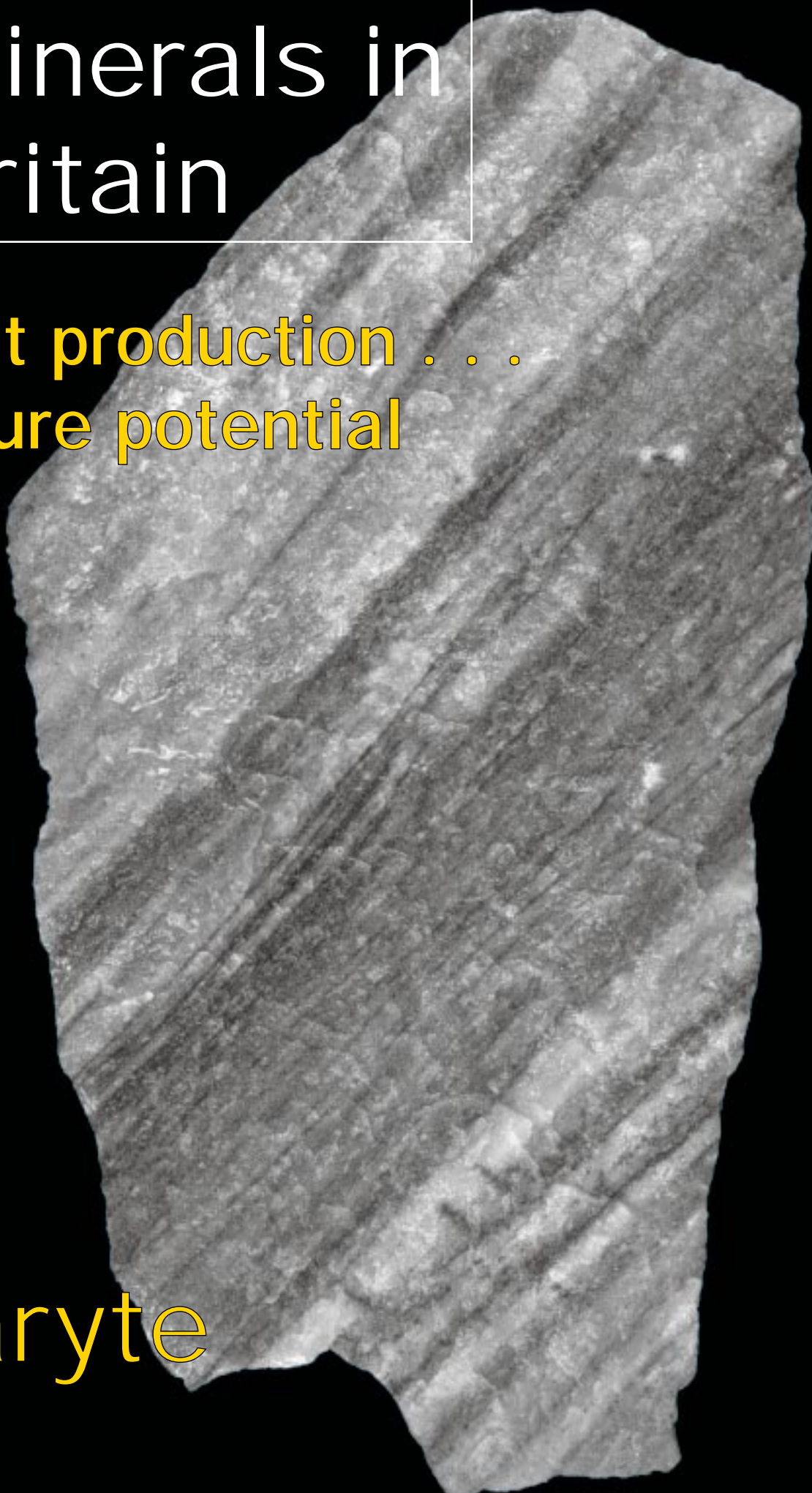


Minerals in Britain

Past production . . .
Future potential

Baryte



Baryte in Britain

Baryte (also known as barytes or barite) has been worked in a number of areas of Britain. Production was formerly from small, high-grade vein deposits in Lower Palaeozoic rocks in Scotland and Shropshire and from vein and replacement deposits in Carboniferous rocks in the Northern and Southern Pennine Orefields and in Devon. Production is now mainly from sedimentary exhalative (Sedex) deposits in the late Proterozoic Dalradian rocks of central Scotland which contain world-class resources of high-grade baryte. Total UK production to date is around 6 Mt of baryte (BaSO_4) and 1 Mt of witherite (BaCO_3).

In recent years, increased understanding of geological and ore-forming processes, together with improved exploration and mining technology, have widened baryte prospectivity in Britain both geographically and in terms of deposit type. Exploration by the BGS and commercial companies has identified several targets with potential for new discoveries, including Sedex and Mississippi Valley Type (MVT) deposits.

Much of the exploration work carried out by private- and public-sector organisations since the 1960s is either published in summary form or held on open file at the BGS. Most of the public-sector work was carried out by the BGS under the DTI-funded Mineral Reconnaissance Programme (MRP). The results of this work are contained in the MRP Report Series and most of the data collected are available in digital form. Much of the private-sector exploration work was carried out under the terms of the Mineral Exploration and Investment Grants Act 1972 (MEIGA) in the 1970s and 80s, and some of the data are available on open file. Some, particularly airborne geophysical data, have been converted to digital form and can be purchased in user-specified formats.

