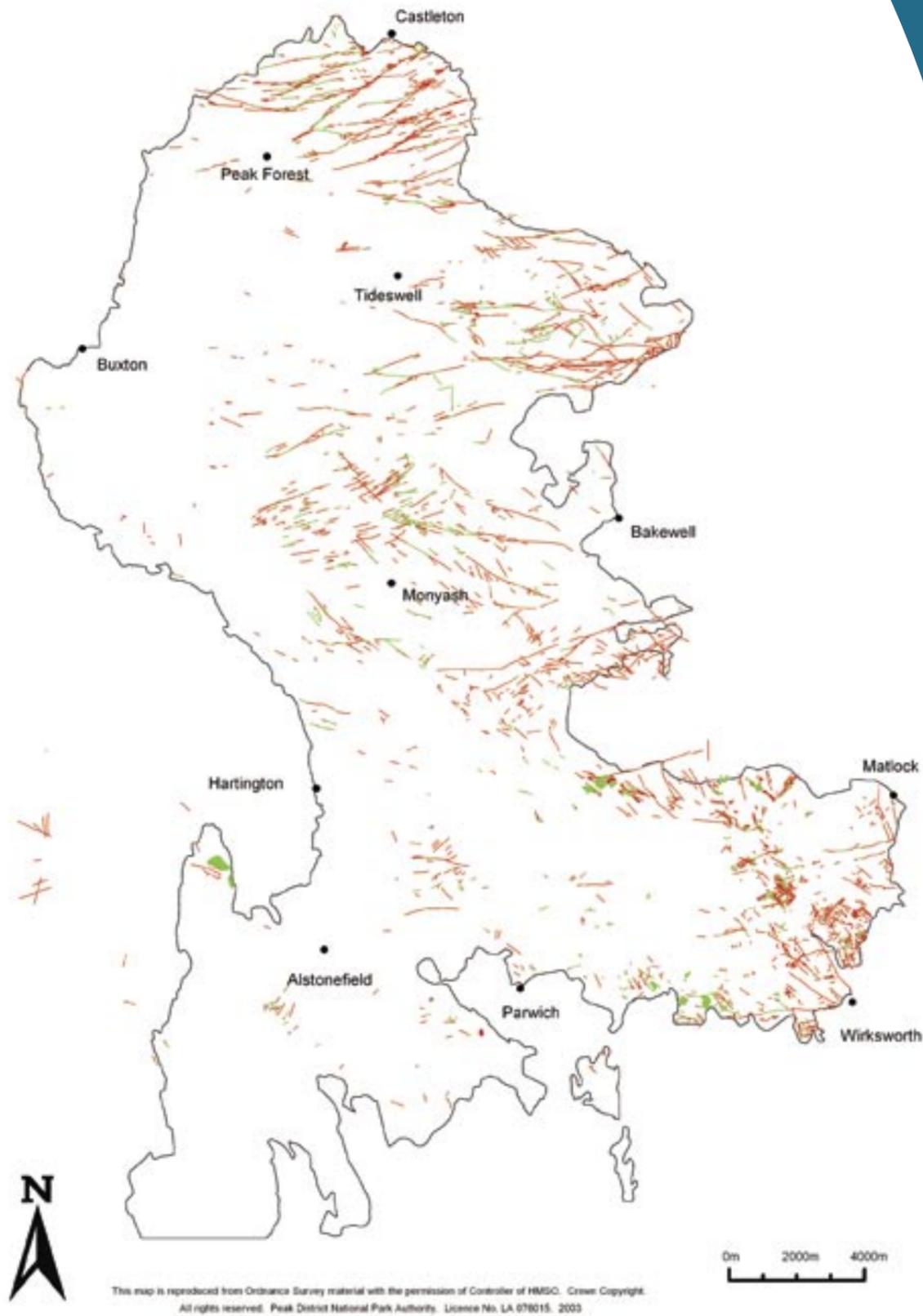


# the lead legacy

The Prospects for the Peak District's Lead Mining Heritage



The Prospects for the Peak District's Lead Mining Heritage



John Barnatt and Rebecca Penny

The distribution of lead mining surface remains in the Peak District orefield (limestone plateau - black line), showing those surviving in reasonable condition (green), and those removed or badly damaged over the last hundred years (red).

**Cover:** There are many surviving lead mining sites in the Peak District of important and multi-faceted conservation interest, as here at Oxlow Rake near Peak Forest (main image right - National Monuments Record/English Heritage). Many have waste hillocks, as at a typical example at the Dunnington Mines near Elton (bottom left - photographer Rebecca Penny, PDNPA). They include nationally important archaeological features, as at Magpie Mine near Sheldon (bottom middle - photographer Jon Humble, English Heritage), and specialist plant communities of international significance that include rare metal-tolerant species such as spring sandwort known locally as leadwort (middle left - English Nature) and the attractive mountain pansy (top middle - photographer Rhodri Thomas, PDNPA). However, these mining sites have been lost at alarming rates in recent decades and this process continues. Some early reworking has left interesting 20th century relics (top left - photographer John Barnatt, PDNPA), but removal of historic mine sites is sometimes total (middle - photographer Ray Manley, PDNPA).

**Title Page:** The extensive lead mining remains on Bonsall Moor are in many ways typical of the high-priority conservation resource surviving in the Peak District orefield. Careful examination of this photograph shows areas which have been damaged or removed. Some of the well-preserved areas here are protected as both a Scheduled Monument and a Site of Special Scientific Interest, while others currently have no statutory protection (2004 National Monuments Record/English Heritage).

