
Blagill Mine, Cumbria

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Introduction

Blagill Mine is the type locality for the very rare barium calcium carbonate mineral barytocalcite ($\text{BaCa}(\text{CO}_3)_2$) (Brooke, 1824). In addition to providing the original specimens, Blagill Mine has been the source of numerous magnificent specimens of this mineral to be seen in museum collections throughout the world. Although the deposit which contains barytocalcite is not exposed at the site today, the mine spoil-heaps contain abundant mineralized veinstone in which barytocalcite and its relationship to associated minerals may be studied.

Lead mining at Blagill may date from as early as the 14th century, and mining is known to have been active until 1895 (Dunham, 1990). Lead was the main mineral produced, although between 1876 and 1895 Blagill is known to have been a producer of 'witherite' for the manufacture of barium chemicals. According to Dunham (1990) there can be little doubt that Blagill 'witherite' was actually barytocalcite. Production of this mineral ended when deposits of true witherite became available from the nearby Nentsberry Mine. Blagill Mine is the only mine known to have produced barytocalcite as a commercial product.

Description

The strong NE–SW-trending vein known as 'Fistas Rake' has been worked for lead from underground workings on the east side of Blagill Burn at Blagill Mine. Vein ore-shoots were present in the Great Limestone, the underlying Quarry Hazle Sandstone and the Four Fathom Limestone. In addition, metasomatic replacement flats are understood to have been associated with the vein in the limestones. The vein is reported to have been up to 3 m wide and to have been composed mainly of barytocalcite with smaller amounts of witherite, calcite, galena and sphalerite (Dunham, 1948, 1990). The vein is not exposed at the surface today and none of the underground workings is safely accessible. However, the remaining spoil-heaps contain an abundance of mineralized veinstone in which examples of the primary minerals and their paragenetic relationships may be studied (Young, 1985c, 1993). In addition the dumps contain small quantities of supergene minerals including smithsonite, hydrozincite, barite and rare traces of greenockite (Young *et al.*, 1987).

Barytocalcite was first described as a new mineral species by Brooke (1824), and, although no precise locality details were given for the original specimens, Young (1985c) has concluded that Blagill Mine was the source. Despite the mineral's great abundance at Blagill it was for many years known, in very small amounts, from only a very few other Northern Pennine localities. Fine specimens of barytocalcite from a number of Northern Pennine locations are in the Russell Collection at the Natural History Museum, London. In a review of the occurrence of barytocalcite, and the chemically identical species alstonite, Young (1985c) showed that barytocalcite is relatively widespread, and locally abundant, in the outer, barium, zone of the Northern Pennine Orefield. Outside of the Northern Pennines the mineral appears to remain a great rarity and has been reported from only a handful of other localities including the Aberfeldy barite deposit, Perthshire (Moles, 1985), the Mendips and South Wales (Alabaster, 1990; see Mwyndy Mine GCR site report, Chapter 5), Dolyhir, Wales (see Dolyhir Quarry GCR site report, Chapter 5), Langban, Sweden and Himmelsfürst Mine, Freiburg, Germany (Roberts *et al.*, 1990) and Rorrington, Shropshire (Starkey *et al.*, 1994). Blagill Mine remains the world's most accessible and most prolific source of specimens of this rare species.

Barytocalcite is the monoclinic trimorph of barium calcium carbonate ($\text{BaCa}(\text{CO}_3)_2$). The orthorhombic trimorph, alstonite, which also has its type locality within the Northern Pennines, occurs much more sparingly within the orefield (see Fallowfield Mine GCR site report, this chapter). Paralstonite, the trigonal trimorph, has recently been reported from the Dolyhir Quarry GCR site (Chapter 5).

Much of the barytocalcite at Blagill occurs as coarsely crystalline masses commonly in excess of 10 cm across. Cavities lined with white to colourless, slender monoclinic prisms, sharply terminated by prominent (121) faces and occasionally

forming fan-shaped aggregates, are common. Individual barytocalcite crystals are typically up to 5 mm in length, but crystals up to 15 mm long are not uncommon (Symes and Young, 2008). Numerous blocks of recrystallized limestone, in part replaced with barytocalcite, and containing many crystal-lined cavities, are almost certainly derived from replacement flats adjacent to the vein. More rarely, barytocalcite is found as relatively fine-grained compact crystalline masses. A few specimens have been collected in which barytocalcite appears to pseudomorph original tabular barite crystals (Young, 1993).

