# Gunnerside Gill, Swaledale, North Yorkshire

[NY 939 012]

Potential GCR site

## Introduction

In the headwaters of Gunnerside Gill, a left bank tributary of the River Swale, uppermost Dinantian and Namurian limestones, sandstones, cherts and shales are cut by a closely spaced belt of mineralized faults which comprise part of the most intensely mineralized parts of the Askrigg Block of the Northern Pennines, collectively termed the 'North Swaledale Mineral Belt' by Dunham and Wilson (1985). The geology and the main mineralized veins are shown on (Figure 3.22). The area has a very long history of lead mining, dating back to the 17th, and perhaps 16th, centuries, although the most extensive working was in the 19th century. Over this period very substantial tonnages of ore must have been raised, although no figures are recorded. In addition to lead ore, significant, although unrecorded, amounts of barite have been extracted from spoil heaps between the 1950s and 1980s. Dunham and Wilson (1985) gave detailed descriptions of the geology and mineralization, together with comments on the history of working. Crabtree and Foster (1963), and Raistrick (1975) have provided more details of mining history, including photographs of key features.

## Description

The North Swaledale Mineral Belt of Dunham and Wilson (1985) comprises a linked system of mineralized faults which extends for at least 29 km from Great Sleddale at the head of Swaledale, to Feldom, near Richmond. It is the most highly mineralized zone within the Askrigg Block and has been exploited at numerous points. In Gunnerside Gill veins within this belt cut beds ranging from the shale above the Ten Fathom Grit (Namurian) down to the Five Yard Limestone (Dinantian). They have been extensively worked at the surface and underground on the west side of the valley at the Lownathwaite mines, and on the east side of the valley from a complex of workings which connected with and formed part of the Old Gang mines, the main access to which lay almost 3 km to the east, in Hard Level Gill. Detailed descriptions of the structural and stratigraphical relationships of the veins and their orebodies, including observations made underground, are given in Dunham and Wilson (1985). ,

Although no good surface exposures of veins remain, and although none of the underground workings are today safely accessible, the area offers one of the finest opportunities to appreciate the extent and nature of mineralization typical of this part of the Pennines. Within both sides of Gunnerside Gill the courses of the major veins are clearly apparent in the spectacular opencasts excavated along them. Known locally as 'hushes', these vast gullies were in part created by a form of hydraulic mining, known as 'hushing', in which torrents of water were periodically released from specially constructed dams high on the hillsides. Although previously considered to be the main agent in creating these features, it is now realized that the scouring effects of water alone could not satisfactorily account for the great size of the excavations. It seems much more probable that water was periodically released to flush from the workings debris created by conventional excavation. Whatever their precise origins, these 'hushes' in Gunnerside Gill are amongst the finest in the Askrigg Block. Underground mining was via a number of adit-levels driven directly on the veins, or as cross-cuts through barren rock. The most notable of the latter was the Sir Francis Level [NY 9399 0001], driven beneath the Five Yard Limestone, and which gave access to veins on both sides of the valley. A sublevel beneath this adit worked ore-shoots in the Middle Limestone. Several veins were also worked from surface shafts sunk directly on their outcrops on the moorland, especially to the east of Gunnerside Gill (Figure 3.23).

Very large volumes of mineralized spoil within the hushes, on adit dumps, and adjacent to the numerous shafts, provide excellent opportunities to study the mineralogy characteristic of these deposits. Galena, the only ore mineral recovered from these workings, remains common in much of the spoil. Sphalerite is also present locally, although it was never worked. Most abundant of the gangue, or 'spar', minerals was barite, which comprises a major proportion of most of the spoil heaps. Much of the barite occurs as cellular, often rather coral-like, crystalline masses composed of small, sharply

pointed crystals in which the dominant faces are (110) combined with (001). The mineral commonly forms comparatively fine-grained stalagmitic masses full of reticulated tubes. Limonite staining is common. This form is characteristic of barite formed by alteration of a primary barium carbonate mineral such as witherite or barytocalcite, and contrasts strikingly with the generally much more coarsely crystallized tabular form in which the dominant faces are (001) (102) and (102) (Dunham and Wilson, 1985; Dunham, 1990). Only very small amounts of barite showing the latter morphology are present here. Witherite is present locally, commonly forming the core to large blocks of cellular barite. Barytocalcite has been said to be present, particularly in parts of Old Rake and Friarfold Vein (Dunham and Wilson, 1985), although these authors were unable to confirm its presence by microscopical and X-ray diffraction examination of veinstone samples. They did, however, record a single specimen of the mineral from the spoil heaps of Sir Francis Level. Fluorite occurs locally in association with barite, particularly in spoil from workings on Old Rake. In common with much of the Askrigg Block, the fluorite is typically colourless or white and, where barium minerals are present, invariably pre-dates these minerals. Strontianite has been recorded from the Sir Francis Level dump (Young, 1987b). Supergene minerals include cerussite, 'limonite', rare traces of cinnabar accompanied by smithsonite, hemimorphite and aurichalcite (Young *et al.,* 1989), and, in places in spoil from workings on Old Rake, pyromorphite (Small, 1982).

