British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

DETR
ENVIRONMENT TRANSPORT REGIONS

DURHAM AND THE TEES VALLEY

(comprising Co. Durham, Darlington, Hartlepool, Middlesbrough, Redcar & Cleveland and Stockton-on-Tees)

A Summary of Mineral Resource Information for Development Plans

Mineral Resources

Scale 1:100 000

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Vein minerals

The area contains a major part of the Northern Pennine Orefield, which has had a long history of metal mining, notably for lead (galena - PbS), with associated by-product silver. Zinc (sphalerite - ZnS) has also been mined locally. In the post-War period the orefield has principally been a source of fluorspar (CaF_2), unlikely tp be resumed in the forseeable future. Barium minerals (baryte -$BaSO_4$ and witherite - $BaCO_3$) have also been produced locally and baryte continues to be produced from the Closehouse openpit in Lunedale.

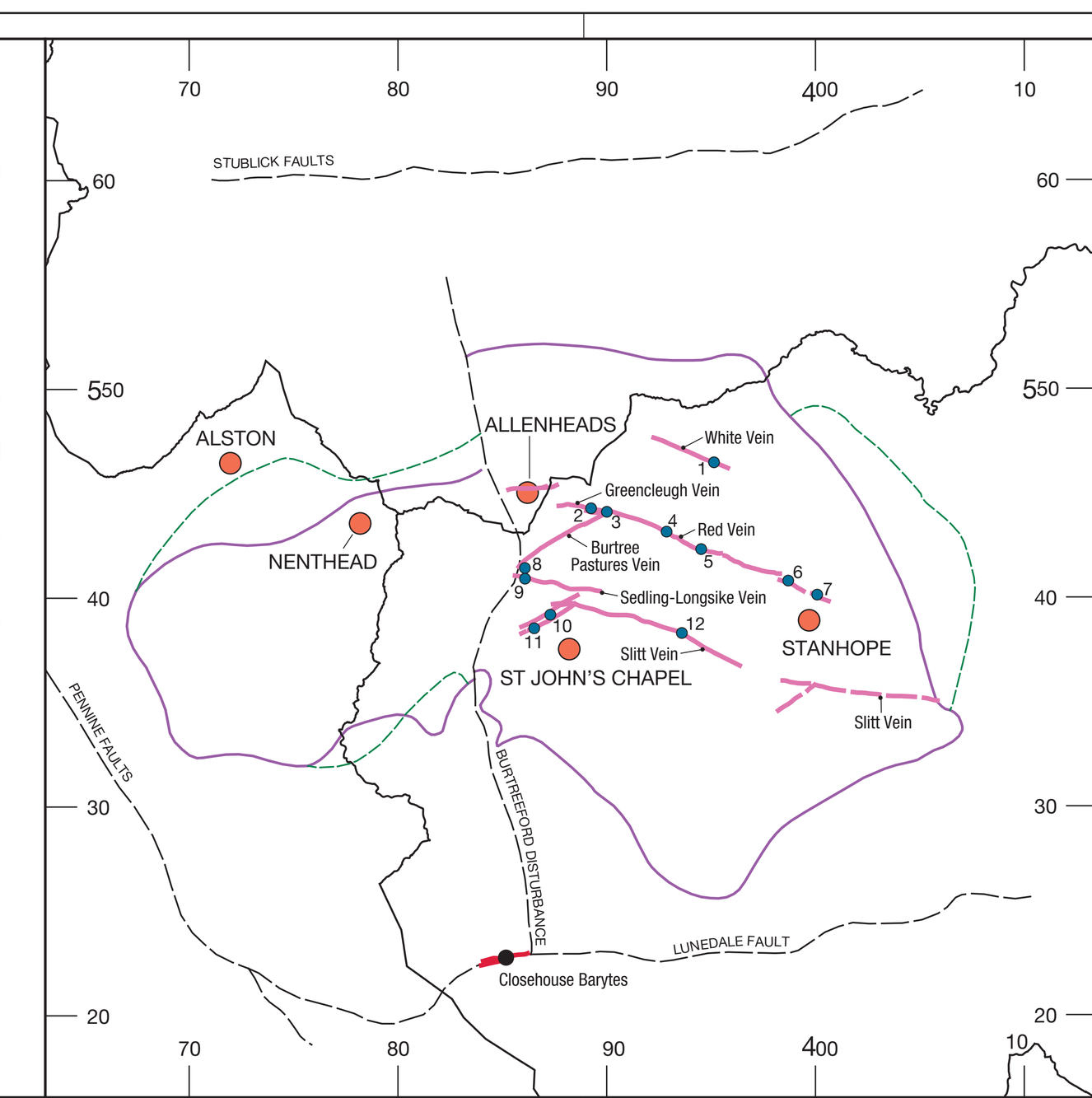
A notable characteristic of the orefield is the very well-marked zonal distribution of minerals, with fluorite being abundant in the centre of the orefield and barium minerals predominating in the outer more marginal zones. The most important mineral deposits occur as veins which cut Carboniferous rocks and the Whin Sill (dolerite). Wall-rock lithology exerts a vital influence on vein width and productivity, with veins being typically wider and more productive in hard rocks, such as limestone, sandstone and the Whin Sill. The major vein structures, which have supported fluorspar production in the past, are shown on the inset map. Any future interest in fluorspar depends upon identifying and accessing downwards extensions of major orebodies and perhaps locating new orebodies in poorly exposed ground on lateral extremities of major veins.