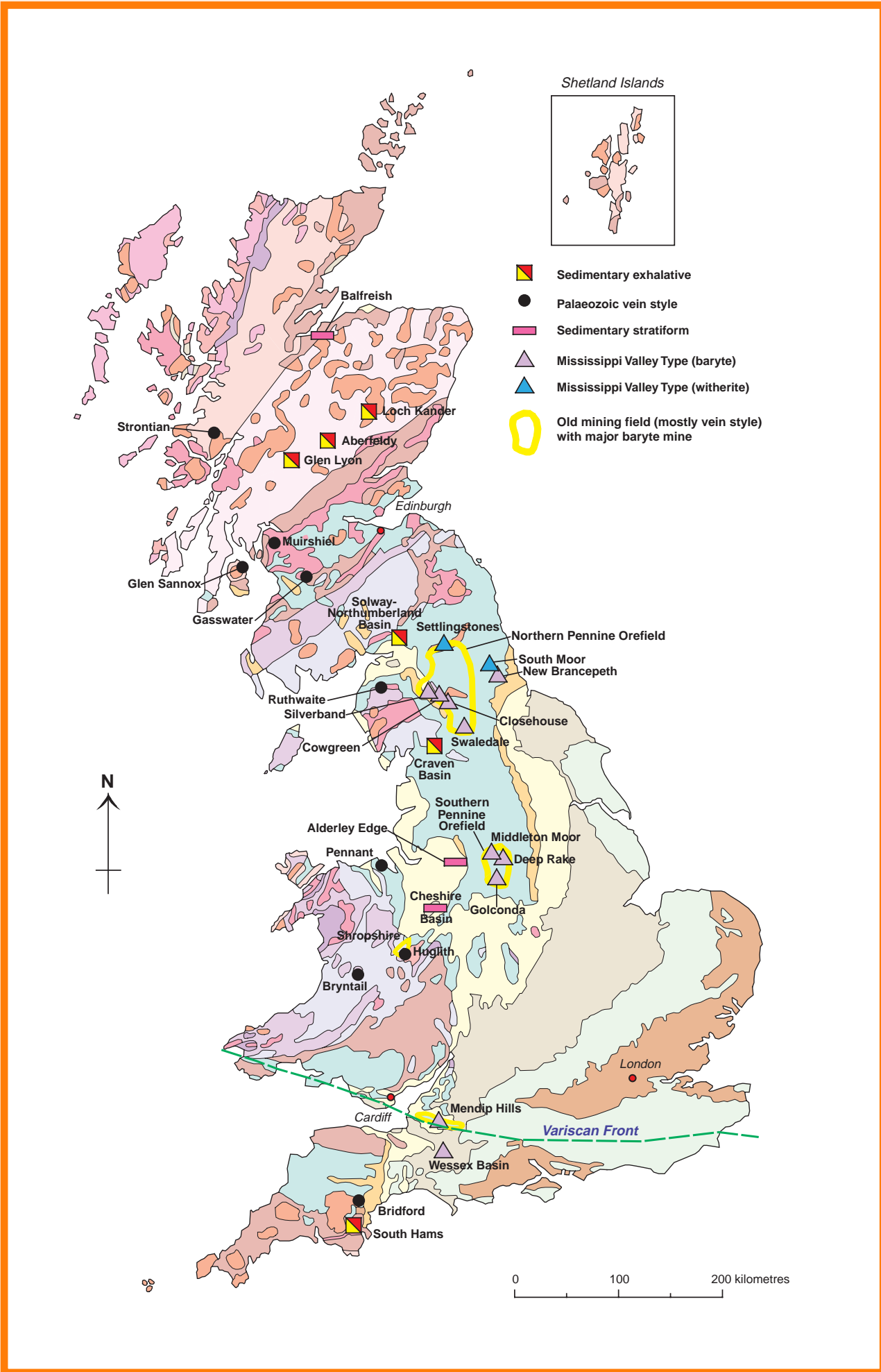
Sedimentary exhalative (Sedex) deposits

The main resource of baryte in Britain is in the *Aberfeldy* area of the Scottish Highlands. Baryte was discovered here by the MRP in 1973 in Middle Dalradian sediments of late Proterozoic age. It occurs in stratabound exhalative deposits which have large (several million tonnes) resources of high-grade baryte. The mineralisation occurs in the Ben Eagach Schist Formation, which includes graphitic schist, mica schist and quartzite with thin limestones. The

mineralised zone, which comprises bedded baryte, quartz-celsian (barium feldspar) rocks and barian muscovite schist, extends intermittently over a 7 km strike length, and is up to 110 m thick. It extends to a depth of at least 500 m. The mineralisation occurs in two largely fault-bounded deposits to the east and west of Farragon Hill, 5 km north of Aberfeldy. The smaller Foss deposit, to the west, has been in operation since 1984. An underground mine currently produces 50 000 t/yr of direct-shipping-grade baryte from an original mineable resource of 0.9 Mt. The baryte beds have an average thickness of 3 m, but structural complexities give a range from less than 1 m to locally over 15 m of pure baryte. The larger Duntanlich deposit to the east, with a strike length of 1.5 km, has a geologically inferred resource of 13 million tonnes with mineable reserves of 7 million tonnes of direct-shipping-grade baryte. As a result of its relatively simple structure it is amenable to low-cost large-scale underground mining methods. Duntanlich has the capacity to supply the current needs of the UK sector of the North Sea hydrocarbon industry (200 000 t/yr) for



A fold in massive bedded baryte underground in the Foss Mine.



- Sedimentary exhalative
- Palaeozoic vein style
- Sedimentary stratiform
- Mississippi Valley Type (baryte)
- Mississippi Valley Type (witherite)
- Old mining field (mostly vein style) with major baryte mine



0 100 200 kilometres

the next 30 years. However, mainly for environmental reasons, it has yet to secure planning consent for extraction.

