the **lead** legacy

The Prospects for the Peak District's Lead Mining Heritage

GLOSSARY, ACKNOWLEDGEMENTS & FURTHER READING

Glossary

Peak District lead 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 [35, 56]).

***Adit** - see Level*

Article 4 and 7 Directions

Parts of Minerals Planning legislation, under General Permitted Development Orders - see Appendix J for details.

Barmote Court

Lead mining in Derbyshire has traditionally been overseen by the miners' Barmote Courts, each with a 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.

Barytes (Barite)

A gangue mineral, barium sulphate, abundant in veins and pipes. 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.

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 have either been replaced with railway sleepers, concrete caps or metal grills, or the shafts have been backfilled.

Belland Yard

Many mines have a wall around their waste heaps to prevent stock in the surrounding area grazing them and being poisoned. Belland is a dialect term for the finely powdered lead ore, while poisoned stock was said to be bellanded. Archaeologically, belland yard is the area defined by a wall that surrounds a mine.

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 acidic mineralising fluids and filled with minerals.

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*

Bouse Teem

A stone semi-circular hopper of 19th century date into which undressed ore 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.

Buddle

Buddles are wooden or stone-lined troughs of various designs used to concentrate the ore, where water was mixed with finely-crushed ore (also see Ore-Dressing). Lead ore was heavier than the gangue minerals with which it occurred and thus by passing the mixed material through flowing or agitated water the lead ore settled first while lighter material was flushed away. Buddles can sometimes still be easily recognised, comprising rectangular slab-lined pits and channels. Two exceptional sites contain surviving late 19th century circular buddles similar to those more common elsewhere, as 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. Often the buddle dams have low banks at the mound-top edges to control the speed of run-off. The heavy ore dropped first and was thus concentrated and could be removed from the upslope end of the dam for rebuddling, while the gangue remained in-situ and hence the mound increased in height with use.

Bunding

An underground working platform, often of wood, above floor level within mine workings.

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.

Calciner

Zinc ores needed to be roasted before they could be smelted. At one relatively large 19th century mine in the Peak District it appears this was done by drawing hot air over the ore in a purpose-built calciner.

Calcite

A gangue mineral, calcium carbonate, commonly found in veins and pipes. Present uses include terrazzo flooring, pebbledash wall coverings and grave ornamentation.

Candidate Special Areas of Conservation (cSAC)

The highest nature conservation designation, protecting sites of international importance, via the EU Habitats and Species Directive (1992) and the Habitats Regulations 1994.

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 to protect the mine entrance, for changing, providing shelter for ore dressers and for storing tools and ore.

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.

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 lieu for them having the first right of purchase.

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, drawing the wheel 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

A local term used by lead miners for 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, using either a hand windlass or an engine.

Dressing Floor

Mines usually had a prepared working area adjacent to the engine shaft where the ore was processed (also see Ore-dressing). Two basic operations took place here in order to prepare an ore concentrate ready for removal to the smelters. These were:

- *Crushing the lumps of ore/gangue brought from the mine, ether by hand or with a mechanised crusher.*
- *Washing, sieving and buddling the ore.*

Archaeological features commonly found associated with dressing floors include engine houses, engine shafts, gin circles, 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. This was sometimes a preferable option as it reduced the amount of material that had 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 which were known as Cornish engines. From the mid 19th century onwards less powerful horizontal engines were used for winding. All 19th century engines had attached boiler houses and had flues to tall adjacent chimneys. Some gin engines are also documented as having engine houses; none of these survive and they may well have been timber-built.

Engine Shaft

A shaft used in conjunction with an engine (gin or steam) 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.

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.

Flat

A miners' term for an ore deposit that lies roughly horizontal, following the limestone bedding. Often found underground running from the sides of veins.

Fluorspar

A gangue mineral, calcium fluorite, abundant in veins and pipes. 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 slags. It was formerly very important as a flux in steel making.

Forefield

The underground working face of a stope or level.

Galena

This mineral, lead sulphide, is by far the commonest lead ore found in the region (also see Lead).

