Greenhow (Duck Street) Quarry, North Yorkshire

[SE 112 639]

Introduction

Greenhow Quarry, sometimes known as 'Duck Street Quarry', is an old limestone quarry in the Dinantian Greenhow Limestone in the core of the Greenhow Anticline. Within the quarry are exposed three branches of Greenhow Rake, one of the major veins of the Greenhow area.

The Greenhow Hill mining area lies in the extreme southern part of the Northern Pennine Orefield, immediately north of the Craven Fault System, the structurally complex hinge zone which separates the Askrigg Block to the north from the Craven Basin to the south. This is a classic area of British geology and is the subject of an extensive literature, an excellent summary being provided by Dunham and Wilson (1985). The Greenhow Hill area essentially comprises an E–W-trending anticline composed of thick Dinantian limestones overlain unconformably by the Namurian Grassington Grit. There is thus clear evidence here of early Namurian folding and erosion. The entire Brigantian succession is missing and the Grassington Grit rests directly on Asbian limestones. Dunham and Wilson (1985) estimated that at least 137 m of limestones are cut out by this unconformity. The limestones of Greenhow Hill are cut by numerous mineral veins, from many of which lead ore and fluorspar have been recovered. In the Greenhow area this mineralization is confined to the limestones, except locally adjacent to the North Craven Fault where mineralization occurs in the Grassington Grit. Dunham and Wilson (1985) commented that the varied stratigraphy and structure of this area provide a more varied environment for introduced mineralization than elsewhere in the region.

The area's long history of mining is the subject of a substantial literature. Important contributions include, apart from those cited below, works by Dickinson (1964a,b, 1967, 1969, 1970), and Jennings (1967). Raistrick (1973) suggested the possibility of Iron-Age or even Bronze-Age workings, and the exploitation of some of the deposits by the Romans seems likely as Roman pigs of lead have been found locally (Dunham and Wilson, 1985). The first documentary records date from the 12th century (Raistrick, 1927, 1973; Raistrick and Jennings, 1965), but the industry reached its peak here in the 18th and 19th centuries. Little mining has been undertaken here since the depression of the 1880s, although a small amount of fluorspar has since been raised from time to time from several sites including Greenhow Quarry. The most recent working for this mineral is believed to have taken place here in the 1960s. Despite the long abandonment of the Greenhow mines the area has remained of interest for mineral exploration, and investigations were carried out as recently as the 1970s (Wadge *et al.,* 1984).

Description

Greenhow Quarry exposes a section through the Greenhow Limestone (Asbian) in the core of the Greenhow Anticline. Greenhow Rake, one of the strongest and most important NW–SE-trending veins of the area, splits into three branches at Greenhow Quarry.

The largest of these branches, regarded by Dunham and Wilson (1985) as the central branch, today forms a prominent rib through the centre of the quarry (Figure 3.19). A level has been driven into the southern wall of this vein and numerous opencuts or old stopes may be seen within it. The vein is up to 5 m wide and is composed mainly of coarse-grained columnar, white to cream-coloured calcite, and white, or more rarely very pale-purple-tinted fluorite. A few scattered crystals of galena, locally coated with cerussite, occur within the fluorite. Small pockets of pale-brown 'dry bone' smithsonite occur in places. Calcite commonly forms bands adjacent to the vein walls with inner, central, lenses or bands of fluorite. Some fluorite lenses occur in contact with limestone wall-rock. Fluorite lenses are typically up to 0.5 m wide although an extensive stope up to about 1 m wide, apparently within a fluorite-rich band, has been excavated in the northern side of the vein. Within the walls of this excavation fluorite crystals greater than 5 cm across may be seen. Much of the fluorite here is white or colourless, although traces of very faint purple colouration may be seen locally. Some of the clear, colourless fluorite contains zones of minute sulphide inclusions. Ixer (1978a) reported the presence of pyrite

and bravoite inclusions in fluorite from the Greenhow area, perhaps including Greenhow Quarry. Vugs lined with calcite and fluorite crystals are common within the vein. These are particularly conspicuous, although rather inaccessible, above the old mine entrance on the south side of the vein. Much of the limestone wall-rock exposed in the quarry shows little obvious evidence of alteration, although locally a prominent medium-brown colouration suggests dolomitization. Sub-horizontal, post-mineralization slickensides may be seen on the southern wall of the vein and locally within it.

