British Geological Survey

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Mineral Resource Information for Development Plans
Peak District National Park: Resources and Constraints

D E Highley and D G Cameron

BRITISH GEOLOGICAL SURVEY

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Mineral Resource Information for Development Plans Peak District National Park: Resources and Constraints

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This report accompanies the 1:100 000 scale map:
Peak District National Park Mineral Resources

Cover photograph
Headstone Head, Monsal Dale, looking west along the valley cut in Monsal Dale Limestones. *British Geological Survey Photographs*. No. L2275.

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INTRODUCTION

This report has been prepared to be used in conjunction with the Mineral Resources Map of the Peak District National Park. The principal aim of the report and its associated map is to show the broad distribution of mineral resources of current or potential economic interest in the Peak District National Park and to relate these to selected, nationally-recognised planning constraints on extraction of minerals. The work is intended to assist in the consideration and preparation of development plan policies in respect of mineral extraction and the protection of important mineral resources.

Development plans set out the main considerations on which planning applications are determined, and they therefore form the essential framework of the planning system. The importance of the development plan system in planning decisions is emphasised by Section 54A of the Town and Country Planning Act 1990, which requires that planning applications and appeals be determined in accordance with the development plan, unless material considerations indicate otherwise. The planning system is therefore a plan-led system.

Development plan preparation must take account of Government guidance. This is primarily set out in Planning Policy Guidance notes (PPGs), Mineral Planning Guidance notes (MPGs) and Regional Planning Guidance notes (RPGs). These provide advice on a range of general and specific issues.

The 'development plan' includes structure plans, which contain strategic planning policies, and local plans, containing detailed policies and proposals, or unitary development plans, which combine both functions. In addition, relevant authorities must produce local plans on minerals and waste.

Information on mineral resources is required to assist the production of mineral local plans by the identification of important resources and the planning constraints which may affect such resources. This information is also necessary for the preparation of structure, local and unitary plans, both in relation to mineral development and the prevention of the sterilisation of important mineral resources.

Three major elements of information are presented and described:

- the geological distribution and importance of mineral resources
- the extent of mineral planning permissions and the location of current mineral workings
- the extent of key planning constraints (national statutory designations)

The map thus brings together a wide range of information, much of which is scattered and not always available in a consistent and convenient form. It is anticipated that the map and report will also provide valuable background data for a much wider audience, including the different sectors of the minerals industry, other agencies and authorities (e.g. The Planning Inspectorate, the NRA, the Countryside Commission and English Nature), environmental interests and the general public.

Mineral resource classification

Mineral resources are natural concentrations of minerals which might now, or in the foreseeable future, be of economic value. However, the identification and delineation of mineral resources is imprecise as it is limited by the quantity and quality of data currently available, and involves predicting what might

or might not become economic to work in the future. The pattern of demand for minerals is continually evolving due to changing economic, technical and environmental factors. The economic potential of mineral resources is not static, therefore, but changes with time.

The maps in this series show principally the extent of **inferred resources**, that is those mineral resources that can be defined from available geological information. They have neither been evaluated by drilling or other sampling methods, nor had their technical properties characterised on any systematic basis. The British Geological Survey has, however, carried out a comprehensive mineral assessment of the Carboniferous limestones of the Peak District, and their distribution and quality is well understood. The map of the Peak District National Park shows primarily the extent of **indicated resources** of Carboniferous limestones, that is, those resources that have been drilled and sampled on a regular basis by BGS, and have had their technical properties characterised. The other mineral resources shown on the map are shown at the **inferred resource** level, as defined above. The mineral resources shown on the map take no account of planning constraints which may limit their working.

That part of a **mineral resource** which has been fully evaluated and is commercially viable to work is called a **reserve** or **mineral reserve**. The relationship between **inferred** and **indicated resources** shown on the map and evaluated and commercial deposits (**reserves**) is described in more detail in Appendix 3. In the context of land-use planning, however, the term **reserve** should strictly be limited to those minerals for which a valid planning permission for extraction exists (i.e. **permitted reserves**).

Mineral workings and planning permissions

The location and name of mineral workings, together with the main commodities produced, are shown on the map and in Appendix 1. However, given the scale of the map, some small workings, for example 'vein' mineral tributers, are omitted. The reworking of waste dumps for recovery of minerals is outwith the remit of the project. A distinction is made between surface and underground workings.

The extent of mineral planning permissions is shown on the Mineral Resources Map. They cover active mineral workings, former mineral workings and, occasionally, unworked deposits. The planning permissions data were obtained from the Peak District Joint Planning Board.

The present physical and legal status of individual permissions is not qualified on the map or in the report. The areas shown may, therefore, include inactive sites, where the permission has expired due to the terms of the permission, i.e. a time limit, and inactive (dormant) sites where the permission still exists. Sites which have been restored have not been separately identified. A planning permission may extend beyond the mapped resource, as it may make provision for operational land, including plant and overburden tips, or it may extend to an easily identified or ownership boundary. Information on the precise status and extent of individual planning permissions should be sought from the Peak District Joint Planning Board.

Environmental designations

The map shows the extent of selected, nationally-designated planning constraints as defined for the purposes of this survey. These constraints are defined on a common national basis, and therefore represent a consistent degree of constraint across the country. In addition, the whole area of the map is

a National Park. No interpretation should be made from the map with regard to the relative importance of the constraints, either in relation to mineral development proposals or in relation to each other. Users should consult policy guidelines issued by the relevant Government department, statutory agency or local authority.

The constraints shown on the map are:

- Peak District National Park (whole area of map)
- National Nature Reserves (NNR)
- Sites of Special Scientific Interest (SSSI)
- Scheduled Monuments

Mineral development may also be constrained by other factors not shown on the map, including conservation areas, considerations relating to the protection of other resources, such as groundwater and local amenity or environmental concerns such as noise, traffic and visual impact. These have been excluded because the constraint is not defined on a national basis or the information is not generally available. The extent or degree of relevance of such constraints can be ascertained from the relevant statutory agency or the Mineral Planning Authority (Appendix 2).

English Nature provided data on SSSIs and NNRs in digital form. Information on the location of Scheduled Monuments has been obtained in digital form from English Heritage, and this has had to be edited and the grid references converted to a form that is suitable for use by BGS Cartographic Services.