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Report prepared by the Peak District National Park Authority for the Peak District National Park Authority Lead Rakes Project in partnership with English Heritage and English Nature.

Funded by the Aggregates Levy Sustainability Fund through Defra and English Heritage.

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First Published 2004.

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# the **lead** legacy

The Prospects for the Peak District's Lead Mining Heritage

**John Barnatt and Rebecca Penny**



Peak District National Park Authority Lead Rakes Project  
In partnership with English Heritage and English Nature, 2004

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## Foreword

The surviving lead mining remains of the Peak District are nationally and in some cases internationally significant. This was one of the largest, richest and longest-worked orefields in Britain and this country in turn was Europe's main supplier of lead for many centuries. Today the vestiges of this once-vital industry have great landscape, cultural, archaeological, ecological and geological merit. Centuries of mining have helped shape what we now value in the Peak District today, one of Britain's best-loved landscapes - a special place where its importance has been recognised by designating it a National Park, the top tier of landscape designation in Britain.

However, many of the surface remains of the lead mining industry in the Peak District have been lost in the last hundred years. Only about a quarter of what once existed now survives in reasonable condition and degradation continues, mainly through mineral operations and agricultural activity.

There is an urgent need to act now to safeguard the remaining lead mining sites and landscapes of high conservation value. A minority of features are protected as Scheduled Monuments, candidate Special Areas of Conservation and Sites of Special Scientific Interest or are currently conserved within agri-environment scheme agreements. However, these measures currently do not provide the necessary safeguards for the majority of the high-priority sites. At the same time, there is no adequate mechanism to protect landscape character at mining sites.

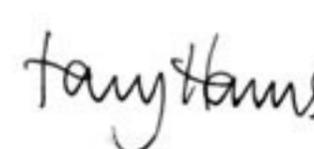
English Heritage, English Nature and the Peak District National Park Authority have worked in partnership to produce this report, at a critical time for this important resource, to raise awareness of the loss of lead mining heritage at a national and regional level. They are working together to secure the conservation of the lead legacy in the Peak District. There is also a need to work with local communities to promote understanding of the strong links with the past and the importance of safeguarding these unique features for future generations.

All of us must now work together to achieve sustainable, integrated management that reflects the interests of all parties.

Action must be taken now, so that this unique and irreplaceable heritage is not lost forever.



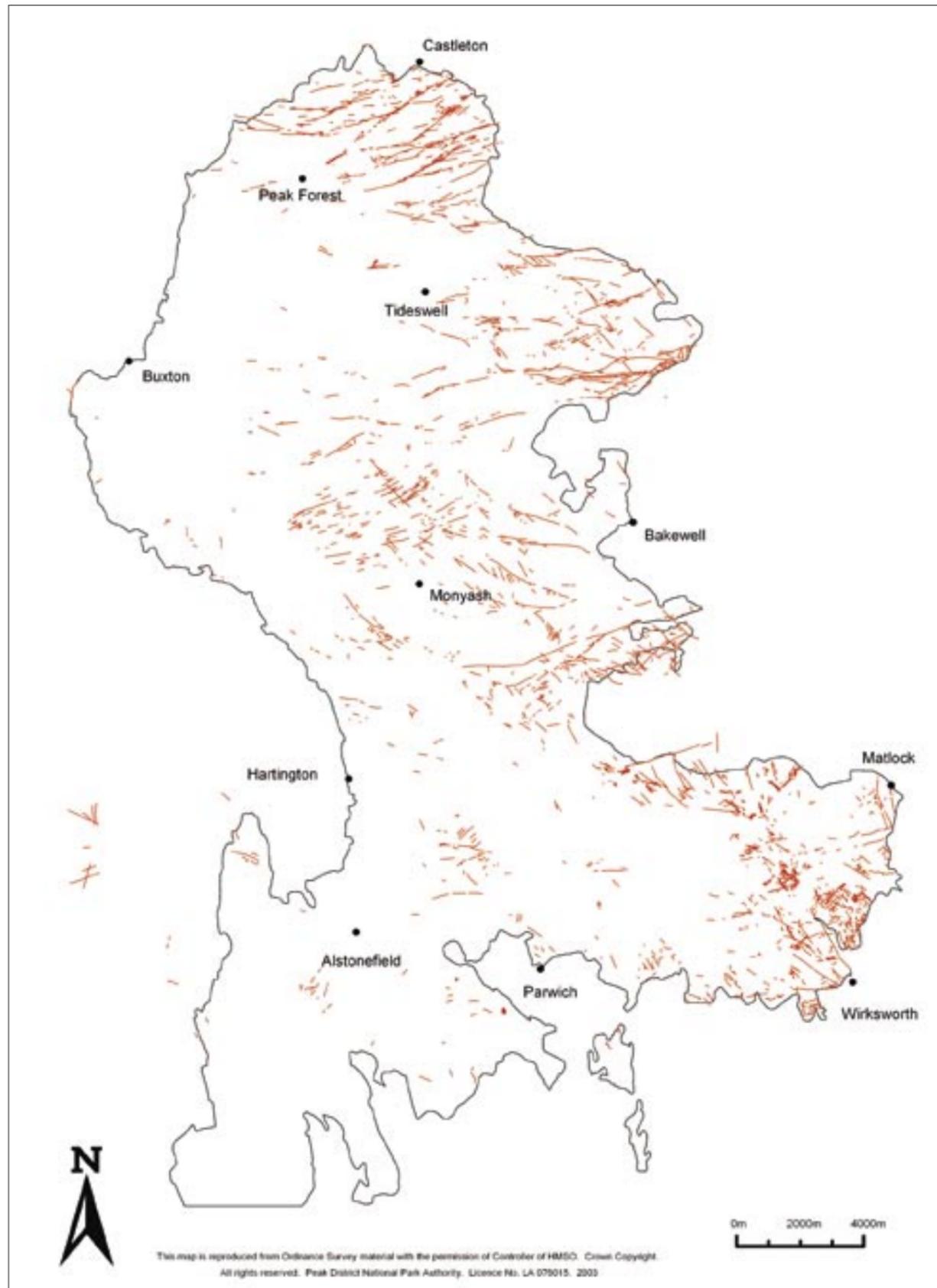
Martin Doughty  
Chair of English Nature