Gangue

The local term for the waste minerals found with lead ore and usually discarded by lead miners, either in surface hillocks or underground. The common gangue minerals are calcite, barytes and fluorspar. In the last 100 years these have become more sought after than the lead.

General Permitted Development Order (GPDO)

In order to simplify the development process and to make the planning system more manageable, the General Permitted Development Order 1995 exists to modify the general requirement for planning permission when construction works or a change of use of land and buildings are proposed. This allows, for instance, some development to mine sites to take place without requiring planning permission. See Appendix J for details.

Gin Circle

The flat circular area round which a horse walked to work a gin engine. A gin was a commonly used 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) walking in a circle and pulling the drum around. Gin engines were used to remove both ore and water from the mines in tubs or kibbles.

Ginging

The miners' term for 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*

Hade

The slope of a vein away from the vertical.

Haulage Level *- see Level*

Headgear

A frame above a shaft, traditionally of wood but in the recent times of metal, which supported the pulley (or pulleys) for the winding rope (also see Engine House and Gin Circle).

Horse-Drawn Ore Crusher *- see Crushing Circle*

Horse Gin *- see Gin Circle*

Hotch

A simple semi-mechanised sieve for processing ore introduced in the 19th century. The sieve was usually on a frame within a rectangular tank with a pole to hand-operate it.

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 in a steeply inclined pipe or stope.

Launder

A long wooden trough or pipe for the conveyance of water, used at surface and underground.

Lead

A toxic heavy-metal, the main ore of which, in the Peak District, is Galena. 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.

Leat

An artificial channel for the conveyance of water. In some cases they 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 bottom (also 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 workings.

Level

A horizontal tunnel through rock, or a horizontal passage driven along a vein, which gave access to workings and allowed ore to be removed on sleds or wagons. Particularly large examples are often referred to as wagon gates or haulage levels. Levels that enter the mine from surface are alternatively known as adits.

Listed Building

A designated building or structure of architectural or historic interest, the character and appearance of which cannot be altered without approval.

Lot

A fraction of the dressed ore traditionally paid by lead miners to the owner of the mineral rights.

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.

Metallophyte

Plants that are tolerant of heavy metals such as lead in the soils.

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).

Natural Vegetation Classification (NVC)

Nationally recognised classification of semi-natural plant communities in Britain.

Opencuts

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-Dressing

The process of separating metal ore from the gangue mineral and adhering rock. For much of the history of lead 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 they were used for water storage, washing, sieving or buddling. Much ore-dressing 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 built to hold the proportion of ore given to the owner of the mineral rights and to 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 in 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.

Pickwork

The distinctive linear scars left in underground passages and in opencuts by the use of a miners' pick.

Pipe

A miners' 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 and with a raised plank floor allowing miners dry access to workings and for removal of ore.

Powder

The term commonly 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 remove rock and mineral. From the late 19th century onwards high explosives have also been used.

Powder House

These small buildings, often of 19th century date, are found at larger mines and are usually set aside from other buildings. They were used to store the gunpowder 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.

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 after having been pumped from deeper in the workings. The 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 to 200 metres.

Lead Rake is used differently in this report, as a shorthand term of convenience, to describe all mineral hillocks and other surface features within the orefield.

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.

Scheduled Monument

A site of archaeological and/or historical national importance given statutory protection from damage or destruction.

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.

Shotholes

The distinctive holes made by miners into which powder was placed in order to remove rock and mineral by blasting.

Site of Special Scientific Interest (SSSI)

A site of national biological or geological importance given statutory protection from damage or destruction.

Slime Pond

At some larger mines the final stage in the dressing process comprised the collection of small amounts of ore missed by placing finely-crushed material in a settling 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 smelters known as ore hearths. Further significant changes occurred in the 18th century with the development of the 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 miners' term for 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. 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 miners' term for a piece of wood or, less commonly, stone wedged across a working or vein. These were used for supporting stacked deads, as roof and working platform supports, and as rungs in ladder-ways.