MINERAL RESOURCES

Introduction

The designation of the Peak District National Park under the National Parks and Access to the Countryside Act 1949 was confirmed in 1951. The purpose of the National Park is to conserve the natural beauty of the countryside and for the promotion of its public enjoyment with due regard to the economic and social interests of the locality. The National Park is mainly in Derbyshire, but also covers some upland parts of Staffordshire, Cheshire, Greater Manchester and South Yorkshire. For mineral planning purposes the Peak District Joint Planning Board is responsible for assessing all applications for minerals-related development. The boundary of the National Park was drawn to exclude mineral extraction operations around Buxton and Wirksworth.

The scenery of the Peak District National Park, and also its mineral resource potential, reflects the nature of the underlying geology. The rocks exposed at the surface are almost entirely of Carboniferous age and principally comprise a southern limestone plateau, the ‘White Peak’, surrounded to the north, west and east by sandstones and shales of the Millstone Grit. The latter gives rise to the bleak moorland and rocky escarpments of the ‘Dark Peak’. The lowermost Coal Measures are preserved in the extreme west and east.

The Peak District has a long history of mineral production. Most activity has been, and continues to be, concentrated on the limestone area, which is not only a valuable resource in its own right, but also hosts important vein and related mineralisation (Table 1)

Table 1 Mineral resources of the Peak District National Park

Age	**Geological Unit**	**Commodity/use**
Tertiary	'Pocket' Silica deposits	*Silica sand for industrial use*
Carboniferous	Coal Measures	*Coal* *Fireclay for refractory use*
	Millstone Grit	Sandstone for building stone and construction fill Shale for cement manufacture
	Eyam Limestones	Limestone for building stone
	Monsal Dale Limestones	Limestone for aggregate and cement manufacture *Chert*
	Bee Low Limestones	Limestone for aggregate and industrial use
	Mineralisation in **Carboniferous** limestones	Fluorspar for the manufacture of fluorine chemicals Barytes for use as a filler in rubber and plastics, and for use as a weighting agent in drilling fluids Calcite for use as a decorative aggregate and white filler Lead, *zinc, copper, silver*

Italics signify commodity no longer produced

Limestone quarrying has been a long-standing industry. The development of canals in the late 18th century and subsequently the construction of the Cromford and High Peak Railway, which connected the Cromford Canal and the Peak Forest Canal, and also the Peak Forest Tramway feeding into the Buxworth area from Doveholes, were particularly important to the industry. These improvements in transport enabled an expansion of limestone quarrying to serve more distant markets and industries. Limestones are amongst the most widely used of economic minerals and Britain's rapid industrialisation thus created an increasing demand for limestone and its derivatives during the latter part of the 19th century.

During the 20th century the increasing use of concrete in construction and subsequently the use of limestone for roadstone created major new markets. These construction markets soon became more important, in volume terms, than industrial uses and this trend has continued. After the Second World War, a shift from rail to road transportation of limestone took place, although rail transport is still used from the Buxton quarries and the Hope Cement Works.

The fluorite-baryte-calcite-lead mineralisation of the Southern Pennine Orefield is restricted to the eastern half of the limestone outcrop and it is now widely accepted that the source of the mineralising fluids lay in deep sedimentary basins to the east. The ore minerals were emplaced in faults and joints in the limestone and also occur as replacement deposits. Lead mining has been carried out almost continuously since at least Roman times, but following the Second World War, lead ore (galena) has only been recovered as a minor by-product of fluorspar mining and processing. A large part of the known orefield occurs within the boundaries of the Peak Park and this area has traditionally been the principal source of fluorspar in Britain.

The deposition of the Carboniferous limestones, which took place mainly in a warm, shallow sea, was punctuated by periodic volcanic activity during which molten lava and airborne ash were erupted from several volcanic centres and interbedded with the limestones. These rocks are generally intensely altered and are not of economic importance as a source of hard rock. Some of the volcanic activity, however, resulted in the intrusion of molten rock between the beds of limestones to give harder intrusive sills of dolerite which have been used as sources of crushed rock. Chert and silica sand deposits also occur associated with the limestone and have been worked on a modest scale in the past, although they are no longer of economic importance.

Carboniferous limestones form attractive scenery and a large part of the limestone resource in the Derbyshire/Staffordshire massif falls within the Peak District National Park, although the main concentrations of limestone quarries near Buxton and Wirksworth in Derbyshire and Waterhouses in Staffordshire are excluded. In addition, limestone is also mined at Middleton, just outside the National Park. There are, nevertheless, nine large limestone quarries within the Park and continuing quarrying will remain a major planning issue because of the inherent conflict between the designation of the National Park and activity associated with limestone extraction.

In contrast to the limestone resource area, the outcrop of the Millstone Grit, which derives its name from its former use in the production of millstones, is not a major resource area. However, the sandstones have a range of textures and colours and provide an attractive source of building stone. Some coal was formerly worked to the west and north of Buxton, but the deposits are no longer of economic importance. Fireclay has locally been of importance as a refractory raw material in the past.

Limestone

The limestones of the Peak District are of Carboniferous age and have an extensive outcrop in the southern part of the National Park forming the characteristic scenery of the ‘White Peak’. Carboniferous limestones are a resource of considerable national importance. They are the major source of limestone in England and Wales and are quarried extensively in the Mendips, South and North Wales, the Derbyshire/Staffordshire massif, including the Peak District, parts of the northern Pennines and around the fringes of the Lake District. The Derbyshire/Staffordshire massif and Peak District area is the single most important source. Carboniferous limestones commonly occur in thick, flat-lying, uniform beds which are relatively cheap to extract and process and usually produce strong, low porosity aggregate materials. They are the most important source of crushed rock aggregate in England and Wales.

The map and text are based on data from published BGS geological and limestone resource maps. The limestone resources of the Peak District have been described and mapped in some detail in six

assessment reports and these results have been summarised in the BGS report 'Limestones of the Peak' (Harrison and Adlam, 1985). The distribution of the limestone resources in the area is, therefore, well understood.

The limestones can be divided into two broad categories, depending on the environment in which they were deposited:

- Shelf limestones pale-coloured, massive, shallow-water limestones which are uniform over wide areas
- Off-shelf limestones dark-coloured, well-bedded, deeper-water limestones which are more variable in character and contain shaly and cherty limestones.

The off-shelf limestones do not support any quarrying activity, largely because of their variable character and the presence of higher quality deposits in close proximity. In contrast, the shelf limestones are a major resource of aggregates. Shelf limestones are also generally of high chemical purity and, with an absence of impurities and uniformity over wide areas, they are highly valued for a wide range of industrial applications.