Tony Hams  
Chair of the National Park Authority



Sir Neil Cussons  
Chair of English Heritage



The distribution of lead mining remains in the Peak District orefield which have been lost or badly damaged (red); limestone plateau - black line.

## Summary

This report highlights the ongoing losses of important historic lead mining remains in the Peak District and sets out the urgent action that is necessary to safeguard this valuable and multi-faceted part of our heritage.

About three-quarters of these important features have been removed or are in significantly damaged condition. Only a small percentage of identified high-priority examples are protected, some through statutory designation and others conserved short-term by agri-environment schemes - these measures, as they stand, do not provide the wide ranging protection so urgently required.

Losses have reached a critical point where action to conserve further vital elements of the lead mining heritage is essential now if irreplaceable examples of sites and landscapes are not to disappear.

Acting on these concerns, the Peak District National Park Authority launched the Lead Rakes Project in 1996. This takes an integrated approach to implementing safeguards for the wide-ranging variety of lead mining features.

One outcome of the Project has been the completion of this report, produced as a partnership between the National Park Authority, English Heritage and English Nature.

### Its main aims are to:

- Present Inventories of high-priority 'Regionally and Nationally Important Lead Mining Sites' known to date and 'Lead Mining Landscapes' that should be conserved.
- Highlight conservation challenges and opportunities and explore ways of achieving sustainable management for the future. Only then will it be possible to retain all high-priority sites and landscapes.

### To place these primary aims in context, this report also:

- Summarises the geological origins and the history of lead mining in the Peak.

- Reviews the many interests found at lead mining sites and landscapes today.
- Summarises the survey findings of the Lead Rakes Project to date and the current degree to which high-priority sites are protected.
- Illustrates the conservation successes and challenges encountered.

### In reviewing the way forward, the report highlights the need to:

- Win hearts and minds by promoting understanding and acting as advocates for the importance of the lead mining resource and by disseminating information widely.
- Continue to implement the Lead Rakes Biodiversity Action Plan and meet archaeological and geological conservation targets.
- Undertake further data collection and research over the whole orefield.
- Generate resources to make all the above possible.

### It also stresses the necessity of:

- Reviewing further statutory designation of important sites and encouraging enhanced positive management of designated sites in an integrated way.
- Identifying and implementing appropriate mechanisms for the protection of historic landscape character.
- Ensuring that future agri-environment schemes recognise and target all the important facets of the lead mining resource, and introduce enhanced measures to make this possible.
- Making the conservation and enhancement of lead mining sites an economic asset to landowners.
- Seeking changes to Environmental Impact Assessment and Waste Management regulations to facilitate their ability to protect all important lead mining sites and landscapes.
- Seeking changes to Minerals Planning Guidance legislation to prevent unwarranted removal of the historic and wildlife resource.
- Developing policies to ensure the Inventories of 'Lead Mining Sites' and 'Landscapes' of special importance are adequately incorporated into the review of the National Park Management Plan and preparation of the Local Development Framework.

Fully effective lead mine heritage conservation will only be possible if all these measures are addressed. If these challenges are met then the resource can be safeguarded for the future.

*About three-quarters of lead mining sites in the Peak District have been lost in the last 100 years. Those that survive, as here at Hurdlow End near Peak Forest, are often of great archaeological and ecological interest (National Monuments Record/English Heritage). In contrast, modern removal is sometimes total, as here at Longstone Edge where the workings are so large that you have to look carefully to see the large machines on site (National Monuments Record/English Heritage).*



## A Vision for the Future - Sustainable Conservation of the Lead Mining Heritage

Centuries of lead mining within the Peak District have left a legacy of some of the most significant and visible features within the landscape. Many features in this nationally important and highly unusual landscape are worthy of conservation but the resource is at high risk through removal for minerals and agricultural 'improvement'. Many lead mining remains are of international, national or regional importance for their landscape, cultural, archaeological, ecological and geological interest.

Having entered a new century, following one that has seen an unprecedented loss in our wildlife and historic fabric, how do we address the future of what remains of the Peak District's mining heritage?

Legally protected archaeological, botanical and geological sites must be retained and managed well. But our vision must surely extend beyond this minimum, identifying further sites and landscapes of national and regional significance and working towards safeguarding them.

The starting point for the future should be a presumption in favour of conservation of all sites of significant value.

Our vision for the future is that it will be exceptional rather than normal to see features of conservation interest lost, although this is not to say that every mining site will survive; there may be overriding reasons for development in some cases. We need to work together, establishing a shared commitment, to use existing protective measures and to develop new ones that safeguard irreplaceable examples of our lead mining heritage. These will be incorporated in a living landscape of the future, not one that fossilises a landscape from a previous age. The aim is to see the lead mining heritage fully accepted as an integral part of the environmental, historical and cultural value of the Peak District.