● Former Fluorspar mines :

1 Whiteheaps
2 Frazer's Hush
3 Groverake
4 Redburn
5 Stotfield Burn
6 Stanhopeburn
7 Crawleyside
8 Burtree Pasture
9 Sedling
10 Blackdene
11 Barbary
12 Cambokeels

major fluorite-bearing veins
major baryte-bearing veins
major structural features
outer margin of fluorite zone
inner margin of barium zone (where not coincident with outer margin of fluorite)
county boundary

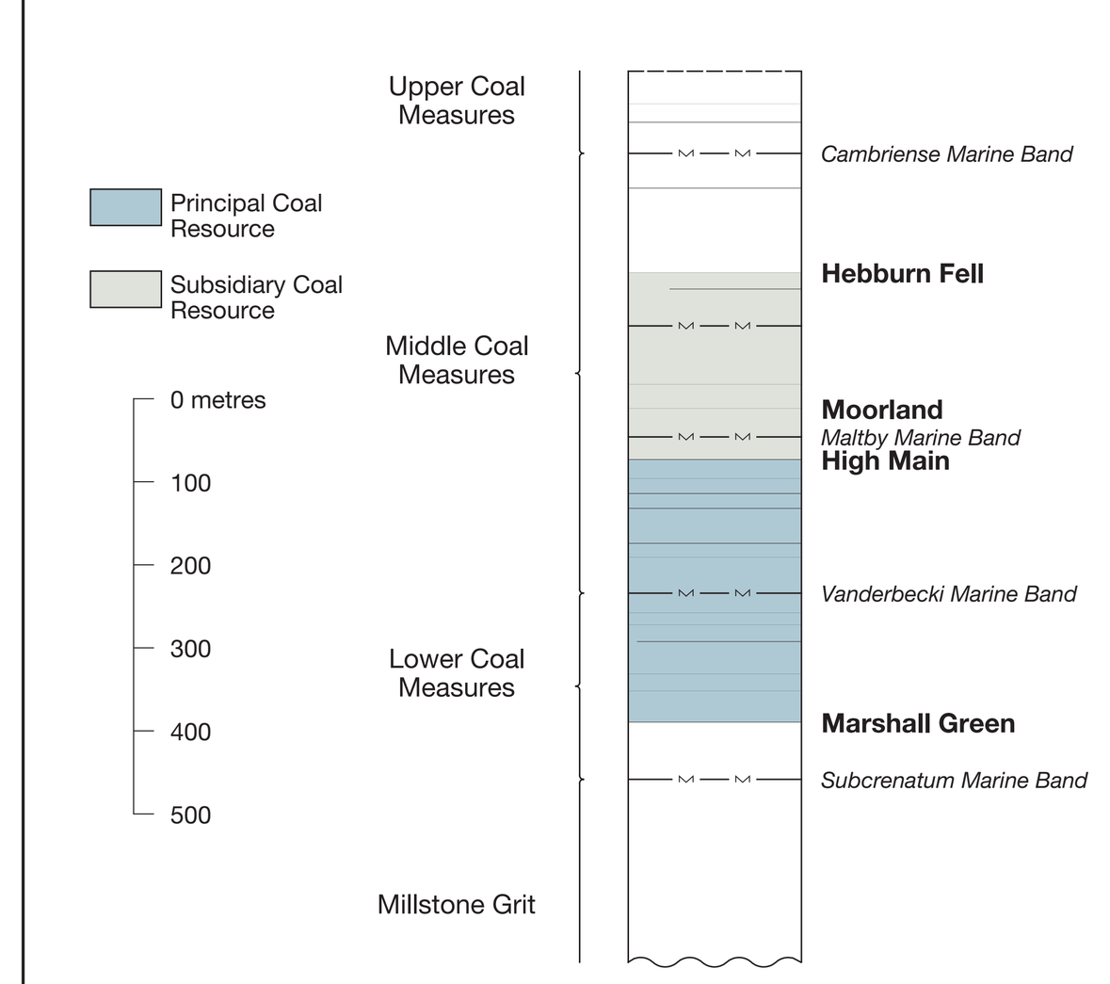
0 5 10 km



Coal

Coal-bearing strata are principally confined to the Coal Measures of the Durham Coalfield. The exposed coalfield occupies a broad outcrop from Consett towards the coast. East of a line through Ferryhill and Boldon and extending offshore, coal-bearing strata dip beneath overlying Permian rocks to form the concealed coalfield. During the final years of deep mining, coal extraction was concentrated at a number of amalgamated coastal collieries in which workings extended up to 5 km offshore. The last deep mine closed in 1993 and small-scale underground production ceased with the closure of the Park Drift mine, near Willington in 1999. Future commercial interest in the coalfield is likely to be confined to sites suitable for opencast extraction.