The term 'high purity' is normally defined in terms of calcium carbonate content with >96–97 % $CaCO_3$ defining high purity limestone, and >98–98.5 % $CaCO_3$ very high purity limestone. The distribution of the latter is shown on the Mineral Resources Map. However, for many applications it is the level of specific impurities present (for example, iron in limestone used for glassmaking) and the consistency or colour of the limestone which are of paramount importance rather than absolute values for calcium carbonate content (Anon, 1990). The term 'industrial' limestone is perhaps more appropriate. Despite its varied applications, demand for limestone for industrial use in Great Britain is small, being about 6 % of the total demand for limestone. However, for most of these applications, material of high quality is essential.

In 1990 limestone production in the Peak Park was 8.6 million tonnes, of which 4.5 million tonnes was for aggregate use and 4.6 million tonnes for non-aggregate applications. High purity limestone is not essential for all of these uses and, for example, some 1.3 million tonnes was consumed in cement manufacture.

Shelf limestones

The Carboniferous shelf limestones have a known thickness of almost 2000 m, although only the uppermost 600 m of strata are exposed. The limestones are divided into a number of formations, the most important being the Bee Low Limestones. This unit provides much of the high purity industrial limestone consumed in Britain as well as large amounts of aggregate and it is perhaps the most important resource of high purity limestone in the country. The Bee Low Limestones have a large outcrop with a maximum thickness of around 200 m. The formation is characterised by pale grey, thickly-bedded limestones, which are laterally and vertically homogeneous. The limestones are consistently of very high purity (>98 % $CaCO_3$) with only small proportions of magnesia, silica, alumina, iron and other impurities. The purity is, however, locally downgraded in beds adjacent to thin clay bands which occur at certain horizons, but most frequently in the middle of the sequence. The Bee Low Limestones produce strong, low porosity aggregate materials which are suitable for a wide range of construction uses (except road surfacing aggregates). The Bee Low Limestones are also extracted for a wide range of industrial applications, including the production of lime and as a chemical feedstock for the production of soda ash (sodium carbonate) by the Solvay (ammonia-soda) process.

The limestones are also easily ground to a relatively white-coloured powder and are widely used as fillers in plastics, rubbers and paint, and have a number of other industrial uses, including glassmaking.

The beds below the Bee Low Limestones, the Woo Dale Limestones, are not widely exposed, although they underlie the whole area. The formation comprises high purity limestones, although locally the limestones are partially dolomitised, with variable magnesia values which are generally less than 1 %. Silica is typically present in only very small amounts. Purity remains high throughout the uppermost 100 m of strata but lower in the sequence the unexposed beds contain limestones with higher silica, alumina and iron contents. Together the Woo Dale and the Bee Low formations have a cumulative thickness of around 300 m of high purity limestone. Resources of high purity limestone are thus extremely large in relation to demand.

The limestone sequence above the Bee Low Limestones is much more varied in character and less pure. The Monsal Dale and Eyam limestones both contain cherty (siliceous) and shale bands, and the Monsal Dale Limestones also contain several volcanic units (basaltic lavas and tuffs) which make up a large proportion of the total thickness in the eastern half of the area. The aggregate properties of these limestones are broadly similar to those of the Bee Low Limestones, and they are quarried at several sites for aggregate use and also for cement manufacture at Hope. Although high purity limestones are present in the Monsal Dale Limestones, they are not so consistent in quality and the formation is not worked for industrial applications to any extent. The Eyam Limestones are a source of dimension and walling stone near Sheldon and near Bradwell.

The resource potential of the shelf limestones is locally affected by dolomitisation, a secondary alteration of normal limestone due to the action of magnesium-rich groundwater, and mineralisation. The most extensive dolomitisation is in the south–east, between Matlock and Monyash, and although the zone of alteration is variable, a thickness of over 200 m of dolomite and dolomitised limestone has been recorded. The dolomitised Bee Low Limestones have high magnesia values, although they are iron rich, while the dolomitised Monsal Dale Limestones are of lower quality. Dolomitised limestones generally produce relatively weak, porous, low quality aggregates. Fluorite-barytes-calcite-lead mineralisation affects the rocks in the eastern half of the Peak District, but the effects are localised and restricted generally to the width of the mineral vein or body.

Off-shelf limestones

The limestones of the Dovedale–Manifold Valley area were deposited in a deeper-water, basinal environment between the shelf areas to the north and south (Staffordshire). The sequence is relatively complex and contains folded limestones which are thin- to thickly-bedded, generally dark grey in colour and contain chert and shaly beds. Some formations contain substantial proportions of mudstone. Limestones predominate, however, in the Milldale Limestones, Hopedale Limestones and Ecton Limestones formations. The thicker limestone units are capable of producing strong aggregate materials, but the variable lithologies and the folded nature of the strata reduce the aggregate resource potential of these limestones.

The off-shelf limestones are mainly impure or of low chemical purity, although the substantial developments of knoll-reef limestone in the Milldale and Hopedale limestones are mainly of very high purity (>98 % $CaCO_3$) with only small amounts of silica and other impurities. The off-shelf limestones do not support any active quarrying operations, largely because of their variable character and the proximity of higher quality resources in the shelf area.

'Vein' minerals

The Southern Pennine Orefield has traditionally been the principal source of fluorspar in Britain, the major part of the output being derived from within the Peak District National Park. Production is currently concentrated in the north–eastern part of the orefield between Longstone Edge and Castleton. All of the ore is treated at the Cavendish Mill, near Stoney Middleton, which is operated by Laporte Minerals primarily for the production of acid-grade fluorspar. The latter contains >97 % CaF_2 and is used in the production of hydrofluoric acid, the starting point for the manufacture of a wide range of fluorine-bearing chemicals.

Ore for the plant is drawn from three main sources in roughly equal proportions. Underground mines and openpit operations under Laporte's control account for two-thirds of the supply and the remainder is obtained from independent suppliers, known as 'tributers', who operate small openpit workings. Typical ore grades fall in the range 20–50 % CaF_2, the higher grade ore being derived from underground operations which are of higher cost. Barytes ($BaSO_4$) and galena (PbS) are associated with the fluorspar and are recovered as by-products. The Cavendish Mill is the second largest source of barytes in Britain. Small amounts of calcite are produced by independent operators for use as a decorative aggregate and white filler.

