Fallowfield Mine, Northumberland

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Introduction

Fallowfield Mine is one of the largest of the small group of mines which worked a number of veins on the north side of the Tyne Valley. The mine lies immediately north of the village of Acomb. Like the deposits worked at Settlingstones Mine, near Haydon Bridge (see GCR site report, this chapter), the vein worked at Fallowfield is hosted by Carboniferous rocks which structurally form part of the Northumberland Trough (see (Figure 3.1)). The Fallowfield Vein, in common with the Settlingstones Vein and other veins in this area, is generally regarded as comprising one of the northernmost worked deposits of the Northern Pennine Orefield. Fallowfield Vein strikes approximately north-east-south-west, cutting Upper Carboniferous (Namurian) rocks, mainly sandstones and mudstones. The mine workings have proved the vein into the Lower Carboniferous (Dinantian) beds beneath the Four Fathom Limestone. Prior to 1846 coal was raised at Fallowfield Mine from the Little Limestone Coal (Namurian), and parts of the workings were connected with those of the nearby Acomb Colliery.

Mining at Fallowfield is known to date from as early as 1611 (Smith, 1923). Workings, accessed by a number of shafts, extended for at least 2 km along the vein. Detailed descriptions of the mine's geology and mineralization have been presented by Wray (in Wilson *et al.,* 1922), Smith (1923), and Dunham (1948, 1990). Fallowfield was originally worked as a lead mine up to 1846. In that year mining for witherite, which was an abundant gangue mineral here, began and continued until the closure of the mine in 1912. Production figures are incomplete, but Dunham (1990) recorded a total of 11 196 tons of lead concentrates for the period 1848–1907, and suggests that the mine's total output of witherite amounted to around 105 000 tons.

In addition to the abundance of witherite, a remarkable feature of the vein was the abundance of alstonite in association with witherite. Fallowfield shares with Brownley Hill Mine, near Alston, the distinction of being the type location for this rare species (Young, 1985c). Magnificent specimens of alstonite, commonly associated with beautiful crystals of witherite, from Fallowfield Mine are to be seen in major mineralogical collections throughout the world.

Although all underground workings have long been inaccessible, and despite the absence of any surface outcrop of the vein, the site remains of importance for the local abundance within several spoil-heaps of specimens of alstonite, locally in association with other vein minerals.

Description

Fallowfield Vein has been worked from a number of shafts along a strike length of over 2 km. Smith (1923) noted that the Fallowfield Vein maintained a width of 6.1 m throughout much of the mine, although in places this increased to over 12 m. The vein filling consisted mainly of witherite with smaller amounts of barite, galena, alstonite, calcite and rarely a little sphalerite.

Witherite occurred as ribs up to 1.8 m wide, containing up to 70% barium carbonate (Dunham, 1990). The mine was, after Settlingstones Mine, one of the region's most important commercial sources of this mineral. It also yielded, during its long working life, some of the finest specimens of crystallized witherite known. Examples of these, often highly distinctive, white pseudohexagonal pyramids are to be seen in major mineralogical collections throughout the world. Rounded, nodular masses, typically with an internal radiating crystalline structure, were also common. Examples of all of these morphologies are present on the spoil heaps but do not compare with the superb specimens collected when the mine was working.

Alstonite was an important constituent of the vein and Fallowfield is, jointly with Brownley Hill Mine, near Alston, the type locality for this rare species. Alstonite is the orthorhombic trimorph of barium calcium carbonate ($BaCa(CO_3)_2$). The monoclinic trimorph, barytocalcite, which also has its type locality in the Northern Pennines, occurs more widely within the orefield (Young, 1985c). Paralstonite, the trigonal trimorph, has been found for the first time in Great Britain at Dolyhir Quarry, Wales (see GCR site report, Chapter 5).

Specimens of the mineral which was to become known as 'alstonite' were first described by Johnston (1835, 1837), and Thomson (1835), from specimens collected at both Fallowfield Mine and Brownley Hill. Although regarded in these early descriptions as a form of barytocalcite, which had first been described several years previously (Brooke, 1824), the separate identity of this mineral was recognized by Thomson (1837), who proposed the name 'bromJite', apparently based on a mis-spelling of Brownley Hill. The name 'alstonite' was introduced by Breithaupt (1841) and soon became the accepted name despite the apparent priority of Thomson's name bromlite'.