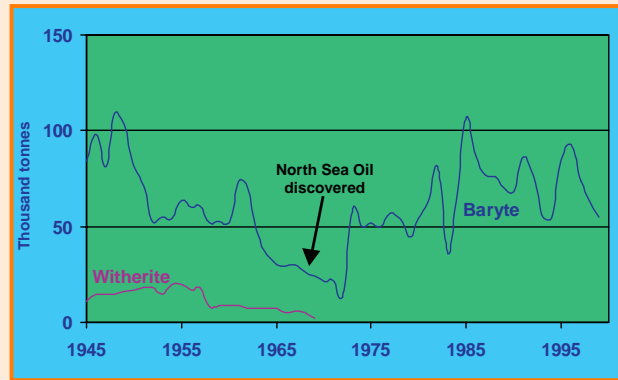
Other stratabound baryte prospects have been found by the MRP in Dalradian sediments to the north-east and south-west of Aberfeldy. Above *Loch Kander*, 45 km north-east of Aberfeldy, bedded quartz-baryte rock over 5 m thick outcrops over a strike length of 0.7 km. In *Glen Lyon*, 45 km south-west of Aberfeldy, a barium-enriched zone 1–3 m thick containing 4.5% Ba occurs over a strike length of 4 km above Loch Lyon. However, both these localities are remote and in areas of high scenic beauty.

Prospective areas for carbonate-hosted Sedex baryte–base metal mineralisation in Britain occur in early Carboniferous (Tournaisian) sediments in geological settings that are generally similar to those of the Irish zinc-lead-baryte deposits. The *Craven Basin* is the most prospective, with minor stratabound Zn-Pb mineralisation known in its north-western part. A large amount of data, including drill core, are available from MRP and MEIGA exploration in the area. The *Solway-Northumberland Basin* also has exposed early Carboniferous rocks.

Stratabound lead-zinc-baryte mineralisation occurs in folded and faulted Middle and Upper Devonian sedimentary and volcanic rocks in south and west Devon. The MRP drilled 7 m of massive stratabound pyrite mineralisation, with associated high grade baryte float, in the *South Hams* area of Devon. The whole Devonian-Lower Carboniferous (Hercynian) volcano-sedimentary belt in south-west England has considerable exploration potential for Sedex mineralisation of the baryte-base metal type similar to the Meggan or Rammelsberg deposits of equivalent age in Germany.

Palaeozoic vein-style deposits in sediments and volcanic rocks

Two major deposits were worked in south-west Scotland. *Gasswater* mine, near Muirkirk, produced 0.5 Mt of baryte from fault-controlled north-west-trending veins over a strike length of 3 km in Devonian and Carboniferous sediments. The *Gasswater* veins occur in an area of widespread baryte mineralisation, which contains around 80 known veins within a 15 km radius of Muirkirk. Most of these are too small to be of economic interest but one vein was worked by openpit around Nutberry Hill in the 1980s. *Muirshiel* mine, 50 km to the north-west of *Gasswater* near Lochwinnoch, produced 0.3 Mt baryte from north-north-east-trending veins in Lower Carboniferous trachytic and basaltic lavas. The mineralisation at *Gasswater* and *Muirshiel* is



Annual UK production of baryte and witherite 1945–1999.

thought to have originated from barium-rich formation waters or remobilisation of sedimentary baryte concentrations in Devonian–Carboniferous sequences.

The *Glen Sannox* mine, on the north-east side of the Isle of Arran, produced around 60 000 t baryte from a vein cutting Lower Devonian sandstones and mudstones.

Near *Strontian*, 25 km south-west of Fort William, several lead-zinc-baryte deposits extending over 7 km of a mineralised fault zone have been worked sporadically for lead from the mid 18th century. The largest, *Main Vein*, is up to 15 m wide and extends to a depth of 300 m. Several companies have investigated the area more recently and baryte was mined for a short time during the 1980s.

The *Shropshire* lead-zinc-baryte mining field yielded over 0.5 Mt of baryte from east–west veins up to 6 m wide in late Precambrian sediments and Ordovician sediments and volcanics. The principal baryte mines in Ordovician volcanics were *Wotherton* and *Cliffdale*, which produced 157 000 t. The main lead mine in the area, *Snailbeach*, hosted in Ordovician sediments, produced 42 000 t of baryte. The largest mine was *Huglith*, which produced 295 000 t from late Precambrian (Longmyndian) sandstones.

A number of small deposits have been worked for baryte in the northern Lake District from veins in Dinantian limestone, especially from the *Ruthwaite* mine where the limestone was faulted against the underlying Ordovician volcanics.