The Durham Coalfield has been an important source of opencast coal, although output has declined in recent years. Opencast activity is confined to the exposed Lower and Middle Coal Measures. The main concentration of coals of economic interest occur between the Bottom Marshall Green at the base and the High Main at the top and this zone has been defined as the principal opencast coal resource area on the map. Locally a few thin seams have been worked below the Bottom Marshall Green. The base of the overlying Permian rocks is taken as the upper limit of the opencast resource, although some coal has been recovered from the floors of large dolomite quarries. The areas of former opencast coal sites mainly reflect the limits of coal extraction, although in some cases they are site boundaries. No claim is made for the accuracy or completeness of this information. More detailed information on specific sites may be obtained from the Coal Authority or relevant Local Authority.



Coalbed methane

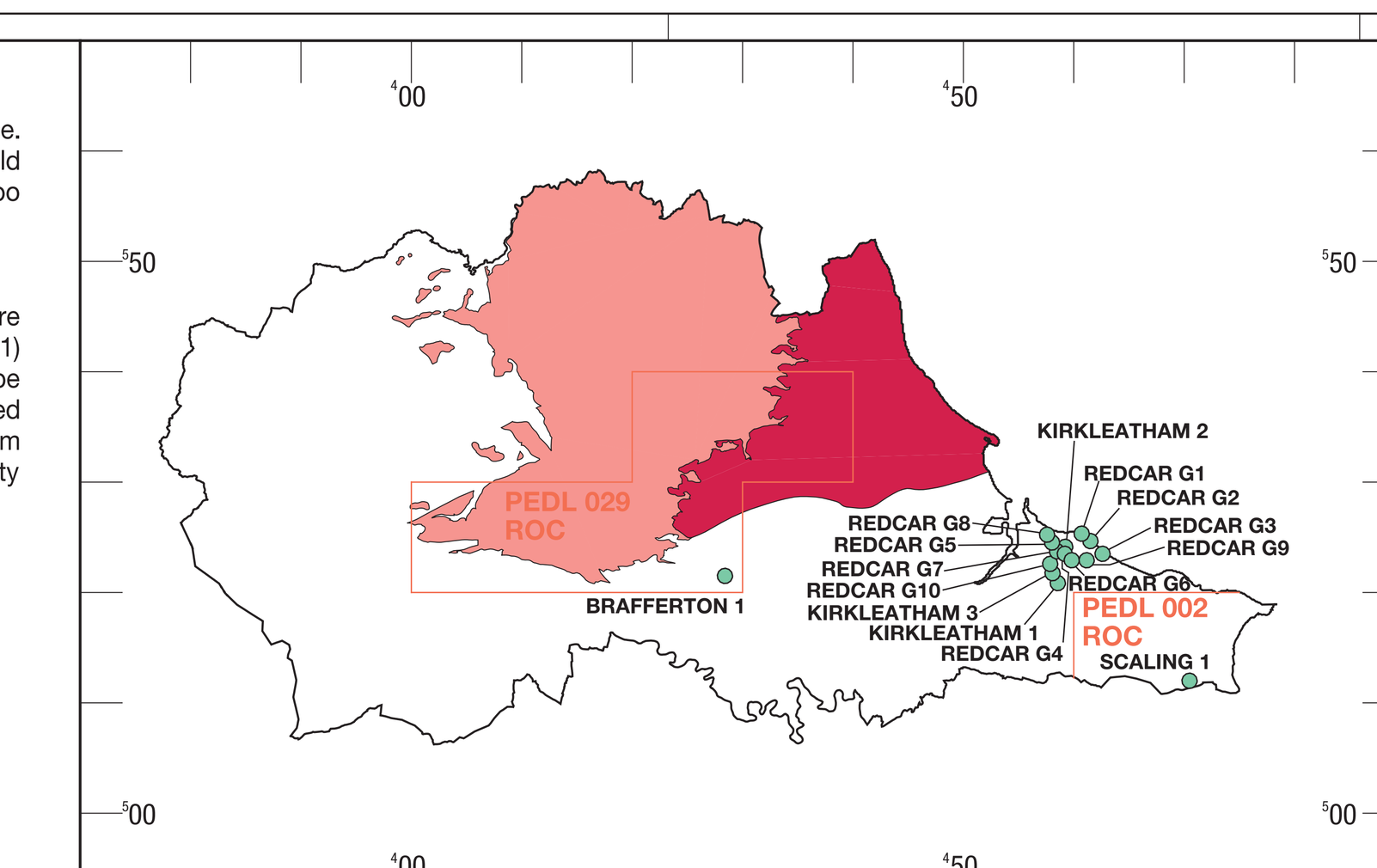
Methane contained within coal seams is known as coalbed methane. However, the gas content of the coal seams of the Durham coalfield and also in outlying areas of coal-bearing strata to the west, are too low to be of interest for the production of coalbed methane.