### **To achieve adequate safeguards for this highly significant resource the following actions have been, and continue to be, needed:**

- Reach a fuller understanding of the resource and its many types of interest.
- Identify high-priority sites and landscapes that cover the full range of interests where conservation efforts should be focused.
- Take urgent action, where possible, to safeguard these places of high conservation interest before irreplaceable examples of the very varied resource are lost forever.
- Identify, and find solutions to, the conservation challenges that stand in the way of achieving this.
- Take further action, once implementation measures are in place, to secure the future of all high-priority sites and landscapes.



*Many fine lead mining sites survive today and hopefully can be saved for future generations to appreciate. A good example is at Black Rakes west of Middleton by Wirksworth where there are extensive mining hillocks and numerous capped shafts hidden by impenetrable bracken in summer. This site currently is not protected by statutory designation (photographer John Barnatt, PDNPA).*

### **In addition, we need to:**

- Promote the value of the lead mining heritage so that owners, managers and the public will better appreciate the importance of lead mining remains and will be enthusiastic advocates for their protection.
- Continue to take action at sites of lesser priority to secure survival where possible or, where future development is permitted, to minimise its impact on the existing resource.
- Encourage more-sustainable development so that, as far as possible, this can contribute positively to the conservation value of the lead mining resource in the Peak District.

Management of high-priority sites needs to be well-informed, learning from archaeological, historical, ecological and geological studies. It should include care for physical features, where necessary consolidating them, as well as tailoring grazing regimes or other habitat management to maximise the ecological value. Where features are to be lost, they should be thoroughly recorded beforehand. A representative selection of the best sites should be considered, with landowners' help, for public access where high quality interpretation and other learning opportunities would be provided. Communities with a lead mining history have a part to play in celebrating their ties with their past and being active participants in its conservation for future generations.

## 1: Lead Mining in the Peak - An Introduction

*'Travel with me through this howling wilderness... and I will show you all that is wonderful about it... to a valley on the side of a rising hill, where there were several grooves, so they call the mouth of the shaft or pit by which they go down into a lead mine,... we were agreeably surprised with seeing a hand, and then an arm, and quickly after a head, thrust up out of the groove we were looking at... the man was a most uncouth spectacle; he was clothed all in leather, had a cap of the same without a brim, some tools in a little basket which he drew up with him... This person was as lean as a skeleton, pale as a dead corpse, his hair and beard a deep black, his flesh lank, and, as we thought something of the colour of the lead itself... he looked like an inhabitant of the dark regions below, and who was just ascending into the world of light.'*

Daniel Defoe [26]\*

The 'howling wilderness' noted by Defoe in the 18th century was a very different Peak District to the one we see today. Many upland parts of the White Peak were open commons and the lead mines were extensive and in full



*A typical lead mining site in the Peak District orefield, on Bonsall Moor, with extensive waste hillocks and hollows at the sites of surface workings and shafts to depth (photographer Rebecca Penny, PDNPA).*

production. Much of the countryside had been 'polluted' by centuries of lead mining. This industrial landscape was widely regarded for much of the 20th century as 'derelict land'.



*Oxlow Rake, with Cop Rake to the left, are highly visible ancient mining sites crossing the landscape near Peak Forest (National Monuments Record/English Heritage).*

### The Importance of Lead Mining Sites

Today lead rakes\*\* are considered to be of high conservation importance, contributing to the nationally important landscape of the Peak District, which is enhanced by its rich wildlife and many historic features.

This once-important industry has left its mark on the landscape. Centuries of delving for the minerals of the White Peak, the central/southern area of the Peak District, have resulted in distinctive networks of hillocks and hollows of great historical importance, often stretching in lines across this limestone plateau and its dales. These hillocks and ruined mining structures survive as a testament to the hard work of generations of local people.

Since last worked the lead mining hillocks have been colonised with mosaics of flourishing plant communities, many of which support rare and interesting plants painting the landscape with colour and scent.

### Notes

\* Throughout the report further reading material is indicated by numbers in square brackets within the text, which correspond with those used in Further Reading.

Readers should consult the Glossary for explanations of specialist terms used.

\*\* The term 'lead rake' was used specifically by the miners for the main mineral veins, worked from surface to great depth. This report concentrates on the surface remains and uses the term 'lead rake' here as a shorthand for all surface mining remains, including hollows and hillocks following a variety of types of mineralisation, not just those at large veins.

**The National Context** - 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.

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 rakes in the Peak support rare metallophyte-rich grasslands, with metal-tolerant species, that are of international importance. Sites of archaeological, biological and geological interest are designated as nationally important.

The assessments of the mining resource presented in this report have great relevance to other regions, pointing the way to integrated and detailed conservation actions that could be adopted elsewhere. The methodologies applied to aerial photographic, archaeological and ecological assessments have the potential for national application at other orefields.

The conservation value of mining remains across Britain has often been undervalued in the past and it is vital that action is taken now to prevent sometimes unique and often important sites and landscapes being lost. The surviving resource is at a critical point where if high-priority features are not assessed in detail at national and regional levels, then rare and particularly informative sites will be lost forever.

**Origins and History** - Lead ore occurs in veins and other deposits within the Carboniferous Limestone of the Peak District as a result of mineralising fluids migrating into the faults and fissures about 270 million years ago. Lead ores have been extensively mined in this important orefield for upwards of 2000 years and the lead produced was an important part of the national as well as the local economy. From the 20th century fluorspar, barytes and calcite, not lead, have been the



main commodities to be mined from lead rakes, although lead ore has continued to be recovered as a by-product.