Alstonite occurs most commonly as highly distinctive acute pseudohexagonal pyramidal or bipyramidal crystals which generally exhibit horizontal striations on the pyramid faces. A vertical medial re-entrant line is commonly seen on these. Euhedral crystals up to 5 mm long are common in vugs in crystalline alstonite, or encrusting witherite or other vein minerals. Crystalline alstonite, with a rather sugary texture, commonly forms pure, or almost pure, masses up to 10 cm across at Fallowfield. The mineral is most commonly colourless or white with a vitreous lustre. More rarely alstonite exhibits a delicate rose-pink colour. Palache *et al.* (1951) noted that this colour fades on exposure to light. Magnificent specimens of crystallized alstonite, commonly associated with distinctive pseudohexagonal pyramidal or prismatic crystals of witherite, are to be seen in many mineralogical collections (Symes and Young, 2008). Alstonite is today known from a handful of other locations within the Northern Pennines and has been reported in small quantities from South Wales (Alabaster, 1990; see Mwyndy Mine GCR site report, Chapter 5) and in the Welsh Borderland, at the Dolyhir Quarry GCR site. Elsewhere in the world it remains a great rarity.

Smith (1923), Hancox (1934), and Dunham (1948, 1990) all referred to the presence of barytocalcite at Fallowfield Mine, although Young (1985c) was unable to confirm this, and no undoubted specimens from this site are known.

Although the underground workings of Fallowfield Mine are totally inaccessible and there are no surface exposures of the vein, spoil heaps which remain adjacent to several of the shafts contain representative specimens of the vein minerals, including alstonite. Many of these heaps lie within a partially landscaped caravan park, although a few lie within adjoining agricultural land. Most of the spoil heaps are today rather overgrown.

Interpretation

Fallowfield Vein occurs within Carboniferous rocks in the southern portion of the Northumberland Trough. Although it therefore does not lie structurally within the Alston Block, from its form and mineralogy it is generally regarded, along with other veins in the Hexham–Haydon Bridge area, as comprising the northernmost expression of the Northern Pennine Orefield. Like all other veins in this northern area the Fallowfield Vein lies within the outer, barium-rich, zone of the orefield.

The possibility of mineralization in the Tyne Valley being related to the Stublick Fault Zone has been discussed briefly in the Settlingstones Mine GCR site report (this chapter).

The Northern Pennine Orefield is unique in the world for the abundance, within this outer zone, of barium carbonate minerals. Fallowfield Vein contained large concentrations of these otherwise rare minerals, and, as has been noted above, was one of the field's major commercial producers of witherite, as well as a celebrated source of fine mineralogical specimens of both this species and alstonite. The double carbonates of barium and calcium, barytocalcite and alstonite, are also locally abundant within this outer zone, although the reasons for their local abundance here and extreme rarity elsewhere in the world have not been satisfactorily explained (Young, 1985c).