Stope

The space left when the vein mineral has been removed, creating a vertical cavern sometimes many metres in length and height. These voids were often filled with 'deads' (waste material) supported on wooden or stone stemples.

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 and were 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 of narrow gauge. Tramways were also occasionally used in the 20th century at surface.

***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 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, from 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 because 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.

Acknowledgements

Many thanks to all the people who have contributed to this report. These include the Lead Rakes Project team: John Barnatt, David Bent, Helen Buckingham, Jane Chapman, Rebecca Penny, Ken Smith, Susan Smith, Rhodri Thomas and Sarah Whiteley.

English Heritage and English Nature have given their support to the Lead Rakes Project, both as partners and financially, with particular input from Ben Le Bas (EN), Kate Fearn (EH), Vince Holyoak (EH), Jon Humble (EH), Audra Hurst (EN), Jonathan Last (EH) and Jon Stewart (EN). This report was funded by a grant from the Aggregates Levy Sustainability Fund through Defra and English Heritage.

Ecological field surveys and analysis were carried out by Helen Buckingham, Pat Curry, Alistair Jump, Mandy Marler, Rebecca Penny and Jonathan Winn. Preliminary work identifying priority ecology sites was undertaken by James Frith. Archaeological field survey and assessment was carried out by John Barnatt, Bill Bevan, Phil Sidebottom, Heidi Taylor and Alice Ullathorne.

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. These include conservation organisations such as The National Trust, Derbyshire Wildlife Trust, Peak District Mines Historical Society and the Peak District National Park Authority. The National Trust part-funded the ecological survey of the Monyash area.

The analysis of aerial photographs to assess levels of survival and loss was carried out by Henrietta Claire, with help from George Ainsley, Kenny Aitchison and Johnny Dempsey, under the supervision of John Barnatt.

Many people have helped with archaeological assessment, identifying sites for consideration, making comment on sites, and carrying out or helping with fieldwork and underground assessments. These include: Paul Deakin, Chris Heathcote, Jon Humble, Len Kirkham, Paul Mortimer, Jim Rieuwerts, Phil Shaw, Clive Waddington, Dave Webb, Dave Williams, Lynn Willies, John Wilmot, and Terry Worthington.

Information on designated sites came from English Heritage and English Nature, and other information was provided by Derbyshire County Council and Defra.

Assistance with editing the report was given by Chris Taylor, the PDNPA Head of Communications, and it was prepared for publication by the PDNPA Design Team, with particular mention of Sarah Gillott who did most of the design work. Help with preliminary preparation of the illustrations was given by Tim Allen, Philippa Davey and Ray Manley.

The majority of the surface photographs were taken by John Barnatt, Ray Manley and Rebecca Penny. Additional images came from Sarah Frith, Jon Humble, Richard Sheppard, Rhodri Thomas and the collections of the Peak District National Park Authority and English Nature. Aerial photographs were provided by English Heritage and the late Derrick Riley. The underground photography is by Paul Deakin who generously gave his permission for reproduction. The photographs of Cavendish Mill and the current Longstone Edge workings were taken with the kind permission of Glebe Mines Ltd. Lynn Willies kindly allowed reproduction of a copy of an eighteenth century print and John Barnatt provided the early photograph of High Rake Mine. Individual credits are given in the illustration captions.

The majority of the maps were prepared by Tim Allen from the National Park Authority's GIS data, with background detail under licence from the Ordnance Survey. Two maps showing national plant distributions are reproduced with the kind permission of the Controller of HMSO and the Queen's Printer for Scotland.

Further Reading

The reference numbers given at the beginning of each entry correspond with those quoted throughout the text.

1 Aitkenhead, N., Chisholm, J. I. and Stevenson, I. P. (1995) *Geology of the Country Around Buxton, Leek and Bakewell.* Keyworth: British Geological Survey Memoirs.

2 Anderson, P. and Shimwell, D. (1981) *Wild Flowers and Other Plants of the Peak District.* Ashbourne: Moorland.

3 Barnatt, J. (1999a) Prehistoric and Roman mining in the Peak District: present knowledge and future research. *Mining History* 14.2, 19-30.