*A horse-drawn ore crusher of 19th century type in use in 1912 at Windy Mine on Moss Rake near Bradwell. This site has now been reworked for gangue minerals and is now levelled (PDNPA collection).*



**The Remains Today** - While much of the lead mining took place underground, for many people today what they see and value is at surface. The interest is multi-faceted:

- **Landscape Character** - The surface remains of the lead mining industry are a key element in the landscape character of the Peak District. This has been recognised as a key character element of the White Peak by the Countryside Agency [25], English Heritage [4] and English Nature [30].
- **Geology** - There are many important sites, at surface and underground, where the mineralisation and its formation can be studied. Some are protected by statutory designation as Sites of Special Scientific Interest (SSSIs) for their mineralogical value, or are listed as Regionally Important Geological and Geomorphological Sites (RIGS).

*The mid-19th century mine buildings at Magpie Mine near Sheldon are amongst the most complete survivals in Britain. The site is dominated by the large Cornish pumping engine house and other buildings. However, there are also far less obvious but important features, such as the two gin circles beyond the buildings to left and right (National Monuments Record/English Heritage).*



*Many lead rake hillocks have exceptionally rich plant communities. For example, at Bonsall Moor the plants include a mass of harebell and bird's-foot-trefoil (left), fragrant orchid, autumn gentian, thyme, fairy flax and hawkweed (right). The example near Elton has the metallophyte spring sandwort (leadwort) and kidney vetch (centre) (photographer Rebecca Penny, PDNPA).*

- **Archaeology** - The surface and underground remains of lead mining are very varied and include hillocks and such features as shafts, coes, gin circles, stopes, engine houses, crushing circles, ponds and buddles, which tell us much about the history of the mining and the processes used. Some sites are protected by statutory designation as Scheduled Monuments (SMs) and Listed Buildings.
- **Ecology** - Important mosaics of metalliferous, calcareous, neutral and acidic grasslands are highly characteristic of lead mining remains in the Peak District. Part of their ecological interest is the rare 'metallophyte' plant communities which tolerate metal-polluted ground. These metallophyte-rich grasslands are of international importance and some sites have been designated as

candidate Special Areas of Conservation (cSACs) and Sites of Special Scientific Interest (SSSIs). They are also recognised as an important component of the Peak District Biodiversity Action Plan (BAP).

- **Cultural, Social and Industrial History** - The surface remains are a visible manifestation of this once-important industry and are far more than just archaeological or ecological features. They provide important tangible evidence of the social, economic and industrial past of the region and its communities.

*Derbyshire lead miners, photographed at a reckoning day in 1867 at Rake Head Mine near Bradwell. Many of their names are known and some have descendants who still live in the region (PDNPA collection).*



The lead rakes of the Peak District are a conservation resource of national importance, with a multitude of types of interest, including landscape character, geology, archaeology, ecology and cultural, social and industrial history.

### A Resource at Risk

Many of the lead mining remains of the Peak District are currently at serious risk of damage or removal. There are two main causes:

- The re-working of the mineral resource.
- Removal or degradation by agricultural activity.

In the 20th century the Peak District became Britain's main source of fluorspar, contained within the waste minerals left behind by the lead miners. Other minerals such as calcite and barytes are also worked. While previous mining activity has left a diverse and valued resource, modern working methods and their often extensive nature have the capacity to obliterate the historic lead legacy and the unique ecological habitats which have developed here.

*At many important sites hillocks have been removed for their minerals, as here at Cop Rake near Peak Forest (photographer Ray Manley, PDNPA).*



In the latter part of the 20th century a large number of lead mining surface remains were removed or damaged by agricultural activity, often as part of general farming trends linked to increased productivity; this continues today. Sometimes removal by landowners and farmers has also been as a result of real or perceived potential problems of lead poisoning in their livestock.

If positive conservation action is not taken now then a wide range of important ecological and archaeological sites will be lost forever.

### Changing Attitudes

The mines started life because of people's desire to acquire mineral wealth, following what would be termed today the development prerogative. They then went through a time of 'abandonment' and were commonly seen as industrial wasteland. In recent years lead mining sites have been recognised as an integral part of the environmental, historical and cultural assets of the Peak District. Thus, historic mining remains have changed in value as our perceptions of them have altered. This is not to say that every example should be conserved, there may be overriding reasons for developing some of them. However, as a minimum, for those sites and landscapes of high-priority conservation value the desirable starting point for the future is a presumption in favour of conservation rather than allowing them to be damaged or removed.

Lead rakes may lack the obvious romance of moorland and hay meadows. However, one goal of the Lead Rakes Project is to enhance people's understanding and appreciation of the fascinating complexities of lead rakes and the many elements of interest they contain, from insects and flowers to geological and historic features. The Project aims to inspire the conservation of these national treasures for the benefit of current and future generations.

There is a need to raise the conservation profile of lead rakes, now recognised as an integral and valued part of the environmental, historical and cultural assets of the Peak District.

### The Lead Rakes Project

In 1996 officers of the Peak District National Park Authority formed the Lead Rakes Project to co-ordinate opportunities for lead rake conservation within the National Park, and identify and implement ways to achieve this. Subsequently, both English Heritage and English Nature have become partners in the Project.

The Project's aim is to ensure that current and future generations can continue to experience and enjoy the Peak District's important lead mining heritage.