Baryte was also produced from the *Teign Valley* in south Devon from a major north–south shatter-belt 200 m wide and 9 km long in Devonian and Carboniferous shales and cherts. The main producer was the *Bridford* mine with over 450 000 t of baryte.

There has been only minor production of baryte in Wales. Baryte and witherite were produced at the *Pennant* and *Bryntail* mines from veins in Ordovician and Silurian mudstones. Total production was less than 10 000 t.

Mississippi Valley type (MVT) deposits

Vein and replacement lead-fluorite-baryte-zinc deposits in Dinantian limestones and sandstones have been exploited in the *Northern* and *Southern Pennine Orefields* for a total production exceeding 2 Mt baryte. The *Settlingstones* area in Northumberland was a major source of witherite (BaCO_3) with a total production of 740 000 t. The main Northern Pennine Orefield contains a number of mines worked primarily for baryte. They occur outside the main, concentric 'fluorite zone' of this primarily lead and fluorite orefield. The most productive mines were *Cowgreen*, *Silverband* and *Closehouse*. Closehouse Mine has produced over 300 000 t of baryte and works lenses and replacement orebodies within a complex structure related to splays of the Lunedale Fault on the southern margin of the orefield. Small-scale production continues.

Silverband Mine, on the western edge of the orefield, produced around 300 000 t of baryte from veins and extensive areas of replacement of the Great Limestone. Cowgreen Mine, in the south of the

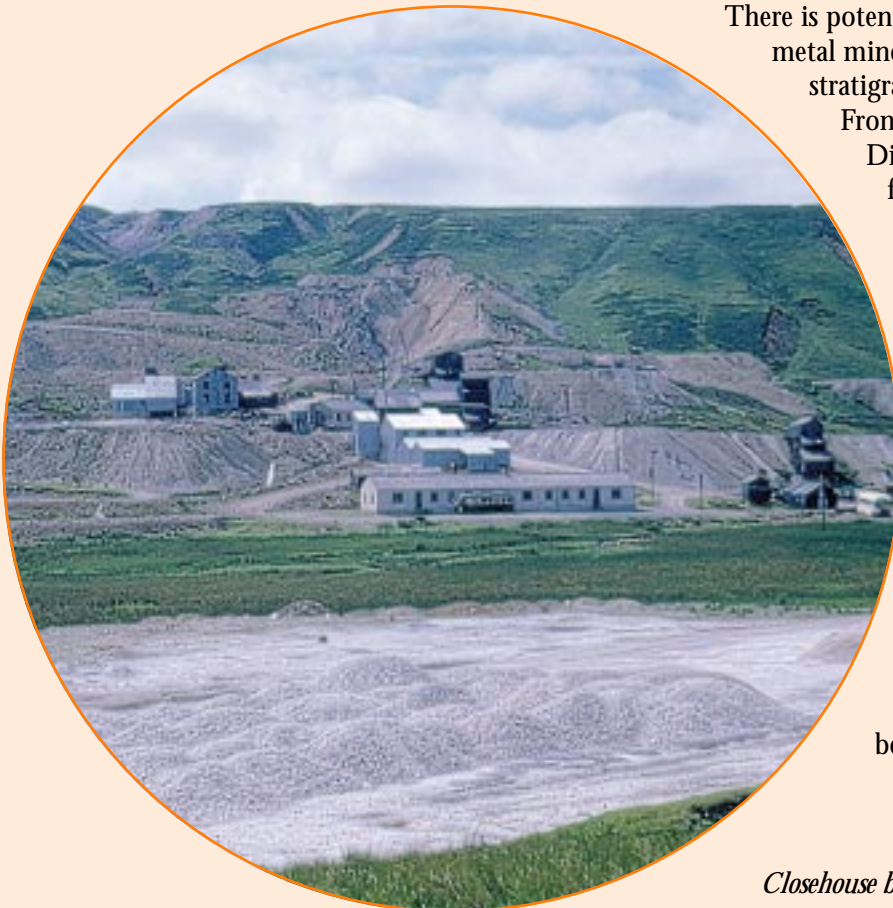
orefield, also produced 300 000 t of baryte, principally from the north-south Winterhush Vein. The main oreshoot was over 700 m long, up to 1.5 m wide and was worked to a depth of more than 80 m. A number of veins in the Askrigg area of the Northern Pennine Orefield also produced baryte, mainly from the Old Gang and Arkengarthdale mines in *Swaledale*.