## Interpretation

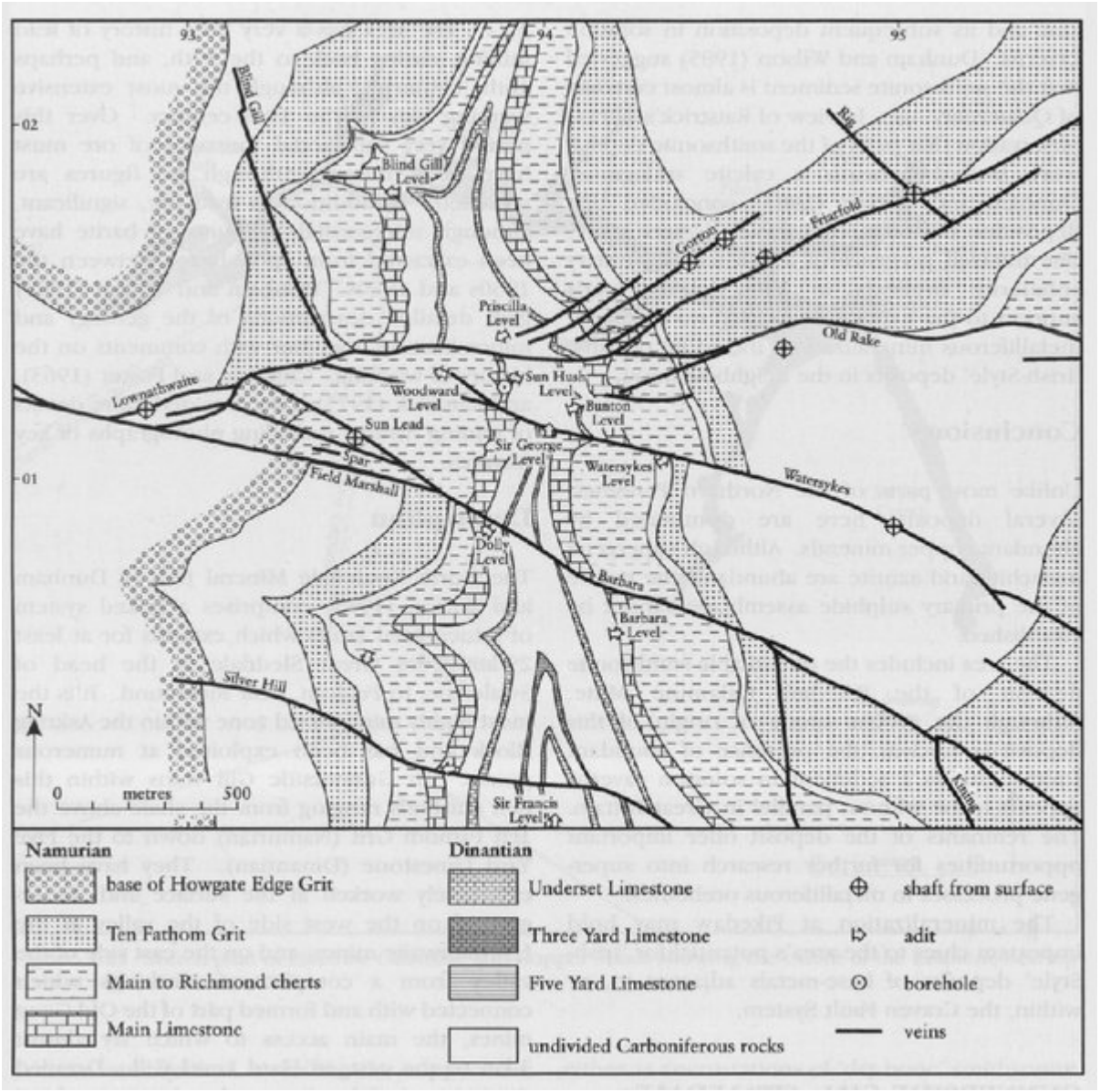
The North Swaledale Mineral Belt as unique in the Northern Pennines for its structural relationships and continuity of mineralization. The proved vertical range of mineralization at Lownathwaite, of almost 230 m, is roughly twice that found elsewhere in the belt, and led Dunham (1952b) to speculate that Lownathwaite may lie above one of the foci from which mineralizing fluids were distributed. The possibility of further workable ore deposits beneath the area was tested by a single borehole drilled on the west side of Gunnerside Gill in 1968, although the results did not lead to further investigation (Dunham and Wilson, 1985).

