Bakewell: Peak District National Park Authority Cultural Heritage Team archive - unpublished report.

Rieuwerts, J. H. 1998c Early gunpowder work in Longe or Cromford Sough, Derbyshire, 1662-1663 and 1676-1680. *Mining History* 13.6, pp. 1-5.

Rieuwerts, J. H. 1999a *The Lead Mines within Winster Liberty.* Bakewell: Peak District National Park Authority Cultural Heritage Team archive - unpublished report.

Rieuwerts, J. H. 1999b *The Lead Mines within the Liberties of Elton, Middleton-by-Youlgreave, Gratton and Smerrill Grange.* Bakewell: Peak District National Park Authority Cultural Heritage Team archive - unpublished report.

Rieuwerts, J. H. 2000a *Lathkill Dale, Derbyshire: its Mines and Miners.* Ashbourne: Landmark.

Rieuwerts, J. H. 2000b *The Mines within the Liberty of Wensley.* Bakewell: Peak District National Park Authority Cultural Heritage Team archive - unpublished report.

Rieuwerts, J. H. 2000c The history of Old Millclose Mine, Wensley. *Mining History* 14.3, pp. 68-79.

Rieuwerts, J. H. 2001 *The Lead Mines within the Liberties of Taddington, Blackwell, Chelmorton and part of Flagg.* Bakewell: Peak District National Park Authority Cultural Heritage Team archive - unpublished report.

Rieuwerts, J. H. 2003 *The Lead Mines within the Liberties of Flagg, Monyash and Ashford Southside.* Bakewell: Peak District National Park Authority Cultural Heritage Team archive - unpublished report.

Rieuwerts, J. H. 2004 *The Lead Mines within the Lordship or Liberty of Ashford Northside*. Peak District National Park Authority Cultural Heritage Team archive – Unpublished report.

Rieuwerts, J. H. 2005 *The Mines within the Lordships or Liberties of Calver, Hassop and Rowland*. Peak District National Park Authority Cultural Heritage Team archive – Unpublished report.

Rieuwerts, J. H. 2007a *Lead Mining in Derbyshire: History, Development & Drainage. 1: Castleton to the River Wye.* Ashbourne: Landmark.

Rieuwerts, J. H. 2007b *The History of Mining in the Liberty of Stoney Middleton, including Watergrove Mine, lying partly in Eyam and Ashford Northside Liberties.* Peak District National Park Authority Cultural Heritage Team archive – Unpublished report.

Rieuwerts, J. H. 2007c *The History of Lead Mining within the Liberty of Eyam*. Peak District National Park Authority Cultural Heritage Team archive – Unpublished report.

Rieuwerts, J. H. 2008a *Lead Mining in Derbyshire: History, Development & Drainage. 2: Millers Dale to Alport and Dovedale.* Ashbourne: Landmark.

Rieuwerts, J. H. 2008b *Lead mining in Hartington, Cold Eaton, Newton Grange and Thorpe, together with Notes relating to the Mining of Iron, Copper, Zinc, Manganese and Other Economic Minerals.* Peak District National Park Authority Cultural Heritage Team archive – Unpublished report.

Rieuwerts, J. H. 2009 *Lead Mining within Brassington, Carsington, Bradbourne, Kniveton, Ballidon, Aldwark and Aldwark Grange, Parwich, Tissington (part of), Cold Eaton and Griffe Grange.* Peak District National Park Authority Cultural Heritage Team archive – Unpublished report.

Rieuwerts, J. H. 2010a *Lead Mining in Derbyshire: History, Development & Drainage. 3: Elton to the Via Gellia.* The Horizon Press.

Rieuwerts, J. H. 2010b *The History and Development of the Mines and Soughs within the Liberty of Wirksworth.* Peak District National Park Authority Cultural Heritage Team archive – Unpublished report.

Rieuwerts, J. H. 2011a *The History and Development of Mining and Drainage in the Liberties of Cromford and Middleton-by-Wirksworth.* Peak District National Park Authority Cultural Heritage Team archive – Unpublished report.