Several deposits were also worked in Westphalian rocks of the Durham coalfield, to the east of the Northern Pennine Orefield, with a total production of 264 000 t of witherite and 234 000 t of baryte. The main deposits were at *South Moor* (witherite) and *New Brancepeth* (baryte).

The Southern Pennine Orefield has produced a total of over 1 Mt baryte from east-west-trending lead-fluorite-baryte veins and replacement deposits in the upper part of the exposed Dinantian limestones. Much of this has been obtained by working of spoil heaps left by earlier lead mining operations, especially on *Middleton Moor* and along the *Deep Rake* vein in the northern part of the orefield, near Castleton. Baryte is now mainly obtained as a by-product of fluorspar mining in the same area. Replacement galena-baryte mineralisation along a contact between dolomite and limestone has been worked in the *Golconda Mine* near Brassington, in the south of the orefield, with a total production exceeding 75 000 t.

There is potential for concealed baryte – base metal mineralisation in structural and stratigraphic traps along the Variscan Front in Southern England.

Dinantian limestones are unconformably overlain by Mesozoic rocks on the northern margins of the Wessex Basin, while to the west Dinantian strata outcrop in the Mendip Hills and in South Wales. In a number of these areas, especially in the *Mendip Hills*, the Dinantian limestones and overlying Triassic dolomitic conglomerates contain vein, replacement and disseminated lead-zinc-baryte mineralisation of Mesozoic age. Baryte and base metal mineralisation has also been reported from several



Closehouse baryte mine, North Yorkshire.

boreholes in the *Wessex Basin* at the unconformity between Dinantian and Mesozoic strata. A concealed Tournaisian Waulsortian reef complex (similar in age to those hosting some of the Irish zinc-lead-baryte ore deposits) was intersected by a deep borehole near Bridgewater in Somerset.

Sedimentary stratiform deposits

Baryte is widespread as a cement in Permo-Triassic sandstones throughout the Midlands of England, especially in the *Cheshire Basin*. Locally the baryte content can increase to form up to 10% of the rock. It is also a significant gangue mineral in the small *Alderley Edge* sediment-hosted stratiform copper deposit in the Cheshire Basin.

A small stratabound baryte deposit occurs at *Balfreish*, near Inverness, just above the Devonian-Precambrian unconformity.



Banded calcite-baryte-fluorite-galena vein mineralisation from Derbyshire.

Data Holdings

A substantial amount of information related to baryte mineralisation in Britain is either published or held on open file at the BGS. Increasingly, the data are held in digital form on databases fronted by a GIS (the BGS MINGOL system) and can be supplied under licence or as hard-copy products, in formats to match the user's requirements. Some of the principal data sources are:

- Mineral Reconnaissance Programme Reports and Data Releases.
- Reports, maps and other data provided under the terms of the Mineral Exploration and Investment Grants Act 1972 (MEIGA). Some data have been converted to digital form and can be purchased in user-specified formats. Hard-copy data and reports may be photocopied.
- Regional and local scale geochemical surveys.
- Regional and local scale ground and airborne geophysical data coverage.
- Geological mapping at various scales.
- Mineral occurrence and mineral workings databases.
- Drillcore and rock samples, thin sections.
- Licensing, legislative and planning constraint information.
- Minerals trade and production statistics in Britain and worldwide.
- Scientific publications on mineral deposits in Britain.

Staff of the BGS Minerals Programme act as a reference point for the supply of advice and information on minerals-related matters in Britain. They can provide detailed information on the above datasets.

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