Hydrocarbons

15 exploration wells have been drilled in the area, 13 of which were located on an anticline near Redcar. One borehole (Kirkleatham 1) was tested for gas in the Magnesian Limestone, but found to be non-commercial. Only minor shows of oil and gas were recorded elsewhere. However, gas has either been generated in the Durham and Teesside area, or has migrated into it. Current exploration activity indicates that the area is still considered prospective.

0 20 km

Hydrocarbon Well
Exposed Coal Measures
Concealed Coal Measures
PEDL Petroleum Development and Exploration Licence issued under the Petroleum (Production) Act 1934 (as at November, 1998)



HYDROCARBON WELLS OF DURHAM AND TEESSIDE

KIRKLEATHAM 1
Operator: D'Arcy Exploration Co Ltd
Drilled: 26.06.1945
Terminal depth: 1138.7 m
Status: Produced 73,000 cubic feet/day gas from Permian Magnesian Limestone, 860 - 904 m.
Minor oil produced from 880 - 904 m.
Traces of gas in Carboniferous
Penetrated: Lias
Triassic, Permian and Carboniferous

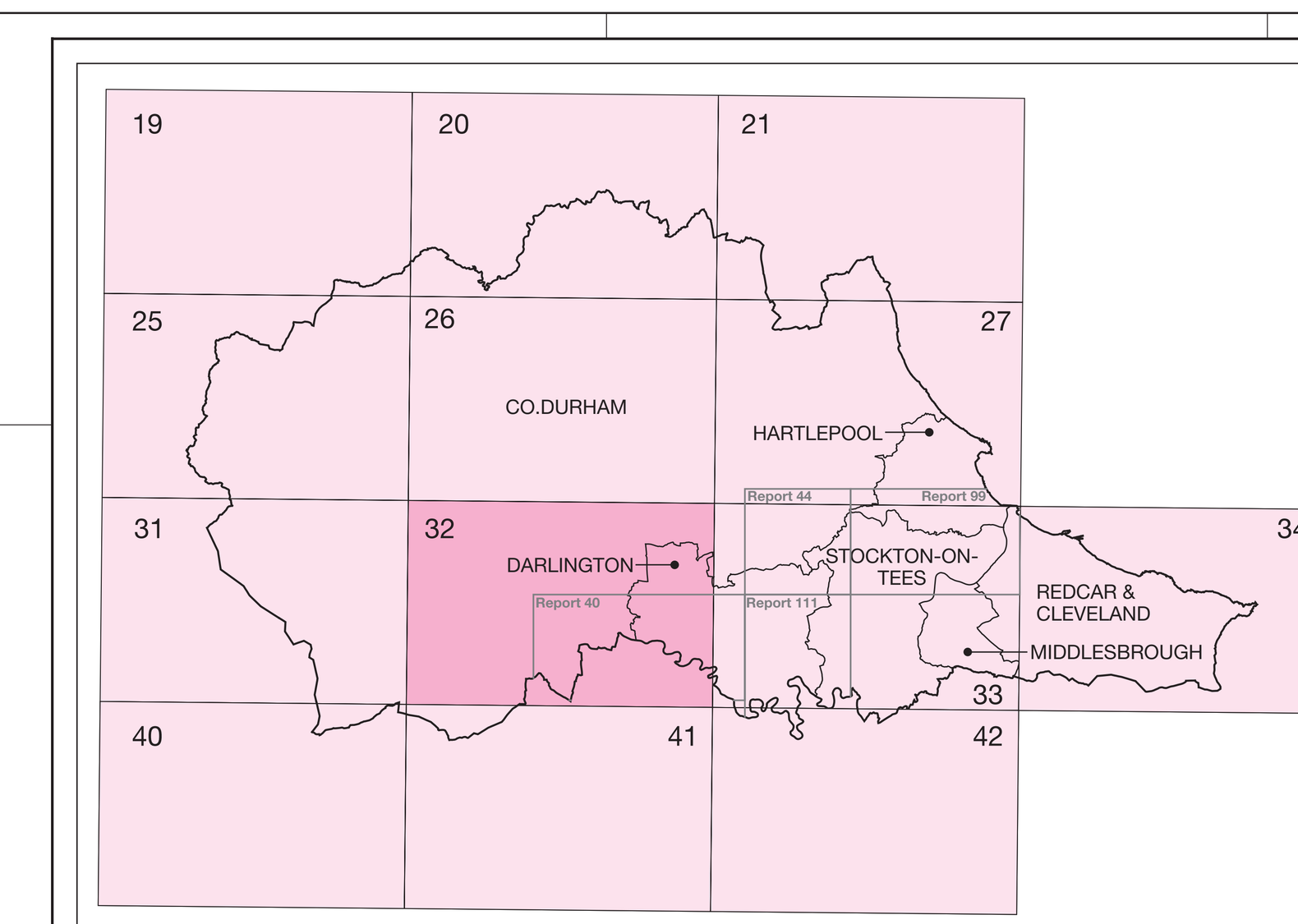
REDCAR G1-G10
Operator: Anglo-American Oil Co
Drilled: 29.04.1939 - 13.07.1939
Status: All holes plugged and abandoned, dry
Tested: Lower Jurassic, Upper Triassic