The fluorspar-barytes-calcite-lead mineralisation occurs in steeply inclined E–W and ENE–WSW fissure veins (rakes) in limestones. These may be up to several kilometres in length and up to 10 m wide. Groups of thin veins (scrins) may be concentrated in places, but only the major veins are shown on the accompanying map. The main mineralisation is confined to the eastern part of the orefield and to the highest limestones beneath the overlying shale cover, which acted as an impermeable caprock to the mineralising fluids. Volcanic rocks interbedded with the limestones are generally barren, but may allow the development of sub-horizontal replacement deposits or flats. The form of the mineralisation is illustrated in a sketch cross-section, Figure 1. There is a broad zonation of minerals in the mineral veins. Fluorspar is the dominant mineral in the east, with barytes and calcite becoming progressively more abundant westward. However, the zones are poorly defined in many places, with considerable overlap.

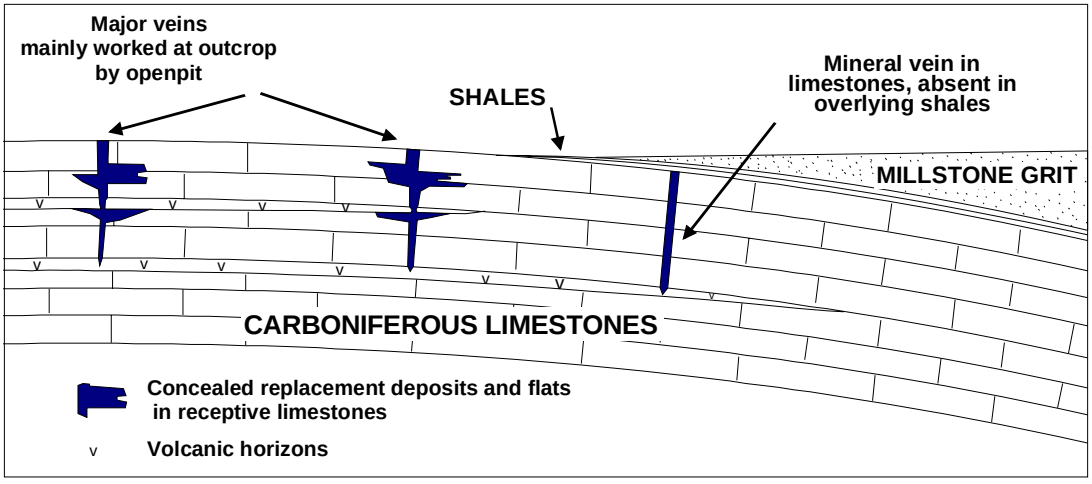

Figure 1 Sketch showing fluorspar and related mineralisation in fissure-vein and replacement deposits (not to scale)

Following a long history of extraction many of the major veins are depleted as sources of openpit fluorspar. Current exploration is now being directed towards finding concealed orebodies related to cavity infillings and replacement deposits in receptive limestone horizons, generally coincident with the Monsal Dale

Limestones. Such orebodies may yield 0.5 million tonnes of ore or more and represent very important targets. The mineralogy of these deposits does not correspond with the broad mineral zonation seen in the veins. Fluorspar and barytes resources may, therefore, occur more extensively in a westerly direction than previously anticipated.

Igneous rock

Igneous rocks occur throughout the limestones, although they are most common in the Monsal Dale Limestones and occupy considerable areas of outcrop. The most extensive are lavas and tuffs (known locally as 'toadstones') which occur interbedded with limestones and are up to a few tens of metres in thickness. They are invariably altered and, therefore, not an aggregate resource. However, they are waste materials, and, where present in significant thicknesses, are a major control on possible quarrying.

Intrusive igneous rocks (dolerites) have a more restricted outcrop, but occur in the upper part of the Bee Low Limestones and the lower part of the Monsal Dale Limestones. None are currently worked, although the intrusions at Calton Hill and Tideswell have been worked in the past.

Sandstone

Carboniferous sandstones have traditionally been a source of building stone. Following a period of declining use, there has been a considerable revival in demand for building stone in the last decade or so and the sandstones of the Millstone Grit are an important source for walling and paving, including sawn and hand-crafted stone. The Millstone Grit offers a potential source of sandstones with varying textures and grain size, and colours ranging from buff to pink. The Ashover Grit in the Birchover–Stanton area is particularly valued, but other sandstones, including the Kinderscout Grit near Grindleford and Hayfield, are also worked. The suitability of a sandstone for building stone depends not only on strength and durability but also on aesthetic qualities and textural consistency, and on the size of the blocks that can be produced. Thinly-bedded sandstones may be suitable for the production of flagstones and occasionally for roofing. When the bedding is more widely separated the stone is likely to be suitable for dressing and sawing into blocks. The potential of individual sandstones within the Millstone Grit and Coal Measures is largely unproven and their extent is not shown on the Mineral Resources Map.

Crushed Carboniferous sandstones are generally too weak and susceptible to frost damage to be used for roadstone or concrete aggregate and for the most part they are used as source of construction fill, where in relative proximity to a market. The Millstone Grit is worked at Glossop and, on an intermittent basis, near Holmfirth for this purpose.

Shale

Shales occur interbedded with sandstones in the Millstone Grit and Coal Measures, but their mineral potential is very limited except in specific situations. Portland cement is manufactured by the reaction of a mixture of calcareous and clayey material at high temperature, the resulting clinker being ground with a proportion of gypsum/anhydrite to control the setting time of the resulting cement. Clay or shale provides most of the silica, alumina and iron oxides necessary for the production of cement clinker and at the large cement works at Hope, near Castleton, the Edale Shales at the base of the

Millstone Grit are worked for this purpose. Hope Cement Works is one of the largest in the country, with a capacity of some 1.3 million tonnes per year, most of which is transported away by rail.

Other minerals

Silica sand

Silica sand occurs locally in 'Pocket Deposits' formed in solution hollows in the Carboniferous limestones of the White Peak. The sands are naturally bonded with a kaolinitic clay and because of their refractory properties were used in the manufacture of a range of refractory products. More demanding operating conditions have limited their use and they are unlikely to be of future economic interest for refractory applications.