**Our primary objective has been to survey in detail the remaining lead rakes in the Peak District orefield to enable conservation priorities to be identified.**

**Using this information, we have worked together to:**

- Raise awareness amongst local communities and the general public of the important contribution lead mining remains make to the historic landscape and its biodiversity.
- Forge partnerships with national and local conservation organisations, and others, to promote conservation of lead rakes.
- Safeguard important sites by negotiating conservation agreements with farmers and landowners.
- Carry out appropriate assessments of sites in relation to planning and development proposals.
- Raise awareness of the current conservation opportunities and challenges.

Much day-to-day conservation of the lead mining resource has traditionally taken place through the normal casework of the Authority's officers, both in the context of Minerals Planning and as a key broker of agri-environment schemes. However, since the formation of the Lead Rakes Project a more focused and integrated approach to the problems of the conservation of lead rakes has been possible.

*Many mining sites are potentially at risk and conservation initiatives are needed. Here, high above Castleton, Hazard Mine in the foreground was largely removed by opencasting for mineral a few years ago and the opencuts were being backfilled when this photograph was taken in 1998. The walled out parts of Daisy Rake and Oxlow Rake beyond survive and are now parts of a Scheduled Monument and SSSI. However, the unwalled parts of the veins here were recently levelled when paper pulp was spread (National Monuments Record/English Heritage).*



**In summary, the main achievements to date have been:**

#### General

- Completion of an aerial photographic assessment of the extent of the orefield's surviving surface remains (Chapter 4) [5].

#### Archaeology

- Commissioning of reports to quantify the loss of significant lead mining features (Chapter 4) [54] and to give the historical background to specific mining areas [55, 57, 59-63].
- Extensive fieldwork and desk-based assessment to produce Inventories of 'Lead Mining Sites' and 'Landscapes' of special importance (Chapter 5) [7].

### Ecology

- Detailed botanical survey of seven selected areas within the National Park, totalling about two-thirds of the overall resource (Chapter 4) [15-20].

### Conservation Action and Promotion

- Forging partnerships with national and local organisations, land managers and individuals to promote conservation initiatives for lead rakes.
- Pro-active work to secure the short-term futures of priority sites, by brokering conservation agreements through agri-environment schemes and by the promotion of voluntary sympathetic management (Chapter 5).
- Promoting the value of the resource to local communities, land managers, minerals operators, organisations and government at local, regional and national levels.
- Completion of this report.

For more details of these outputs see Appendix A.

### This Report

An early result of the increased focus on lead mining remains has been confirmation that statutory designation, the planning system and agri-environment schemes, all of which are key elements of increased protection and improved conservation, are not enough in their current form to ensure a sustainable future for the remaining resource.

#### The work of the Lead Rakes Project highlights the need to:

- Promote greater awareness and interest in lead rakes locally and nationally.
- Forge new, and consolidate existing, partnerships to further lead rake conservation.
- Work with the minerals industry and landowners to promote the retention of sites of conservation interest.
- Secure additional resources for conservation and research.
- Promote changes in legislation, agri-environment schemes and the planning system at national, regional and local levels.

This report, prepared in partnership with English Heritage and English Nature, and funded by the Aggregates Levy Sustainability Fund through Defra and English Heritage, addresses these issues (Chapters 7 and 8).

As a preliminary to this, the report introduces the conservation interests and what survives today (Chapters 2 and 4), presents Inventories of Lead Mining Sites and Landscapes of known high conservation priority (Chapter 5 and The Inventories), and gives examples of recent conservation initiatives (Chapter 6).

## 2: The Origins and History of Lead Rakes

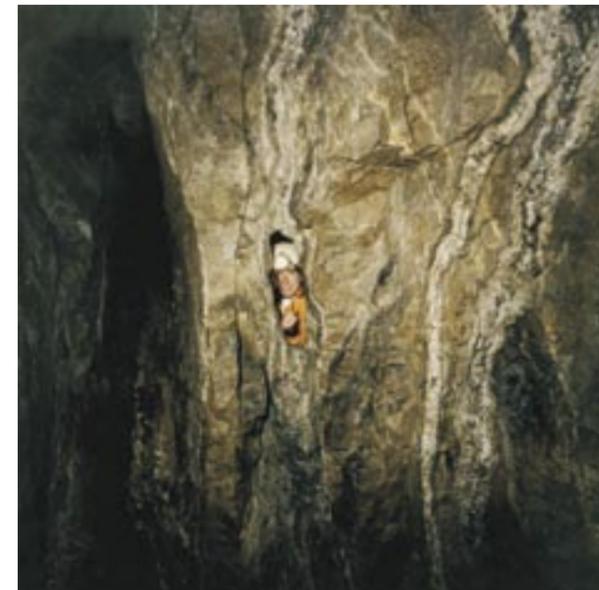
Natural processes initially formed the lead veins about 270 million years ago. Over the last 2000 years they have been mined by people who depended on them as a source of income and sometimes wealth.

### Geology and Minerals

**The Bedrock** - The formation of the rocks of the central Peak District is described succinctly by Ford and Rieuwerts [35]:

*"The limestones of the White Peak were formed as sediment on the floor of a tropical sea in the Carboniferous period of geological time, some 310-330 million years ago, when Britain lay close to the equator. The shallow sea was warm and clear and inhabited by a multitude of shellfish, corals, sea lilies (crinoids) and various microscopic forms of life. When these died their remains accumulated as layer upon layer of shell debris which hardened with time to form limestone."*

**Lead Ore** - The common lead ore of the Peak District is galena (lead sulphide). It occurs most commonly in veins in the Carboniferous Limestone, present as a result of mineralising fluids migrating into the faults and fissures several million years after the limestone was formed [1, 21, 24, 34-36, 46, 71]. The lead miners' term 'rake' applies to a major vertical or near-vertical mineralised vein. 'Scrins' are smaller veins. Other mineral deposits include 'flats' which are near horizontal deposits in the bedding planes between layers of limestone. 'Pipes' are irregular cavities that have been mineralised, with this often extending beyond the cavity to replace the surrounding limestone.