KIRKLEATHAM 2
Operator: D'Arcy Exploration Co Ltd
Drilled: 05.03.1946
Total depth: 942.1 m
Status: Plugged and abandoned with traces of oil at top of Carboniferous section.
Penetrated: Lower Jurassic, Triassic, Permian and Carboniferous

SCALING 1
Operator: Shell
Drilled: 11.11.1987
Total depth: 2519 m
True vertical depth: 2159 m
Status: Plugged and abandoned
Tested: Jurassic, Triassic, Permian, Carboniferous

KIRKLEATHAM 3
Operator: D'Arcy Exploration Co Ltd
Drilled: 19.03.1963
Total depth: 675.7 m
Status: Plugged and abandoned with gas shows in Permian anhydrite.
Penetrated: Lower Jurassic, Triassic, Permian and Carboniferous

BRAFFERTON 1
Operator: Enterprise Oil plc
Drilled: 23.05.1989
Total depth: 1981.2 m
Status: Plugged and abandoned dry
Tested: Upper (Millstone Grit) and Lower Carboniferous (Carboniferous Limestone)



1:50 000 map published
1:63 360 map published
1:25 000 map published (Industrial Minerals Assessment Sand and Gravel Resource Map)

Current digital availability of these sheets can be found at the British Geological Survey website www.thebgs.co.uk or www.british-geological-survey.co.uk

Sand & Gravel

Two main categories of sand & gravel are defined:
(1) Superficial (drift) deposits, further subdivided into (a) river sand & gravel, (b) glacial sand & gravel, and (c) beach and blown sand deposits.
(2) Bedrock (solid) deposits represented here by the Basal Permian Sands.

Parts of the area assessed for sand and gravel by BGS are identified on the map. Resources shown here are taken from these maps where available. In these areas, the possible extent of glacial sand and gravel concealed beneath till is shown. These areas were defined by overburden to mineral ratios. Outside these areas, available data are more limited. Only exposed sand and gravel is defined, although resources concealed beneath till may be extensive in some places. In addition, narrow (<200 m) spreads of alluvial deposits are mainly excluded from the map (unless associated with glacial sand and gravel) as their limited width is likely to preclude economic working.

Superficial deposits

River sand & gravel

These include post-glacial river terrace deposits, alluvial deposits and fluvioglacial deposits. Alluvial deposits are developed along the major river valleys. They are widespread and well developed in the Tees Valley as far up as High Force, and are also relatively common in some of the larger tributaries such as the Greta. They also occur along the Wear in the central lowlands of the County Durham. Fluvioglacial Terraces are widespread in the Tees Valley and are also common in valleys now abandoned by the main river. Deposits on the Wear, near Bishop Auckland, are more restricted in their extent and are shallower. These deposits form the largest group of sands and gravels found in the area.

Glacial sand & gravel

Glacial sand & gravel beds may be up to 30 m thick, but can disappear within a distance of a few metres. Detailed surveys carried out in the south of the area revealed considerable thicknesses of glacial sand & gravel around Billingham, Sedgefield and Darlington. Other resources in County Durham are in the vicinity of Chester-le-Street and Durham. However, the deposits in the central lowlands of the county may contain a significant proportion of fines and considerable portions of deleterious material, particularly coal. The intimate association of the sands and gravels with glacial clays and silts within the complex drift sequence of central Durham makes it difficult to estimate resources. Deposits are relatively small in upland areas to the west.

Beach and blown sand

Beach deposits are found along the length of Durham coasts and are often backed by sand dunes. The sand dunes are rarely worked because of conservation considerations. The area of beach worked usually lies between low water mark to within about 20 m of the dunes.

Bedrock deposits

The Permian Basal Sands crop out intermittently along the base of the Magnesian Limestone escarpment and dip to the east beneath the limestone. They consist mainly of weakly cemented, yellow, fine- to medium-grained, well-sorted sands of wind blown origin. They comprise a resource of fine aggregate and are mainly worked as a source of building sand, with some also being used as asphalting sand.