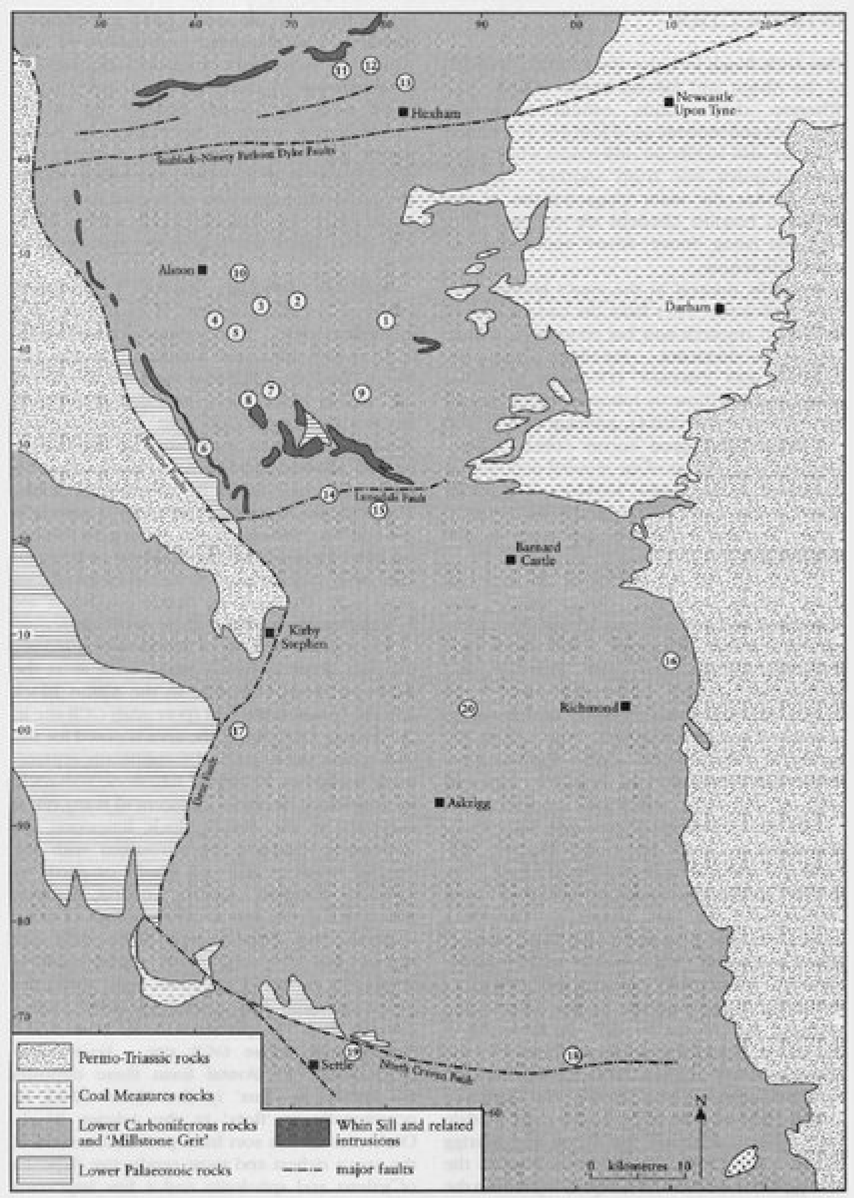
In a study of the distribution and relationships of barium carbonate minerals within the orefield, Young (1985c) showed that both alstonite and barytocalcite usually occur in deposits in which witherite is also present. In most instances the double carbonates comprise relatively minor proportions of the assemblage, although locally barytocalcite appears to be the most abundant barium mineral. In the comparatively few localities at which alstonite has been found it is always a minor, and generally inconspicuous, member of the assemblage. In his review Young (1985c) demonstrated that alstonite and barytocalcite almost invariably occur in deposits hosted by limestone wall-rock, and that crystallization of the double carbonate mineral usually post-dated that of witherite. Examination of numerous specimens of witherite with alstonite from Fallowfield reveals that here too formation of the double carbonate, alstonite, typically post-dated crystallization 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. That the lithology of the wall-rocks in general exercised little influence on the formation and deposition of witherite is dear 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 orebodies at Fallowfield typically occurred where limestone formed at least one wall of the vein. The reasons for the crystallization of the double barium calcium carbonate as alstonite in preference to barytocalcite has yet to be explained, although Young (1985c) has suggested that temperature may be a major factor.

Conclusions

Fallowfield Mine, the joint type locality for the very rare mineral alstonite, has provided numerous beautifully crystallized specimens of alstonite and witherite. Despite the inaccessibility of the underground workings and the absence of exposures of mineralization, the site comprises the world's most accessible and prolific source of alstonite. The remaining spoil-heaps contain veinstone in which alstonite and its relationship to other minerals may be studied in the context of barium carbonate mineralization in the outer zones of the Northern Pennine Orefield.

References



(Figure 3.1) Geological sketch map with locations of GCR sites. 1– West Rigg Opencut; 2 – Killhope Head; 3 – Smallcleugh Mine; 4 – Tynebottom Mine; 5 – Sir John's Mine; 6– Scordale Mines; 7 – Lady's Rake Mine; 8 – Willyhole Mine; 9 – Pike Law Mines; 10 – Blagill Mine; 11 – Settlingstones Mine; 12 – Stonecroft Mine; 13 – Fallowfield Mine; 14 – Closehouse Mine; 15 – Foster's Hush; 16 – Black Scar; 17 – Cumpston Hill North and South Veins; 18 – Greenhow (Duck Street) Quarry; 19 – Pikedaw Calamine and Copper Mines; 20 – Gunnerside Gill.