*Small veins containing gangue minerals but not much lead ore cut through the limestone in this part of Coalpit Rake at Matlock Bath. A richer vein to the left was mined away several hundred years ago (© Paul Deakin).*

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 an insulator against radiation.

**Other Minerals** - Galena forms only a small percentage of the minerals present in the Peak District orebodies. Although lead was the most economically important in the past, several once discarded minerals have been exploited over the last 100 years. The most common of these useful minerals are:

- **Fluorspar** (Calcium fluoride) - Common 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 slags. It was formerly very important as a flux in steel making.
- **Barytes** (Barium sulphate) - The main 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.
- **Calcite** (Calcium carbonate) - Used for terrazzo flooring, pebbledash wall coverings and grave ornamentation.

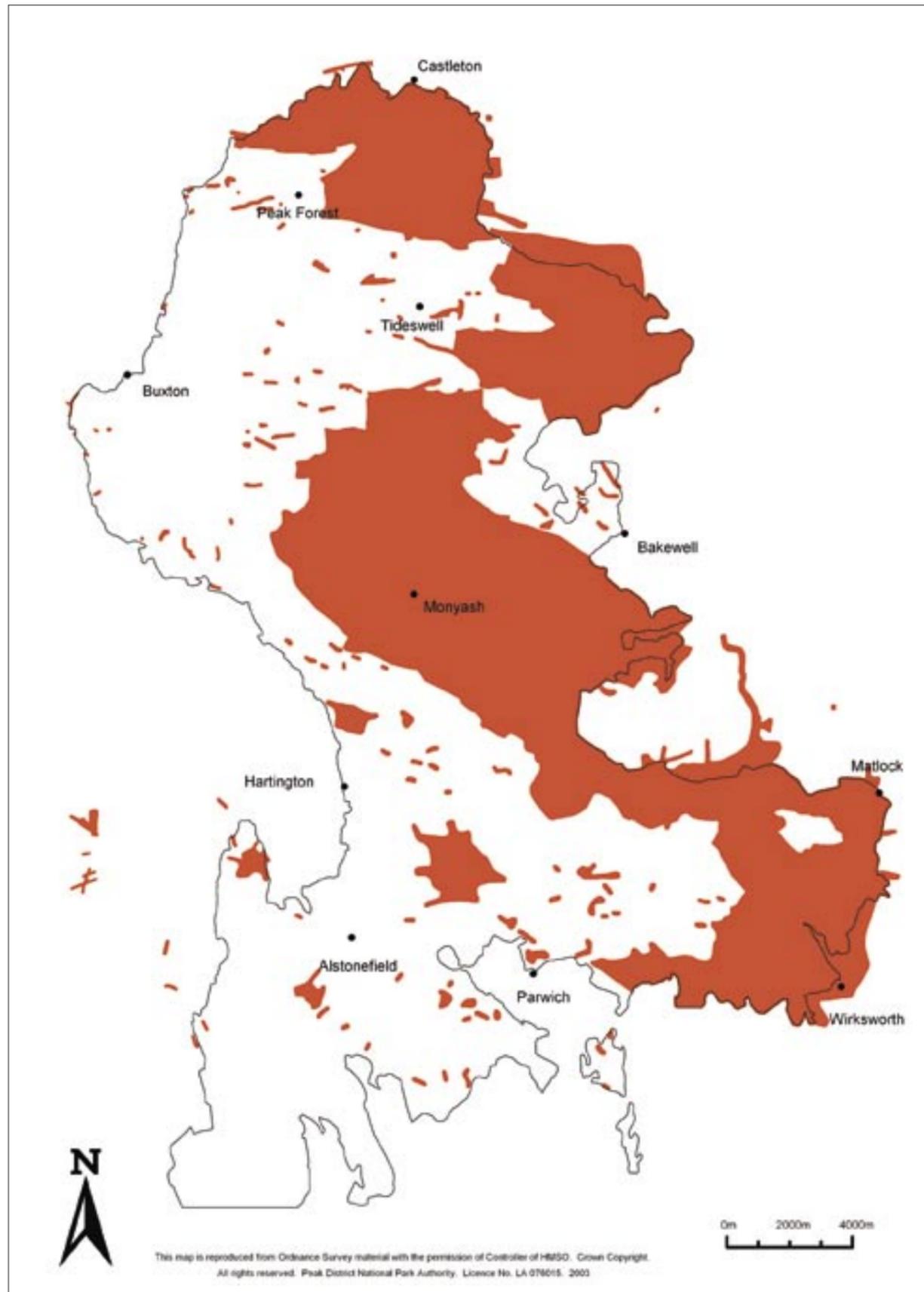
### Mining History

Lead mining has been an extremely important industry in the Peak District since the Roman period. Mining was extensive in the medieval period and later reached a peak in the 17th and 18th centuries, before the industry all but collapsed in the late 19th century. In post-medieval times 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 de-water the mines. 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 [3, 7, 8, 11, 42, 44, 56, 74-76]. The lead produced from the mines was a vital part of the economy of the Peak District and was important nationally, lead being one of Britain's major exports.

**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 recent discovery of a mining tool there which has been radio-carbon dated [12].