Evaporites

Gypsum / Anhydrite

Gypsum ($CaSO_4.2H_2O$) is formed by the hydration of anhydrite ($CaSO_4$) at or near surface but passes into anhydrite at depth. Anhydrite is, therefore, much more extensive than gypsum and occurs at several horizons within Permian strata in the east of the area. The most extensive is the Billingham Anhydrite, which is 4 to 7 m thick. It was formerly mined on a large scale at the Billingham mine between 1925 and 1971 for the manufacture of ammonium sulphate and sulphuric acid. The Hartlepool Anhydrite was also mined at Hartlepool between 1924 and 1930. Gypsum is highly soluble and dissolves rapidly at or near surface and may give rise to subsidence problems. As a result the presence of gypsum cannot be predicted with certainty at any one location. The conjectured outcrops of the Hartlepool and Billingham anhydrites are shown on the map. There has been no significant gypsum production in the area.

Potash

Potash (sylvine, potassium chloride, KCl) resources of Upper Permian age underlie the extreme south-eastern part of the area. The resource comprises the Boulby Potash, which has an average thickness of some 7.5 m and occurs at depths of over 800 m. It is worked at the Boulby Mine, which lies in the North York Moors National Park. Mine workings extend into Redcar & Cleveland and offshore. The conjectured western limit of the Boulby Potash is shown on the mineral resources map.

Rock salt

Halite (sodium chloride, NaCl) or 'rock salt' of Permian age underlies extensive parts of Teesside and the major chemical industry in the area was originally developed on these large deposits. The resource comprises the Boulby Halite Formation, which is up to 90 m thick in north-east coastal areas but thins gradually westward before dying out abruptly due to dissolution. The sub-surface extent of the Boulby Halite, and its conjectured western limit, is shown on the mineral resources map.

Salt is extracted by controlled brine pumping to the west of Seal Sands at depths of over 300 m. Cavities of controlled size and shape are created to maintain the stability of the overlying strata. About 25 per cent of the workable reserve is removed. The brine is used as a feedstock for the manufacture of chlorine by electrolysis, caustic soda (NaOH) being an important by-product. Rock salt is produced at the Boulby potash mine for use in de-icing roads. The salt is obtained from the development of major roadways in the Boulby Halite which lies below the potash bed.

SAND & GRAVEL

Superficial deposits

- River sand & gravel resources
- Concealed river sand & gravel resources in assessed areas
- Glacial sand & gravel resources
- Concealed glacial sand & gravel resources in assessed areas
- Blown sand and raised beach deposits
- Boundaries of areas assessed for sand & gravel at the indicated resource level

Bedrock deposits

- Outcrop of Basal Sands } Permian
- Silica sand - Millstone Grit sandstone } Upper Carboniferous

LIMESTONE

Dolomite

- Upper Magnesian Limestone
- Middle Magnesian Limestone } Permian
- Lower Magnesian Limestone

Limestone

- Limestone } Carboniferous

IGNEOUS ROCK (Intrusive)

- Dolerite (Whin Sill) } Upper Carboniferous
- Trace of solid resource underneath superficial deposits

EVAPORITES

Potash

- Approximate western limit of Boulby Potash

Salt

- Approximate western limit of Boulby Halite

Gypsum/Anhydrite

- Conjectured western limit of Billingham Anhydrite (BA) and Hartlepool Anhydrite (HA)
- Major fault bounding evaporite deposits

VEIN MINERALS

- Fluorspar : Major fluorite-bearing veins
- Barytes : Major baryte-bearing veins

COAL

Areas of shallow coal

- Principal resource area - thick, closely spaced coals } Coal Measures
- Subsidiary resource area - widely spaced coals } Coal Measures
- Opencast coal: Worked area

COAL LICENCE AREAS (as at 01.08.00)

Source: The Coal Authority

- Opencast coal site

MINERAL PLANNING PERMISSIONS (as at 01.01.00)

Source: Mineral Planning Authorities

- Surface planning permission (valid and expired)
- Underground planning permission for minerals other than coal (valid and expired)
- Upper Weardale & Rookhope blanket consent for underground vein minerals

MINERAL WORKINGS

Thrislington	Active site	
Bowlees	Inactive, worked-out and/or restored site	
○	Planning Permission undefined	
▲	Active underground mine site	
▼	Brine pumping area	
♦	Active wharf	