4 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.

5 Barnatt, J. (2000) *Lead Rakes in the Peak District: Hillock Today, Gone Tomorrow*. Bakewell: PDNPA Cultural Heritage Team archive - Unpublished report for English Heritage.

6 Barnatt, J. (2002) Excavation and conservation at How Grove, Dirtlow Rake, Castleton, Derbyshire. *Mining History* 15.2, 1-40.

7 Barnatt, J. (2004) *An Inventory of Regionally and Nationally Important Lead Mining Sites in the Peak District: Archaeological Importance*. Bakewell: PDNPA Cultural Heritage Team archive - Unpublished report.

8 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.

9 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, 24-43.

10 Barnatt, J. and Rieuwerts, J. (1998) The Upper Nestus Pipes: an ancient lead mine in the Peak District of Derbyshire. *Mining History* 13.5, 51-64.

11 Barnatt, J. and Smith, K. (in prep). *The Peak District: Landscapes Through Time* (Second Edition). Bollington: Windgather Press.

12 Barnatt, J. and Thomas, G. H. (1998) Prehistoric mining at Ecton, Staffordshire: A dated antler tool and its context. *Mining History* 13.5, 72-78.

13 Brown, A., Hall, R. and Townsend, D. (2001) *State of Nature: The Upland Challenge*. Peterborough: English Nature.

14 Buckingham, H., Chapman, J. and Newman, R. (1997) *Meadows Beyond the Millennium: The Future for Hay Meadows in the Peak District National Park*. Bakewell: Peak District National Park Authority.

15 Buckingham, H. and Penny, R. (1997) *Bonsall Moor: Lead Rakes Project Ecology Technical Report*. Bakewell: PDNPA archive - Unpublished report.

16 Buckingham, H., and Penny, R. (2000a) *Castleton Moor and Peak Forest: Lead Rakes Project Ecology Technical Report*. Bakewell: PDNPA archive - Unpublished report.

17 Buckingham, H. and Penny, R. (2000b) *Bradwell Survey Area: Lead Rakes Project Ecology Technical Report*. Bakewell: PDNPA archive - Unpublished report.

18 Buckingham, H. and Penny, R. (2001a) *Winster Survey Area: Lead Rakes Project Ecology Technical Report*. Bakewell: PDNPA archive - Unpublished report.

19 Buckingham, H. and Penny, R. (2001b) *Elton Survey Area: Lead Rakes Project Ecology Technical Report*. Bakewell: PDNPA archive - Unpublished report.

20 Buckingham, H. and Penny, R. (2001c) *Monyash: Lead Rakes Project Ecology Technical Report*. Bakewell: PDNPA archive - Unpublished report.

21 Chisholm, J. I., Charsley, T. and Aitkenhead, N. (1988) *Geology of the Country Around Ashbourne and Cheadle*. Keyworth: British Geological Survey Memoirs.

22 Clapham, A. (ed.) (1969) *The Flora of Derbyshire*. Derby: Bemrose & Sons.

23 Cooper, E. (1997) *Summary Descriptions of the National Vegetation Classification Grassland and Montane Communities*. Peterborough: Joint Nature Conservation Committee.

24 Cope, F. W. (1998) *Geology Explained in the Peak District*. Cromford: Scarthin Books.

25 Countryside Agency (1999) *Countryside Character - Volume 4: East Midlands*. Cheltenham: Countryside Agency.

26 Defoe, D. (1724-6) *A Tour Thro' the Whole Island of Great Britain*. London.

27 Defra (Conservation Management Division) (2002a) *'Agri-Environment Schemes Framework Document' - A Consultation on the Future of Agri-Environment Schemes*. London: Defra - Consultation document.

28 Defra (2002b) *Environmental Impact Assessment (Agriculture) Regulations 2002*. London: Defra.

29 D.C.M.S. (2003) *Protecting Our Historic Environment: Making the System Work Better*. London: Department of Culture, Media and Sport.