The main direct evidence for Roman mining in the Peak is the discovery of several inscribed lead ingots, known as pigs, found locally and as far away as Normandy. One of the main interests in lead ore for the Romans (and in later times) was that it is the main source of silver, often a small but significant component of the ore. In the Peak orefield they may have been disappointed, for the ores produced in post-medieval times were usually particularly poor in silver.

Documentary evidence for mining in Anglo-Saxon and medieval times is sparse, 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 at Wirksworth were controlled by the important Mercian abbey at Repton in the Trent Valley. 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 estates here. Domesday

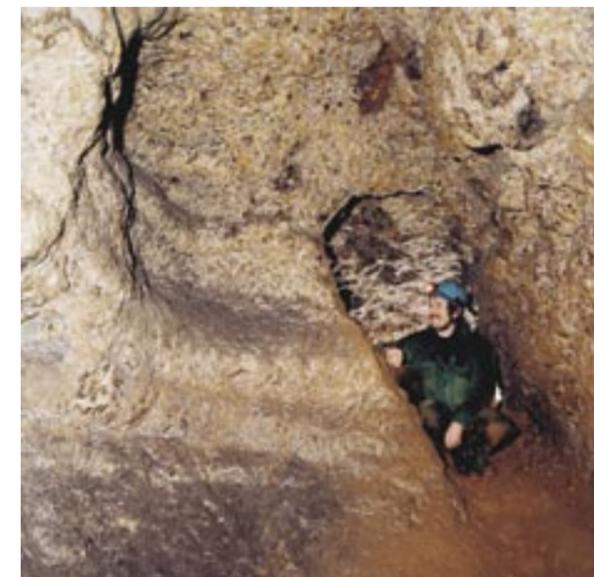


The location of the orefield (red), centred on the limestone plateau (black line) at the heart of the Peak District.

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 worked by full-time miners. In medieval times all mines are likely to have been either surface opencasts 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 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 [10].

*Distinctive small pickwork on all the visible rock surfaces indicates ancient working at the Nestus Pipes on Masson Hill at Matlock Bath. Here there are several hundred metres of pipeworkings, which were largely worked out by the 1480s, and today this is one of largest known medieval mines in Britain (© Paul Deakin).*



**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, 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. Similarly, 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 [48]. 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. Other, and sometimes somewhat shallower, mines used less expensive horse-powered gin engines, which had been employed from the 17th century. Engines were essential at all mines where winding shafts were over 50-75m deep.



*Some of the larger 18th and 19th century mines in the orefield needed high capital investment and had large buildings, as here at New Engine Mine above Eyam, where survivals include the 19th century horizontal engine house, now converted to a field barn, and remains of the adjacent boiler house (photographer Rebecca Penny, PDNPA).*

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 [9, 58], and had become common by the mid 18th century at latest. The use of gunpowder allowed ore to be extracted more efficiently, and shafts and levels to be driven through hard limestone far more easily.

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 advances 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.

Lead mining in the Peak went into terminal decline in the second half of the 19th century. With the exception of the rich Millclose Mine at Darley Bridge, which worked until 1939, little profitable work was done from the beginning of the 20th century onwards. From the early 20th century to the present, lead mining sites have been extensively reworked for minerals thrown away by the lead miners, known by them as gangue. Those of economic worth are primarily fluorspar, barytes and calcite, while lead ore is still a valuable by-product.

**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 [7, 35, 56]. As with any industry, many local traditional terms evolved associated with Peak District mining. 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 were first codified and set down on paper in the Quo Warranto of 1288 [47]. 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. On royal estates, which were extensive, the Crown has now held the lead mining rights and royalties 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 where somewhat different mining customs often applied.

Lead mining in Derbyshire has been overseen by the miners' Barmote Courts since medieval times. 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' and 'cope'. 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 by the companies for which they worked, although any profit was often taken up by the costs of purchase of equipment and materials necessary to continue mining. The mineral rights for Staffordshire were all in private hands in post-medieval times and traditional miners' law had ceased to operate.

In smaller mines, the miners usually worked for themselves, often part-time, frequently in small groups. In many cases there were also non-working partners 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. Commonly 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. Prior to the 19th century investors in mine companies were



*Mr Eagle, the King's Barmaster, handing over a disused lead mine on Moss Rake at Bradwell to a new group of miners in 1906. They stand next to a small shaft entrance with hand windlass (PDNPA collection).*

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.

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 Court officials. 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.

Normally it was men who worked down the mines doing the heavy work, with boys carrying out lighter tasks. At many mines woman and children did much of the surface ore-dressing. However, men sometimes carried out the heavier work here, winding the ore from underground, helping sieve the ore and emptying buddles.



*Women did much of the surface work at lead mines. At Gildereye Mine above Matlock Bath in about 1770, a woman sieves ore in a vat of water, while the men gaze into the distance (Lynne Willies collection).*

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 seven deaths were recorded between 1752 and 1856 [38].

**Lead Production** - In 1700 Britain was Europe's largest lead producer and the Peak District orefield made a significant contribution [74]. At the end of the 18th century the price of British lead did not recover from a fall and the steep decline of the industry began as rich ore sources were developed in other parts of the world.

The fortunes of any lead miner or mine owner were very dependent upon the world price of lead, which fluctuated significantly over the decades. 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, 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 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. In other cases full-time miners supplemented their income with smallholdings. 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.

While 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. This extraction continues to be undertaken by local people working for themselves as 'tributers' or more commonly directly for larger companies. Some people working in the industry carry on the tradition of being part-time farmers or having other second incomes.