MINERAL COMMODITY

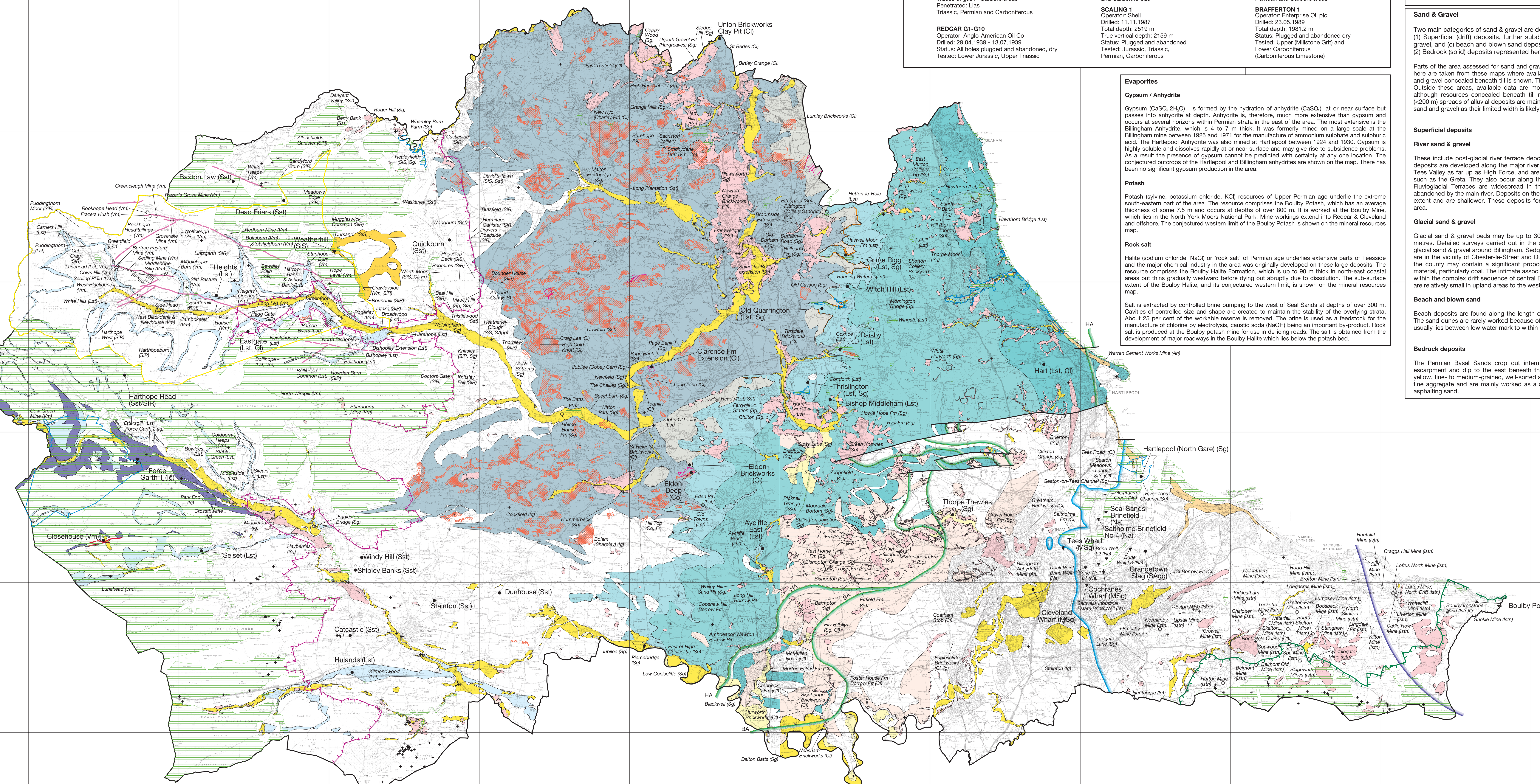
An	Anhydrite	K	Potash	SiR	Silica rock / ganister
Cl	Common clay & shale	Lst	Limestone, including dolomite	SiS	Silica sand
Co	Coal	MSg	Marine sand & gravel	Sst	Sandstone
Fr	Fireclay	Na	Salt	Vm	Vein minerals
Ig	Igneous rock	SAgg	Secondary aggregates		
Istn	Iron ore	Sg	Sand & gravel		

ENVIRONMENTAL DESIGNATIONS

- North York Moors National Park (part)
- Area of Outstanding Natural Beauty : North Pennines (part)
- Site of Special Scientific Interest
- National Nature Reserve
- \+ Scheduled Monument

ADMINISTRATIVE AREAS

- Mineral Planning Authority
- District



Igneous rock

Igneous rock resources are confined to the Whin Sill which is intruded into Carboniferous strata and is an important resource of crushed rock aggregate in northern England. However, in Durham it is currently worked at only one location near Middleton-in-Teesdale as a source of high specification roadstone and for concrete aggregate. The Whin Sill is a sheet intrusion composed of a hard dolerite. It is up to about 80 m thick in Upper Teesdale: elsewhere it averages around 30 m in thickness. A number of narrow vein-like intrusions (dykes), both associated with the Whin Sill, and of more recent age, also occur in the area. Although they have been worked in the past they are too narrow to support modern quarrying operations and are not shown on the map.

Limestone and dolomite

The limestone and dolomite resources of the area are divided into two categories: Permian dolomites and limestones, which provide the bulk of production, and Carboniferous limestones. The Permian Magnesian Limestone occurs in the east of the area and has traditionally been divided into the Lower, Middle and Upper Magnesian Limestone. These sub-divisions are shown on the map, although a revised nomenclature now also exists. The Magnesian Limestone is highly variable, both regionally and locally, in its physical, mechanical and chemical properties. It is inferior to Carboniferous limestones as a source of aggregate, because of its variable character, lower strength and higher porosity. The Lower Magnesian Limestone, which forms a prominent scarp along its western outcrop, accounts for most of the production. It is mainly used as a source of aggregate and agricultural lime, but it is also the most important source of industrial grade dolomite in Britain. Calcined dolomite produced at the large Thrislington Quarry provides a primary feedstock for the seawater magnesia plant at Hartlepool and is used as a flux in steelmaking.