Fireclay

The Stannington Pot Clay, which is located at the top of the Millstone Grit, was formerly valued as an important source of fireclay and was mined and quarried in the Bradfield area. The Pot Clay Coal, with which it is associated, is not of economic importance. The fireclay was originally used in making crucibles for the steel industry but more recently, until the mid-1970s, the fireclay was valued for the manufacture of specialised steel casting pit refractories. Due to changes in steelmaking technology, the use of fireclay has largely been replaced by alternative processes requiring higher quality refractories. The Stannington Pot Clay is unlikely to be of future economic interest.

Chert

Chert beds formed by the replacement of preferred horizons in the uppermost part of the Monsal Dale Limestones were formerly worked in the Bakewell area by both underground and surface working. Large blocks of chert were produced and subsequently hand-trimmed to make 'runners' for the old type of pan mills once extensively used in the pottery industry and by colour manufacturers for fine grinding raw materials. The Bakewell chert was particularly suitable for use as runners as it contains a proportion of intermixed limestone. The difference in hardness between the runners and the 'pavors' lining the floor of the mill produced an irregular surface and a better grinding action. Harder cherts from North Wales were more suitable for pavors. Pan mills have been replaced by ball mills and the last chert mine at Bakewell was closed in 1968. It is highly unlikely that the chert will be of future economic interest.

Coalbed methane

The main requirements for coalbed methane prospects are unworked coal seams at depths between 200 and 1500 m, together with adequate levels of methane. Areas of coal-bearing strata (Coal Measures) occur on the extreme eastern and western fringes of the Peak District (see inset on Mineral Resources Map) but at depths of less than 200 m. The area has, therefore, no coalbed methane potential.

Conventional hydrocarbons

There has been considerable interest in the hydrocarbon prospectivity of the Peak Park, sparked initially by the presence of oil seeps at the surface in Carboniferous rocks (e.g. Lees and Cox, 1937). The source of these seeps is uncertain, although they are likely to come from both Dinantian (Carboniferous Limestone) and Namurian (Millstone Grit) shales, which are widespread in the Peak Park. These shows indicate that oil has been generated in, or migrated into, the Peak Park area, and thus that it has some potential for hydrocarbon discoveries.

To date four boreholes have been drilled for oil. Three had minor oil shows, although no significant quantities have been produced. Results are detailed below and shown on the Mineral Resources Map.

Wessenden.	Enterprise 1987.	Tested Namurian and Dinantian. Total depth in Lower Palaeozoic at 1128 m. *No shows.*
Gun Hill.	D'Arcy 1938.	Tested Namurian and Dinantian. Total depth in Dinantian at 1411 m. *Treacly oil shows* in Namurian sandstones and uppermost Dinantian limestones and shales.
Edale.	Steel Bros. 1937–38.	Tested Namurian and Dinantian. Total depth in Dinantian at 231 m. *Spots of oil in core* at 183–195 m and 215–216 m.
Alport.	Steel Bros. 1939–41.	Tested Namurian and Dinantian. Total depth in Dinantian at 779 m. *Spots of oil* at 433, 461, 481, 483 and 491 m, all in Dinantian.

The best shows were in the Gun Hill borehole, close to the minor gas discovery at Nooks Farm, outside the Peak Park. However, the description of the oil in Gun Hill as 'treacly' indicates that it consists of heavier oils that are more difficult to produce.

The productive oilfields in the Millstone Grit and Coal Measures in the East Midlands nearly all have their reservoirs in the Crawshaw Sandstone or other sandstones near the Millstone Grit/Coal Measures boundary. The Crawshaw Sandstone is absent over most of the Peak Park. It crops out in the east, and dips under the productive Coal Measures on the extreme eastern margin of the Peak Park, but even there it is only shallowly buried. The best chance of finding moveable oil is probably in the older, more deeply buried, Millstone Grit sandstones that are widespread around the margins of the Park. Reservoir quality is likely, but not certain, to be poor in Lower Carboniferous limestones and sandstones.

MINERAL RESOURCES AND ENVIRONMENTAL DESIGNATIONS

The character of the landscape reflects the nature and structure of the underlying rocks, the erosive forces to which they have been subjected and the soil and vegetation that they support. It is constantly changing due, in the longer term, to geomorphological processes, and in the shorter term, to economic and social pressures. Mineral extraction can produce irrevocable, but not necessarily harmful, change to a locality over a relatively short timescale. In order to ensure that such changes are both sustainable and non-injurious to the environment, the most important landscapes and habitats, such as National

Parks and SSSIs, are given a greater degree of protection from mineral working. The necessity for mineral extraction in such areas has to be justified by a most rigorous examination of the merits of the proposal. This examination should consider the public interest in the development of the resources and the social desirability of employment, as well as the need to protect the environment. There is no prohibition on working minerals in such areas.

The resolution of conflicts between mineral resource development and other considerations is undertaken through the development plan framework and a balanced appraisal of the various issues associated with particular developments. The Mineral Resource Map of the Peak District National Park provides a synthesis of available information which can be revised and updated as additional data becomes available. It is hoped that it will assist local and national Government, the minerals industry and other interests in the consideration and production of policies included in development plans.

The designated area of the Peak District National Park is, in itself, a key planning constraint. The principal mineral resource in the Peak District National Park is limestone and a major proportion of the limestone resource of the Derbyshire/Staffordshire massif falls within the area of the Peak Park. The boundaries of the Park were specifically drawn to exclude several major limestone quarries in Derbyshire and Staffordshire, but the Peak Park nevertheless remains an important source of limestone.

The limestones of the Peak Park are also the hosts to the main fluorspar mineralisation in Britain and the Park currently accounts for over 80 % of national production. Outside the limestone outcrop, the mineral potential of the Peak Park is essentially limited to sandstones for building stone and construction fill. These operations are of limited extent and, while the potential for conflict is smaller, such operations could still give rise to serious conflicts locally.

SSSIs cover extensive areas of the Peak. Most of the Millstone Grit outcrop of the Dark Peak, Leek Moors and the Eastern Moors fall within very extensive SSSIs. Due to the limited economic potential of the Millstone Grit there is at present no serious conflict. However, any major increase in the development of the sandstone resource could significantly increase the potential for conflict.

In the Carboniferous limestone resource area, SSSIs are mainly large, linear areas, located along the sides and floors of the Dales, leaving the plateau with a scattering of small sites. A number of the Dales SSSIs are also National Nature Reserves.

The main concentration of Scheduled Monuments is over the Carboniferous limestone resource area, where large numbers are scattered over the southern, eastern and north–eastern parts of the outcrop.