Rieuwerts, J. H. 2011b *History and Development of Lead Mining within the Liberty of Matlock (Excluding that part within the Lordship of Snitterton).* Peak District National Park Authority Cultural Heritage Team archive – Unpublished report.

Rieuwerts, J. H. 2012a *Lead Mining in Derbyshire: History, Development & Drainage. 4: The area south of the Via Gellia.* Peak District Mines Historical Society.

Rieuwerts, J. H. 2012b The Mines and Drainage Levels in the Crich Inlier. Peak District National Park Authority Cultural Heritage Team archive – Unpublished report.

Rieuwerts, J. H. 2012c The History of Mining within the Ashover Inlier. Peak District National Park Authority Cultural Heritage Team archive – Unpublished report.

Rieuwerts, J. H. n.d. (a) *Maiden Rake, Heath Bush and the Calvestone Mines.* Bakewell: Peak District National Park Authority Cultural Heritage Team archive - unpublished report.

Rieuwerts, J. H. n.d. (b) *White Rake, Tideslow Rake and High Rake.* Bakewell: Peak District National Park Authority Cultural Heritage Team archive - unpublished report.

Rieuwerts, J. H. n.d. (c) *The Eldon Hill, Slitherstone and Linacre Mines.* Bakewell: Peak District National Park Authority Cultural Heritage Team archive - unpublished report.

Rieuwerts, J. H. n.d. (d) *Foreside (Faucet) Rake, New Rake and Associated Small Veins in Castleton and Peak Forest Liberties.* Bakewell: Peak District National Park Authority Cultural Heritage Team archive - unpublished report.

Rieuwerts, J. H. n.d. (e) *The Principal Mines and Veins SW from Dirtlow Rake Head.* Bakewell: Peak District National Park Authority Cultural Heritage Team archive - unpublished report.

Rieuwerts, J. H, and Ford, T. D. 1985 The mining history of the Speedwell Mine or Oakden Level, Castleton, Derbyshire. *Bulletin of the Peak District Mines Historical Society* 9.3, pp. 129-70.

Riley, L. J. 1977 Gank Hole Mine, Lathkill Dale. *Bulletin of the Peak District Mines Historical Society* 6.6, pp. 293-94.

Riley, L. J. and Willies, L. 1979 The recovery of the pumps from Wills Founder Shaft, Winster. *Bulletin of the Peak District Mines Historical Society* 4.6, pp. 199-205.

Robey, J. A. 1966 Field Grove Mine, Sheldon, Derbyshire. *Bulletin of the Peak District Mines Historical Society* 3.2, pp. 93-102.

Rodwell, J. S. (ed.) 2000 *British Plant Communities, Volume 5: Maritime Communities and Vegetation of Open Habitats.* Cambridge: Cambridge University Press.

Russell, A. 2013 William Senior's 1617 Map of Sheldon. *Mining History* 18.5, pp. 45-48.

Russell, A. in prep. The Mines of the Field Grove Vein.

Smith, A. and Ford, T. D. 1971 Some adits in Via Gellia. *Bulletin of the Peak District Mines Historical Society* 4.5, pp. 378-83.

Shaw, R. P. 1980 A survey and the geology of Putwell Hill Mine, Monsal Dale. *Bulletin of the Peak District Mines Historical Society* 7.6, pp. 342-344.

Stevenson, I. P. and Gaunt, G.D. 1971 *Geology of the Country Around Chapel en le Frith.* Keyworth: British Geological Survey Memoirs.

Timberlake, S. in press. Prehistoric Copper Extraction in Britain: Ecton Hill, Staffordshire. *Proceedings of the Prehistoric Society.*

Tune, R. 1969 A survey of Mandale Mine, Lathkill Dale. *Bulletin of the Peak District Mines Historical Society* 4.1, pp. 67-71.

Tune, R., Hurt, L. and Ford, T. D. 1968 Snake Mine, Hoptonwood, Derbyshire. *Bulletin of the Peak District Mines Historical Society* 3.5, pp. 291-297.

Warriner, D. J. 1981 Exploration of Fritchley Sough and Old End Vein, Crich. *Bulletin of the Peak District Mines Historical Society* 8.1, pp. 49-53.