Carboniferous limestones are numerous but occur in a mixed sequence of limestone, mudstone and sandstone beds (the so-called ıYoredale facies˙). The limestones are usually less than 10 m thick and are, therefore, too thin to support a modern quarrying operation. Consequently they have been excluded from the mineral resources map. The main exception is the Great Limestone which is sufficiently thick (20 m), extensive and consistent in quality to form a workable resource. It is worked at five quarries in Weardale, Teesdale and near Bowes for aggregates and cement manufacture.

Building stone

Sandstones of Carboniferous age, primarily the Stainmore Group (Millstone Grit - Namurian) and the Coal Measures (Westphalian) are the principal building stone resource in County Durham and the Tees Valley area. They satisfy the accepted criteria for building stone use such as strength and frost resistance (low porosity), durability and hardness (well cemented and resistant mineral framework), size of block, based on thickness of the bed, and aesthetic qualities such as colour and texture.

Demand for stone is currently concentrating on sandstones of uniform colour (buff, pale yellow and grey) and fine- to medium- grain-size. Coarser granular and pebbly sandstones or gritstones, which were once widely used, are now generally less commonly worked. As the stone quarries are often small the extent of the resource is not shown on the map. Despite this, the quarries are commercially important and their products are widely used in the north-east and also exported further afield, particularly to cities and towns elsewhere in England and Scotland. Quarrying has been carried out since at least the 12th Century, for example blocks can be seen in Durham Cathedral and Castle. Production reached a peak in the 19th to the early part of the 20th centuries. Demand is rising as natural stone is specified, mainly on aesthetic grounds, for new buildings in the area. Sandstones from quarries in the Stainmore Group such as Dunhouse, Shipley Bank and Stainton, are the most important sources, but sandstone is also obtained from quarries in the Coal Measures at Quickburn.

Clay and shale, including fireclay

Coal Measures mudstones are the principal brick clay resource in Durham and are worked at two sites near Bishop Auckland for facing brick manufacture. Coal Measures mudstones are widespread in the Durham Coalfield but those that meet the requirements of the brick industry are likely to have a more restricted distribution because of the need for clays with consistent forming and firing properties and low levels of impurities such as carbon and sulphur. Glacial lake clays are also worked near Chester-le-Street for facing brick manufacture at a plant just outside the area.

Fireclays typically occur beneath coal seams and resources are confined to coal-bearing strata. The close association of fireclay and coal means that opencast coal sites provide one of the few viable sources of the clay. Resources are, therefore, coincident with opencast coal resources. Fireclays were originally valued as a refractory raw material, but demand for this use has declined markedly. However, some fireclays with relatively low iron contents compared to other brickmaking clays are now valued for the production of buff-coloured facing bricks and pavers. They are often blended with red-firing brick clays to give a range of colours. The Durham Coalfield has been an important source of fireclay both for use in local brick factories and elsewhere. Production is largely dependent on the level of opencast activity which has been declining in recent years with a resultant decrease in the supply of fireclay.

AIMS AND LIMITATIONS

The purpose of the maps and associated reports in this series is to show the broad distribution of those mineral resources which may be of current or potential economic interest and to relate these to selected nationally-recognised planning designations. The maps are intended to assist in the consideration and preparation of development plan policies in respect of mineral extraction and the protection of important mineral resources against sterilisation. They bring together a wide range of information, much of which is scattered and not always available in a convenient form.

The maps have been produced by collation and interpretation of mineral resource data principally held by the British Geological Survey. Information on the extent of mineral planning permissions has been obtained form the relevant Mineral Planning Authority (MPA). Some of these permissions may have lapsed or expired. The status of individual areas can be ascertained from the appropriate MPA. Location information on national planning designations has been obtained from the appropriate statutory body (Countryside Agency, English Nature and English Heritage). For further information the relevant body should be contacted.

The mineral resource data presented are based on the best available information, but are not comprehensive and their quality is variable. The inferred boundaries shown are, therefore, approximate. Mineral resources defined on the map delineate areas within which potentially workable minerals may occur. These areas are not of uniform potential and also take no account of planning constraints that may limit their working. The economic potential of specific sites can only be proved by a detailed evaluation programme. Such an investigation is a essential precursor to submitting a planning application for mineral working. Extensive areas are shown as having no mineral resource potential, but some isolated mineral workings may occur in these areas. The presence of these operations generally reflect very local or specific situations which are referred to in the accompanying report.

The maps are intended for general consideration of mineral issues and not as a source of detailed information on specific sites. The maps should not be used to determine individual planning applications or in taking other decisions on the acquisition or use of a particular piece of land, although they may give useful background information which sets a specific proposal within context.

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