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For further information on national planning policy, users should consult the following:

- Planning Policy Guidance Notes
- Minerals Planning Guidance Notes
- Regional Planning Guidance Notes and Circulars

published by HMSO for the Department of the Environment.

Information from the following documents and maps was used in the compilation of the map:

a) British Geological Survey 1:50 000 or 1:63 360* scale New Series geological map sheets

No	Sheet Name	Published
86	Glossop	(1980)
87	Barnsley	(1976)
98	Stockport	(1962)
99	Chapel-en-le-Frith	(1977)
100	Sheffield	(1974)
110	Macclesfield	(1968)
111	Buxton	(1978)
112	Chesterfield	(1971) *
124	Ashbourne	(1983)

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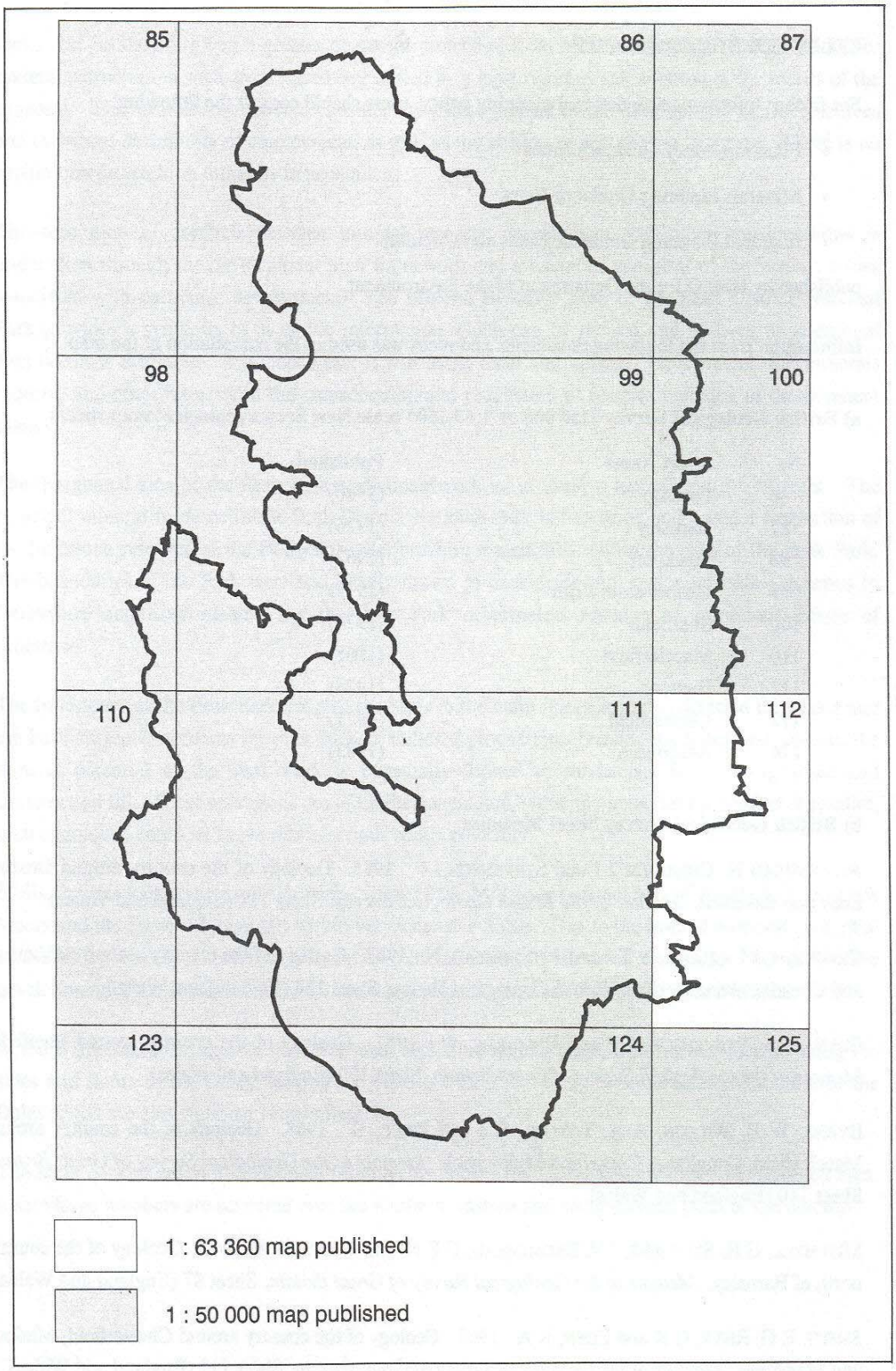

Figure 2 Availability of British Geological Survey 1:50 000 or 1:63 360 scale New Series geological map coverage of the Peak District

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APPENDIX 1 MINERAL WORKINGS IN THE PEAK PARK (1994)

Pit Name	Location	Operator	Commodity
Topley Pike	Buxton	Tarmac-North West	Limestone
Ballidon	Ashbourne	Tilcon-Western	Limestone
Goddards	Stoney Middleton	RMC-Thos W Ward (Roadstone)	Limestone
Shining Bank	Bakewell	RMC-Thos W Ward (Roadstone)	Limestone
Eldon Hill	Chapel-en-le-Frith	RMC-North West Aggregates	Limestone
Darlton	Stoney Middleton	Wimpey Asphalt	Limestone
Once-a-Week	Sheldon	Mandale Stone Co. Ltd	Limestone
Ivonbrook	Wirksworth	Evered Bardon-Bardon Roadstone	Limestone
Hazelbadge Hills	Bradwell	E S Rowarth and Sons	Limestone
Old Moor*	Buxton	Buxton Lime Industries	Limestone
Hope	Castleton	Blue Circle	Limestone
Hope	Bradwell	Blue Circle	Common Clay and Shale
Moss Rake West	Bradwell	Buxton Aggregates	Calcite
Moss Rake East	Bradwell	Star Quarry Products	Calcite / Limestone
Castlegate Lane	Little Longstone	T & T Broadhurst	Calcite
Sallet Hole Mine	Eyam	Laporte Minerals	Fluorspar / barytes
Cresswell Part	Bradwell	Ernest Hinchcliffe Ltd	Fluorspar / barytes
Cresswell Parts	Bradwell	High Peak Spar Ltd	Fluorspar / barytes
Tearsall Farm	Matlock	Slinter Mining Co. Ltd	Fluorspar / barytes
Backdale	Bakewell	Peak Minerals	Fluorspar / barytes / Limestone
Milldam Mine	Great Hucklow	Laporte Minerals	Fluorspar / barytes
Pike Hall Lane	Winster	T & T Broadhurst	Fluorspar / barytes
Dirtlow	Castleton	Peak Minerals	Fluorspar / barytes / calcite
Hazard/Hollandtwine	Castleton	Peak Minerals	Fluorspar / barytes
White Rake	Wardlow	Peak Minerals	Fluorspar / barytes
Middle Hay	Bakewell	S Waine	Fluorspar / barytes
Washes Lane	Windmill	L Bond	Fluorspar / barytes
Chance Mine	Bradwell	L Bond	Fluorspar / barytes
White Rake	Tideslow	High Peak Skip Hire	Fluorspar / barytes
Chinley Moor	Hayfield	B Merrick	Sandstone
Stoke Hall	Grindleford	Stoke Hall Quarry Ltd	Sandstone
New Pilhough	Stanton in Peak	Realstone Ltd	Sandstone
Palmers Pilhough	Stanton in Peak	Albrighton plc	Sandstone
Shire Hill	Glossop	Marchington Stone Ltd	Sandstone
Dale View	Stanton in Peak	Stancliffe Stone Co.	Sandstone
Watts Cliff	Elton	Realstone Ltd	Sandstone
Birchover	Birchover	Albrighton plc	Sandstone