30 English Nature (1998) *Natural Area Profile - White Peak*. Over Haddon: English Nature.

31 Fairclough, G. J. (1998) Assessment and characterisation, English Heritage's approach to the historic landscape. In M. Jones and I. D. Rotherham (eds.) *Landscapes - Perception, Recognition and Management; Reconciling the Impossible*. Sheffield: Wildtrack - Landscape, Archaeology and Ecology, Volume 3.

32 Fairclough, G. J. (2002) Steps towards the integrated management of a changing landscape: Historic Landscape Characterisation in England. In G. Swensen (ed.) *Cultural Heritage on the Urban Fringe*, Nannetsad Workshop Report March 2002, NIKU 126. Oslo: Norsk Institut for Kulturminneforskning, 29-39.

33 Fairclough, G. J. and Rippon, S. J. (eds.) (2002) *Europe's Cultural Landscape: Archaeologists and the Management of Change, EAC Occasional Paper 2*. Brussels and London: Europae Archaeologiae Consilium and English Heritage.

34 Ford, T. D. (2002) *Rocks and Scenery of the Peak District*. Ashbourne: Landmark.

35 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.

36 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, 16-55.

37 Grime, J. P., Hodgeson, J. G. and Hurst, R. (1988) *Comparative Plant Ecology*. Oxford: Oxford University Press.

38 Heathcote, C. (2001) A history and gazetteer of the mines in the Liberty of Peak Forest, Derbyshire, 1605-1878. *Mining History* 14.5, 1-28.

39 HMSO (1995) *Biodiversity: The UK Steering Group Report* (2 Vols). London: HMSO.

40 Hubbard, C. E. (1992) *Grasses*. Harmondsworth: Penguin.

41 Jefferson, R. G. (1996) *Lowland Grassland in Natural Areas: National Assessment of Significance. Review of the Lowland Grassland Significance of England by Natural Areas*. Unpublished report for English Nature.

42 Kiernan, D. (1989) *The Derbyshire Lead Industry in the Sixteenth Century*. Chesterfield: Derbyshire Records Society Vol. XIV.

43 Peak District Biodiversity Partnership (2001) *The Peak District Biodiversity Action Plan*. Bakewell: Peak District National Park Authority.

44 Porter, L. and Robey, J. (2000) *The Copper and Lead Mines Around the Manifold Valley, North Staffordshire*. Ashbourne: Landmark.

45 Prestman, C. D., Pearman, D. A. and Dines, T. D. (2002) *New Atlas of the British Flora*. Oxford: Oxford University Press.

46 Quirk, D. G. (1993) The origins of the Peak District orefield. *Bulletin of the Peak District Mines Historical Society* 12.1, 4-15.

47 Rieuwerts, J. H. (1978) The Inquisition or Quo Warrento of 1288. *Bulletin of the Peak District Mines Historical Society* 7.1 and 7.2, 41-49 and 96-98.

48 Rieuwerts, J. H. (1987) *History and Gazetteer of the Lead Mine Soughs of Derbyshire*. Sheffield: Privately published.

49 Rieuwerts, J. H. (1992a) *Bonsall Lees Mines*. Bakewell: PDNPA Cultural Heritage Team archive - Unpublished report.

50 Rieuwerts, J. H. (1992b) *Gorseydale Mines*. Bakewell: PDNPA Cultural Heritage Team archive - Unpublished report.

51 Rieuwerts, J. H. (1993a) *The Alport Mining Field*. Bakewell: PDNPA Cultural Heritage Team archive - Unpublished report for English Heritage.

52 Rieuwerts, J. H. (1993b) *The Whitelow Mines, Bonsall Moor*. Bakewell: PDNPA Cultural Heritage Team archive - Unpublished report for English Heritage.

53 Rieuwerts, J. H. (1993c) *Ashton's Mine, Pindale Side and the Nether Dirtlow Mines*. Bakewell: PDNPA Cultural Heritage Team archive - Unpublished report for English Heritage.

54 Rieuwerts, J. H. (1996) *Lead Rakes: Surviving Archaeological Features and Destroyed Sites*. Bakewell: PDNPA Cultural Heritage Team archive - Unpublished report.