Whereas a zonal distribution of fluorite and barium minerals is locally discernible in the Askrigg Block, this distinction is generally by no means as clear as in the Alston Pennines. Moreover, unlike the Alston Block, where fluorite and barium minerals generally exhibit a mutually exclusive relationship, in the Askrigg Block it is common to find fluorite and barium minerals in close juxtaposition in the same deposit; where this is so fluorite is invariably the earliest phase. Dunham and Wilson (1985) have demonstrated a concentration of fluorite mineralization within the North Swaledale Mineral Belt which embraces parts of the veins which crop out in and around Gunnerside Gill. Fluorite is present locally, notably in spoil from Old Rake, although the gangue assemblage throughout the deposits described here is dominated by barite, in places accompanied by a little witherite. As noted above, the bulk of the barite occurs in a form indicative of late-stage alteration of a barium carbonate mineral, leading Dunham and Wilson (1985) to suggest that prior to this alteration, witherite was very abundant, especially in veins such as Old Rake and Friarfold Vein. The date of this alteration is unclear. Although barite with this morphology can be found as an alteration of witherite related to present-day supergene activity, its great abundance here from workings which extended far beneath present zones of supergene influence suggests a much earlier widespread alteration of barium carbonate minerals. Young *et al.* (1989) suggested that the close association of cinnabar with supergene zinc minerals may indicate that a small amount of mercury may be present within primary sphalerite, although they were unable to cite any analyses of local sphalerite for mercury.

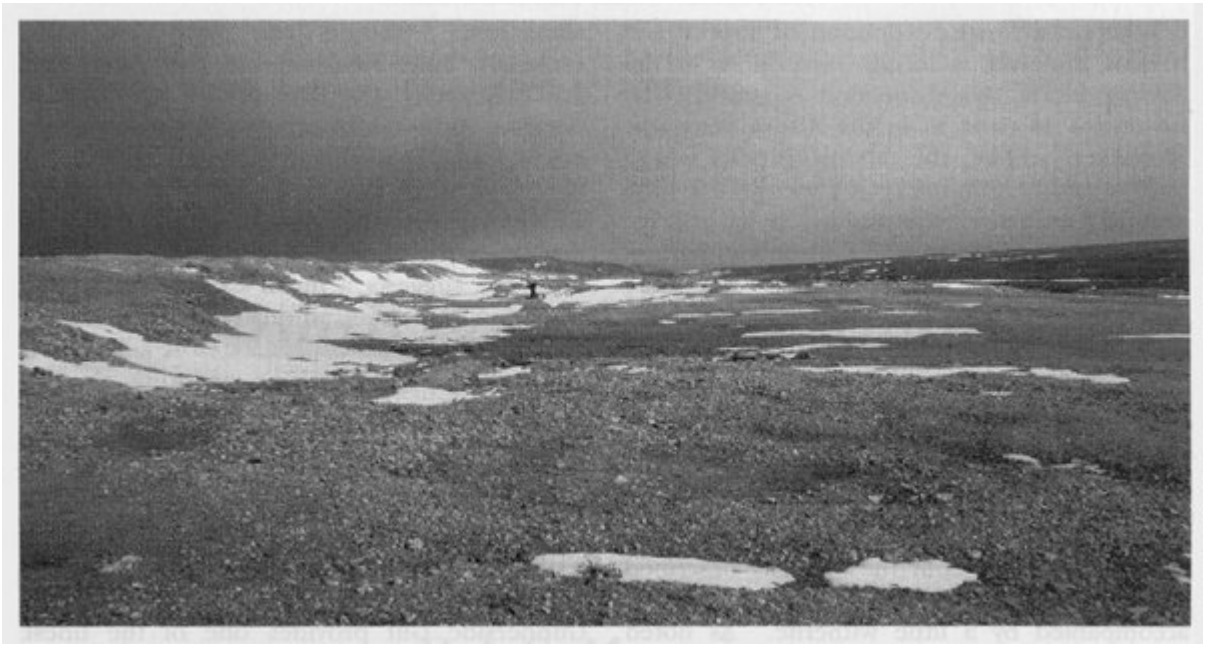
## Conclusions

Gunnerside Gill provides one of the finest opportunities to study the mineralogy and geological setting of deposits characteristic of this part of the Askrigg Block of the Northern Pennines.

**References**




*(Figure 3.22) Map of the geology and mine workings in Gunnerside Gill. After Dunham and Wilson (1985).*



*(Figure 3.23) View east along old workings on Old Rake. (Photo: B. Young.)*