* Partly in Derbyshire
Waste dump workings are excluded
As at 16.12.94

APPENDIX 2 CONTACT ADDRESSES FOR FURTHER ENQUIRIES

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Director of Planning and Economic Development Staffordshire County Council County Buildings Martin Street Stafford ST16 2LE Tel: 01785 223121 Fax: 01784 223316	Groundwater Section National Rivers Authority Yorkshire Region Rivers House 21 Park Square South Leeds LS1 2QG Tel: 0113 2440191 Fax 0113 2461889
Groundwater Section National Rivers Authority Severn Trent Region Sapphire East 550 Streetsbrook Road Solihull West Midlands B91 1QT Tel: 0121 7112324 Fax: 0121 7115824	The Secretary East Midlands Regional Aggregate Working Party The National Stone Centre Ravenstor Road Wirksworth Derbyshire DE4 4FY Tel: 01629 824833 Fax: 01629 824833
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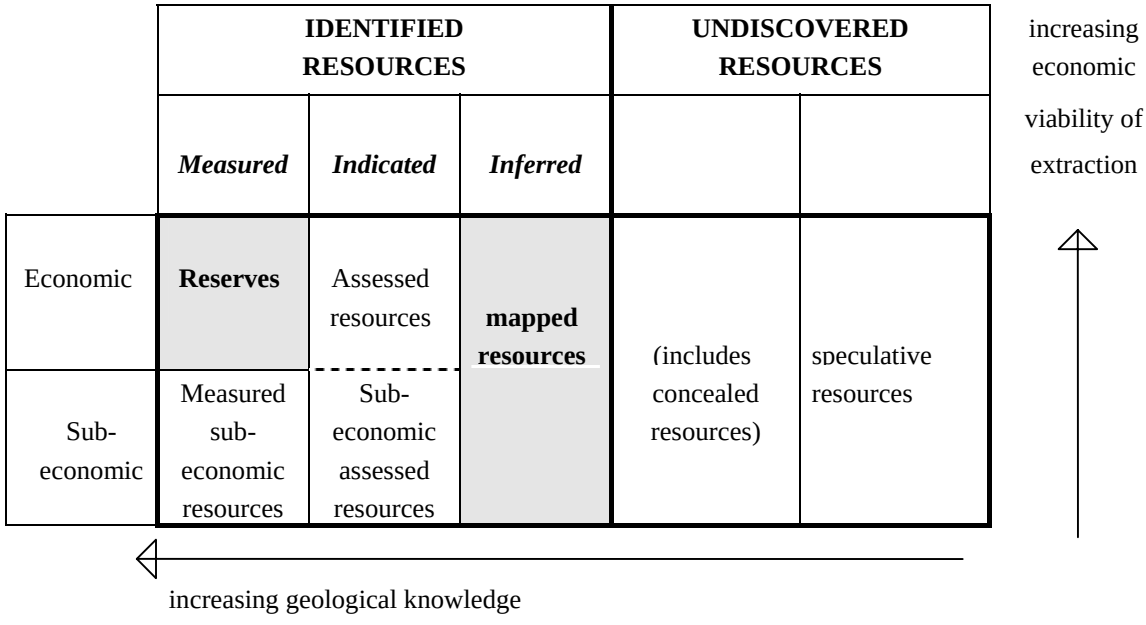
APPENDIX 3 METHODOLOGY

The British Geological Survey (BGS) was commissioned by the Department of the Environment to prepare, on a trial basis, a set of concise statements mainly in map form, to show the broad distribution of mineral resources in selected counties and to relate these to selected, nationally designated planning constraints. The trial study has developed a methodology for the collection and display of data in a consistent and comparable format based on four Mineral Planning Authority (MPA) areas - Bedfordshire, Derbyshire, Staffordshire and the Peak District National Park.

The main element of the trial study was the production of maps, with accompanying concise reports, for each MPA area. All mineral resource and planning constraint information has been captured digitally on a PC-based system using Intergraph Microstation to produce a cartographic database. Data has been captured as a series of files, structured on separate levels so that they can be viewed either independently or in various combinations, as required. Most of the information has been captured digitally from hard copy maps mainly with scales of 1:25 000, 1:50 000 and 1:63 360. The BGS 1:250 000 digital geological dataset has been used in places. Other material was obtained in a variety of digital formats which have had to be converted for use by the Intergraph Microstation System.

As the data are held digitally, map output can be on any scale but 1:100 000 has been found to be a convenient size to summarise the information for individual MPAs. This provides a legible topographic base which enables both the broad implications of the information, and sufficiently accurate detail, to be shown. The particular advantage of holding all the information in digital form is that it is comparatively easy to update and revise as additional information becomes available, and also provides scope for producing customised maps of selected information on request. Any future changes in administrative boundaries (e.g. post-local government reorganisation) can be easily accommodated.