Warriner, D. J. 1982 Examination and survey of Bage Mine. *Bulletin of the Peak District Mines Historical Society* 8.4, pp. 243-59.

Warriner, D. J. 2000a Old Millclose Mine and Sough: exploration report. *Mining History* 14.3, pp. 1-52.

Warriner, D. J. 2000b Survey of Yatestoop Sough. *Mining History* 14.3, pp. 57-62.

Warriner, D. J. and Birkett, N. 1982 Ratchwood Founder Shaft, Wirksworth. *Bulletin of the Peak District Mines Historical Society* 8.3, pp. 151-58.

Warriner, D. J., Willies, L. M. and Flindall, R. 1981 Ringing Rake and Masson Soughs and the mines on the east side of Masson Hill, Matlock. *Bulletin of the Peak District Mines Historical Society* 8.2, pp. 65-102.

Watson, J. J. W. 1860 Notes on the metalliferous saddles, or ore-bearing beds in the contorted strata of the Lower Carboniferous rocks of certain parts of Debyshire and North Staffordshire. *The Geologist* 3, pp. 357-69.

Webb, D. 2001 *A Cave and Mine Conservation Audit for the Masson Hill Area.* Derbyshire Caving Association.

Willies, L. 1974 A survey of Maypit and Redsoil Mines, Sheldon. *Bulletin of the Peak District Mines Historical Society* 5.6, pp. 349-59.

Willies, L. 1975 The washing of lead ore in Derbyshire during the nineteenth century. *Bulletin of the Peak District Mines Historical Society*, 6.2, pp. 53-63.

Willies, L. 1977 The recovery of the Wills Founder water pressure engine. *Bulletin of the Peak District Mines Historical Society* 6.5, pp. 191-99.

Willies, L. 1979 Technical Development in Derbyshire Lead Mining, 1700-1880. *Bulletin of the Peak District Mines Historical Society*, 7.3, pp. 117-151.

Willies, L. 1986 Prosperity and decline in Derbyshire lead mining. *Bulletin of the Peak District Mines Historical Society* 9.5, pp. 251-82.

Willies, L. 1991 Lead Ore Preparation and Smelting. In J. Day and R. F. Tylecote (eds) *The Industrial Revolution in Metals*. London: Institute of Metals, pp. 84-130.

Willies, L. 1998 Washing Floors at Winster Pitts, Derbyshire. *Mining History*, 13.6, pp. 49-57.

Willies, L. 1999 Derbyshire lead mining in the 18th and 19th centuries. *Mining History* 14.2, pp. 31-33.

Willies, L. 2003 *Magpie Mine (Revised Edition)*. Peak District Mining Museum: Peak District Mines Historical Society.

Willies, L., Gregory, K. and Parker, H.M. 1989 *Millclose the Mine that Drowned.* Scarthin Books.

Willies, L and Parker, H.M. 1999 *Peak District Mining and Quarrying*. Stroud: Tempus.

Willies, L., Roche, V. S., Worley, N. E., and Ford, T. D. 1980 *The History of Magpie Mine, Sheldon, Derbyshire.* Peak District Mines Historical Society.

Willies, L., Rieuwerts, J. H. and Flindall, R. 1977 Wind, water and steam engines on Derbyshire lead mines: a list. *Bulletin of the Peak District Mines Historical Society* 6.6, pp. 303-20.

Wood, A. 1999 *The Politics of Social Conflict: The Peak Country 1520-1770.* Cambridge: Cambridge University Press.

Worley, N. E. 1976 Lithostratigraphical control of mineralization in the Blende Vein, Magpie Mine, Sheldon near Bakewell, Derbyshire. *Proceedings of the Yorkshire Geological Society* 41.1, No 9, pp. 95-106.

Worley, N. E. and Ford, T. D. 1976 Mandale Forefield Shaft. *Mining History* 6.3, pp. 141-43.

Worley, N. E., Worthington, T. and Riley, L. 1978 The geology and exploration of the Hubbadale Mines, Taddington. *Bulletin of the Peak District Mines Historical Society* 7.1, pp. 31-39.