55 Rieuwerts, J. H. (1997) *The Lead Mines of Bonsall Moor*. Bakewell: PDNPA Cultural Heritage Team archive - Unpublished report.

56 Rieuwerts, J. H. (1998a) *Glossary of Derbyshire Lead Mining Terms*. Matlock Bath: Peak District Mines Historical Society.

57 Rieuwerts, J. H. (1998b) *Lead Mining Remains on Bradwell Moor*. Bakewell: PDNPA Cultural Heritage Team archive - Unpublished report.

58 Rieuwerts, J. H. (1998c) Early gunpowder work in Longe or Cromford Sough, Derbyshire, 1662-1663 and 1676-1680. *Mining History* 13.6, 1-5.

59 Rieuwerts, J. H. (1999a) *The Lead Mines within Winster Liberty*. Bakewell: PDNPA Cultural Heritage Team archive - Unpublished report.

60 Rieuwerts, J. H. (1999b) *The Lead Mines within the Liberties of Elton, Middleton-by-Youlgreave, Gratton and Smerrill Grange*. Bakewell: PDNPA Cultural Heritage Team archive - Unpublished report.

61 Rieuwerts, J. H. (2000) *The Mines within the Liberty of Wensley*. Bakewell: PDNPA Cultural Heritage Team archive - Unpublished report.

62 Rieuwerts, J. H. (2001) *The Lead Mines within the Liberties of Taddington, Blackwell, Chelmorton and part of Flagg*. Bakewell: PDNPA Cultural Heritage Team archive - Unpublished report.

63 Rieuwerts, J. H. (2003) *The Lead Mines within the Liberties of Flagg, Monyash and Ashford Southside*. Bakewell: PDNPA Cultural Heritage Team archive - Unpublished report.

64 Rieuwerts, J. H. (n.d.) *Maiden Rake, Heath Bush and the Calvestone Mines*. Bakewell: PDNPA Cultural Heritage Team archive - Unpublished report.

65 Rieuwerts, J. H. (n.d.) *White Rake, Tideslow Rake and High Rake*. Bakewell: PDNPA Cultural Heritage Team archive - Unpublished report.

66 Rieuwerts, J. H. (n.d.) *The Eldon Hill, Slitherstone and Linacre Mines*. Bakewell: PDNPA Cultural Heritage Team archive - Unpublished report.

67 Rieuwerts, J. H. (n.d.) *Foreside (Faucet) Rake, New Rake and Associated Small Veins in Castleton and Peak Forest Liberties*. Bakewell: PDNPA Cultural Heritage Team archive - Unpublished report.

68 Rieuwerts, J. H. (n.d.) *The Principle Mines and Veins SW from Dirtlow Rake Head*. Bakewell: PDNPA Cultural Heritage Team archive - Unpublished report.

69 Rodwell, J. S. (ed.) (2000) *British Plant Communities, Volume 5: Maritime Communities and Vegetation of Open Habitats*. Cambridge: Cambridge University Press.

70 Rose, F. (1991) *The Wildflower Key*. Harmondsworth: Penguin.

71 Stephenson, I. P. and Gaunt, G. (1971) *Geology of the Country Around Chapel en le Frith*. Keyworth: British Geological Survey Memoirs.

72 Willies, L. (1979) Technical Development in Derbyshire Lead Mining, 1700-1880. *Bulletin of the Peak District Mines Historical Society*, 7.3, 117-151.

73 Willies, L. (1991) Lead Ore Preparation and Smelting. In J. Day and R. F. Tylecote (eds) *The Industrial Revolution in Metals*, 84-130. London: Institute of Metals.

74 Willies, L. (1999) Derbyshire lead mining in the 18th and 19th centuries. *Mining History* 14.2, 31-33.

75 Willies, L. and Parker, H. (1999) *Peak District Mining and Quarrying*. Stroud: Tempus.

76 Wood, A. (1999) *The Politics of Social Conflict: The Peak Country 1520-1770*. Cambridge: Cambridge University Press.