Figure 1 Classification of resources



Based on McKelvey, 1972 and Harris, 1993

Classification of reserves and resources

The diagram, Figure 1, is a representation of a conventional method for classifying mineral reserves and resources, based on a system introduced the US Bureau of Mines and the US Geological Survey and adapted by the British Geological Survey. In this conceptual diagram the vertical dimension of the diagram represents the economic viability of the resource and consists simply of two categories, **economic** and **sub-economic**, depending on whether or not it is commercially viable under prevailing economic circumstances. As the costs of extraction and the prices obtained for the mineral may change with time, the division between the two categories is not fixed. This has been well illustrated in recent years in the coal industry where coal reserves in operational mines have moved into the sub-economic category as a direct consequence of these mines being closed. The horizontal dimension represents degrees of geological knowledge about the resource, from mere speculation about its existence (right-hand side) to thorough assessment and sampling on a systematic basis (left-hand side). **Identified resources** are divided into **inferred**, **indicated** and **measured** categories depending on the degree of knowledge about their extent and nature.

In the present study the County Mineral Resource Maps have been produced by the collation and interpretation of data held by the British Geological Survey. Since the mineral resource data presented are not comprehensive and the quality is variable, the boundaries shown are approximate. However, where mineral assessment studies, including drilling and testing, have been carried out, sufficient information may be available to define the extent and quality of the deposits at the **indicated resource** level (Appendix 3, Figure 1). The Carboniferous limestone resources of the Peak District National Park have been assessed at the indicated resource level. Most of the mineral resource information presented is, therefore, at the **inferred resource** level (Appendix 3, Figure 1), that is to say those resources that can be defined from available geological information and which may have some economic potential. They have neither been evaluated by drilling, or other sampling methods, nor had their technical properties characterised on any systematic basis.

A mineral resource is not confirmed as economic until it is proved by a relatively expensive evaluation programme. This usually involves a detailed measurement of the material available for extraction together with an evaluation of the quality of the material, its market suitability, the revenue its sale will generate and, ultimately, the viability of the deposit. That part of a resource that is both ‘measured’ and ‘economic’, i.e. it has been fully evaluated and is commercially viable to work, is called a **reserve** or **mineral reserve**.

In the context of land-use planning, however, the term **reserve** should strictly be limited to those minerals for which a valid planning permission for extraction exists, i.e. **permitted reserves**. The extent of mineral planning permissions is shown on the Mineral Resources Map. These cover active mineral workings and also inactive (dormant) mineral permissions. Some mineral planning permissions may have remained unworked, and others may have become uneconomic prior to being worked out. In most cases the areas involved are likely to have been worked to some extent in the past, and may now be restored. In addition, parts of the resource areas may have been fully evaluated by the minerals industry, but either have not been subject to a planning application or have been refused permission for extraction. These areas are **unpermitted reserves**.

A **landbank** is a stock of planning permissions and is commonly quoted for aggregates. It is composed of the sum of all **permitted reserves** at active and inactive sites at a given point of time, and for a given area, with the following provisos (DOE, MPG6):

it includes the estimated quantity of reserves with valid planning permission at dormant or currently non-working sites;

it includes all reserves with valid planning permission irrespective of the size of the reserves and production capacity of particular sites;

it does not include estimated quantities of material allocated in development plans but not having the benefit of planning permission; and

it does not include any estimate for the contribution that could be made by marine dredged, imported or secondary materials.

It is important to recognise, however, that some of the permitted reserves contained within landbanks have not been fully evaluated with the degree of precision normally associated with the strict use of the term **reserves**, indeed some may not have been evaluated at all.

Mineral workings and planning permissions

The location and name of currently active mineral workings are shown on the map, although given the scale of the map some small-scale workings e.g. vein mineral tributers, are omitted. The information is derived from the British Geological Survey's Mines and Quarries Database, updated as appropriate from the Peak Park's records. Letters (e.g. **Lst** = limestone) are used to show the main mineral commodity produced. Some operations produce more than one commodity and for example, a number of vein mineral operations also produce limestone.

The requirement to define past mineral workings presented an initial difficulty, in that no comprehensive and up-to-date source of information was identified. Following discussions with the MPAs and with DOE's agreement, it was agreed to show the extent of mineral planning permissions, which will reflect most activity post-1946. For the Peak Park, the Peak Park Joint Planning Board kindly made available index maps from which the planning permissions were digitised. Planning permissions for re-working old mine tips are not included.

The extent of the planning permissions shown on the Mineral Resources Map cover active mineral workings, former mineral workings and, occasionally, unworked deposits. A distinction is made between surface and underground permissions. The present physical and legal status of the planning permissions is not qualified on the map. The areas shown may, therefore, included inactive sites, where the permission has expired due to the terms of the permission, i.e. a time limit, and inactive (dormant) sites where the permission still exists. Sites which have been restored are not separately identified. Information on the precise status and extent of individual planning permissions should be sought from the Peak District National Park.

Most planning permissions appear on a mapped mineral resource area and thus the underlying resource colour identifies the mineral type. This is not the case in the following circumstances:

- where a planning permission for one mineral overlies another resource area, e.g. fluorspar permissions are almost entirely over limestone resource areas
- where no resource has been mapped

Planning permissions fall outside resource areas for the following reasons:

- some old permissions may be for minerals which are no longer of economic importance and no resource has, therefore, been mapped: e.g. planning permissions for fireclay extraction
- permissions shown partly off resource areas may extend to ownership, or other easily defined boundaries, or to include ground for ancillary facilities such as processing plants, roads and overburden tipping
- isolated workings occurring outside defined resource areas may reflect very local or specific situations not applicable to the full extent of the underlying rock type: shale workings adjacent to Hope cement works is an example

The latest data available for the total areas of planning permissions in the Peak District, collected for the Department of the Environment Minerals Survey of 1988, is shown in Table 1. This will be updated in due course.

Table 1 Areas of planning permissions for mineral workings in the Peak District National Park, 1988

	Commodity	**Total (hectares)**	**%**
Surface Workings	Clay/Shale	47	3.50
	Limestone/Dolomite	409	30.45
	Sand (Industrial/Silica)	25	1.86
	Sandstone	68	5.06
	Vein Minerals	782	58.23
	Other Minerals	12	0.89
Total		**1343**	**100**
Underground workings	Clay/Shale	286	18.52
	Vein Minerals	1252	81.09
	Other Minerals	6	0.39
Total		**1544**	**100**

From: Department of the Environment, Survey of Land for Mineral Workings in England, 1988.