In many blocks of veinstone the barytocalcite exhibits an outer crust of compact, rather chalky, barite, almost certainly produced by supergene alteration. Specimens may be found in which this alteration has produced compact, chalky barite pseudomorphs after well-formed barytocalcite crystals.

Interpretation

Blagill Mine lies within the outer zone of the Northern Pennine Orefield in which barium minerals comprise the characteristic gangue. Throughout this zone barite is the most widespread and abundant mineral. However, the Northern Pennine Orefield is unique in the world for the abundance within it of barium carbonate minerals. Most abundant and widespread of these is witherite, many thousands of tons of which have been mined from the area. Barytocalcite is also an important member of this barium carbonate assemblage and has been shown to be both widespread and locally abundant in the orefield (Young, 1985c). The reasons for the remarkable abundance of barium carbonates, particularly the rare barium calcium carbonates barytocalcite and alstonite, within the Northern Pennines have yet to be satisfactorily explained.

In a study of the distribution and relationships of barium carbonate minerals within the orefield, Young (1985c) showed that barytocalcite, together with alstonite, usually occurs in deposits in which witherite is also present. In most instances the double carbonates comprise relatively minor proportions of the assemblage, although in some deposits barytocalcite is present in equal or, more rarely, greater amounts than witherite. Blagill is one of the deposits in which barytocalcite greatly predominates over witherite. In his review, Young (1985c) demonstrated that barytocalcite and alstonite almost invariably occur in deposits within limestone wall-rock and that the crystallization of these minerals usually post-dated that of witherite.

Hancox (1934) presented evidence that much of the witherite within the Northern Pennine Orefield was produced by hydrothermal alteration of previously deposited barite by reaction with fluids carrying an abundance of carbonate ions. The close association of barytocalcite and alstonite with witherite suggests that these minerals may be a product of this event and that these late carbonating fluids may have become locally enriched in calcium. Indeed Hancox (1934) observed that at the Settlingstones Mine GCR site (see GCR site report, this chapter), near Hexham, barytocalcite occurred as the final encrustation on witherite and suggested that the development of barytocalcite and alstonite resulted from an influx of calcium carbonate in the final stages of the carbonating episode. That the lithology of the wall-rocks in general exercised little influence on the formation and deposition of witherite is clear from the range of wall-rocks which host the main witherite orebodies. However, the strong correlation between the presence of barytocalcite and alstonite and limestone wall-rocks is persuasive evidence for a reaction between the carbonating fluids and the adjacent wall-rocks. Leaching of the wall-rock during the final stages of mineralization may thus have provided the calcium ions necessary for the formation of these minerals (Young, 1985c). The great abundance of barytocalcite as a replacement of limestone, as appears to be the case in parts of the Blagill deposit, suggests that conditions locally favoured the formation of barytocalcite rather than witherite.

Young (1993) described and figured a specimen from the Blagill dumps in which barytocalcite clearly forms large tabular pseudomorphs, presumably after primary barite, in recrystallized and ankeritized limestone. There is thus evidence that some barite may have originally been deposited as a component of the replacement flats at Blagill. The hydrothermal event which converted large volumes of barite to witherite throughout the orefield may, at least locally, have effected the conversion of some of this barite to barytocalcite.

Supergene alteration at Blagill has produced an abundance of barite which locally pseudomorphs barytocalcite.

Conclusions

Blagill Mine, the type locality for the rare mineral barytocalcite, has provided numerous fine crystallized specimens of this mineral. The site remains the world's most accessible and most prolific source of specimens of this unusual mineral. Although no mineralization is exposed *in situ* today, the mine spoil-heaps contain abundant mineralized veinstone in which barytocalcite and its relationship to associated minerals may be studied in the context of barium carbonate mineralization in the outer zones of the Northern Pennine Orefield.

[References](#)