Smaller branches of Greenhow Rake, exposed in the northern section of the quarry, appear to unite near the main quarry face. These branches carry very similar mineralization to that seen in the main branch, with, in places, a little barite. A small isolated knoll of limestone, about 25 m north of the main branch vein, contains a vein up to 1 m wide in which fluorite clearly occurs as a central filling in a vein of coarse-grained columnar calcite.

Interpretation

The sections of Greenhow Rake exposed in Greenhow Quarry are perhaps the finest permanently exposed sections through a vein of this kind in the southern part of the Askrigg Block. Fine sections of other veins are, from time to time, exposed in the nearby workings of Coldstones Quarry, although these are usually removed or obscured as quarrying proceeds.

In common with other veins in the area the constituent minerals in Greenhow Rake are characteristically coarse-grained. The vein shows clear evidence of having been filled with rhythmic repetitions of these minerals. Whereas the veins of the Askrigg Block exhibit local evidence of lateral zonation, this is nowhere as well defined as the zonation present within deposits in the Alston Block. Indeed, Dunham and Wilson (1985) remarked that so few veins in the Askrigg Block contain fluorite without barium minerals that a zone comparable to the fluorite zone of the Alston Block cannot be established. However, concentrations of deposits with fluorite are recognizable locally, and fluorite-bearing zones have been delineated in several parts of the Askrigg Block. Unlike the deposits of the fluorite zone of the Alston Block, those of the Askrigg Block almost everywhere carry barite, and locally witherite, interbanded or intergrown with fluorite. Dunham and Wilson (1985) grouped the deposits of Greenhow Hill, together with the neighbouring deposits at Skyreholme and Appletreewick, within one of these fluorite-rich zones. Studies of fluid inclusions in fluorite from dumps in the Greenhow area gave homogenization temperatures of between 110° and 160°C and salinities of between 15 and 25 equiv. wt% NaCl. These are consistent with values obtained elsewhere in the fluorite-rich zones of the Askrigg Block.

The main branch of the vein exposed in the quarry clearly demonstrates the important role that wall-rock lithology, in this case limestone, plays in determining vein width. The term 'bearing beds' was commonly applied to such favourable stratigraphical units by the former lead miners. Dunham and Wilson (1985) noted that ore-shoots at Greenhow Hill extend over a vertical range of at least 152 m, a substantially greater range than for most parts of the Askrigg Block. This may in part result from the stratigraphical and structural control exercised by the thick sequence of Dinantian limestones within the Greenhow Anticline. These authors also noted that only in the fluorite-rich zones of the Askrigg Block do orebodies extend over substantial vertical intervals. Dunham and Wilson (1985) canvassed the suggestion that an emanative centre of mineralization may have lain beneath the Greenhow area. The presence of well-developed mineralization below the deepest levels penetrated by the Greenhow mines was established during the final years of the 19th century in driving the Bradford Corporation aqueduct tunnel as part of the Scar House Reservoir scheme.

Whereas Dunham and Wilson (1985) and others generally regarded the deposits of the Greenhow area, like those of the remainder of the Askrigg Block, as being representative of the Mississippi Valley-type, the proximity of these deposits to the major hinge line of the Craven Fault System invites speculation on the role this structure may have played in mineralization. In recent years comparisons with base-metal deposits in central Ireland has focused attention on the possibility that syn-sedimentary mineralization may be present adjacent to similar basin-margin structures such as the Craven Fault (for example Wadge *et al.,* 1984). The possibility of a similar relationship of the barium-rich mineralization at sites such as Settlingstones and Fallowfield mines, to the Stublick Fault Zone on the southern margin of the Northumberland Trough has been mentioned in the Settlingstones Mine and Fallowfield Mine GCR site reports (this chapter).

Conclusions

Greenhow Quarry provides perhaps the finest sections available of a major vein within the southern part of the Askrigg Block. The width of the vein, and the known extension of this and other nearby veins in depth, can be related to the thick development here of Dinantian limestones and to the possible presence of an emanative centre of mineralization beneath the Greenhow area. The deposits of this area thus have considerable research potential.

References

(Figure 3.19) Greenhow (Duck Street) Quarry. The central branch of Greenhow Rake here forms a prominent rib through the centre of the quarry (Photo: B. Young.)