Long Comb, Cumbria

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Introduction

A NNE–SSW-trending quartz vein, usually known as 'Scar Crag Vein', crops out on the east side of Long Comb, between Sail and Scar Crags above the head of Coledale. The vein is unusual in the Lake District in carrying abundant apatite and arsenopyrite together with small amounts of cobalt minerals. The presence of cobalt led to several trial workings on it in the 19th century, although none was successful.

According to Adams (1988) the first trial workings, in search of cobalt ore, were made in about 1848. Dressing floors and a smelter were built at Stoneycroft, about 3 km to the east in the Vale of Newlands, to process the ore. The initial optimism was not rewarded and the venture seems to have been a spectacular failure with little, if any, cobalt recovered from the workings (Postlethwaite, 1913; Adams, 1988).

Despite the failure to prove workable cobalt ores the vein has attracted considerable mineralogical interest. Descriptions of the minerals include those by Davidson and Thomson, (1948), Kingsbury and Hartley (1957a), Strens (1962), Stanley (1979), Ixer *et al.* (1979), Stanley and Vaughan (1982a), and Young (1987a, 1988). Aspects of the local geology and its relevance to the origins of mineralization in this part of the Lake District have been the subject of investigations by D.C. Cooper *et al.* (1988).

Description

The Scar Crag Vein occupies a NNE–SSW-trending fault of very small throw which cuts slates assigned to the Kirk Stile Slates of the Ordovician Skiddaw Group. The bleached and locally iron-stained slates, originally described by Eastwood *et al.* (1931) as the 'Blake Fell Mudstone', are within the broad area of hydrothermal alteration known today as the 'Crummock Water thermal aureole' (Cooper, D.C. *et al.,* 1988). The vein forms a small gully which may be traced for approximately 150 m along the foot of the crags above the footpath through Long Comb. According to Postlethwaite (1913) four levels were driven on the vein, although Adams (1988) commented that only three could then be located. The vein is well exposed above the portals of these levels. In these exposures it is up to 1.5 m wide, and composed of several parallel bands, each up to about 0.5 m wide, of massive quartz with abundant chlorite. Within these occur local concentrations of arsenopyrite, much of which has been weathered to cellular masses of pale-green to brown scorodite. Dark-red hematite staining is common along fractures and joints. Abundant spoil from the levels shows conspicuous concentrations of white to pale-cream apatite prisms up to 5 mm in diameter embedded in quartz and chlorite. In addition to the small surface exposures of the vein, good sections may be examined underground in the small stope accessible a few metres inside the upper level of the mine.

In a detailed study of the ore mineralogy, Ixer *et al.* (1979) recorded a suite of cobalt minerals including glaucodot, skutterudite, cobaltite and alloclase, recorded here for the first time from a British locality. All are present as minute grains or as overgrowths on arsenopyrite. Other metalliferous minerals recorded by these authors include small quantities of marcasite, pyrite, native bismuth, bismuthinite and molybdenite. Ixer *et al.* (1979) also noted the presence of tourmaline and rutile as early members of the paragenesis. Much, if not all, of the smaltite reported by Postlethwaite (1913) may be skutterudite. The presence of 1011ingite, claimed by Sirens (1962), and Kingsbury and Hartley (1957a), and scheelite, suggested by Kingsbury and Hartley (1957a), has not been substantiated by the more-recent studies.

Young (1988) described the occurrence of wavellite and variscite in the Scar Crag Vein. These minerals are sparingly present coating joint-surfaces in a quartz rib on the western side of the vein in the small stope in the upper level of the mine. Wavelike occurs here as colourless to white acicular crystals forming flat spherulitic aggregates up to 10 mm across, and very rarely as small hemispherical spherules up to 2 mm across. Variscite typically forms bright turquoise-blue to green crystalline coatings and minute botryoidal aggregates up to 1.5 mm thick on quartz.

Scorodite is the most abundant supergene mineral at the site. Erythrite, reported by Postlethwaite (1913), and Davidson and Thomson (1948), appears to be very rare. Kingsbury and Hartley (1957c) found that much of the pink material which superficially resembles erythrite proved to be either pink scorodite or altered apatite.

Ryback *et al.* (2001) have demonstrated that the late A.W.G. Kingsbury falsified the localities of numerous rare mineral species, including many from the Lake District. Although no conclusive proof has been established of deception relating to specimens from this site, great care should be exercised when considering claims by Kingsbury which have not been substantiated or duplicated by subsequent collectors. Particular caution should be applied to Kingsbury and Hartley's (1957a) claim of childrenite and scheelite from Long Comb, which must now be considered unlikely.

Interpretation

Ixer *et al.* (1979) presented a detailed paragenetic sequence for the component minerals of the Scar Crag Vein. In their discussion of the formation of this mineralization they suggested that arsenopyrite here may be employed as a geothermometer. They concluded that the early sulpharsenide assemblage, including arsenopyrite, glaucodot and alloclase, formed at temperatures within the range 350°–400°C, with later ore minerals such as pyrite deposited at around 300°C.

Ixer *et al*. (1979) suggested that the Scar Crag mineralization could be related to a concealed granitic intrusion beneath the Causey Pike area. Stanley and Vaughan (1982a) assigned a Lower Devonian age to the Scar Crag Vein.

The bleaching and spotting of the Skiddaw Group rocks in this area, to which Eastwood *et al.* (1931) applied the term 'Blake Fell Mudstone', are now interpreted as forming part of the Crummock Water thermal aureole, an elongate zone of intense hydrothermal alteration overlying a postulated granitic body (Cooper, D.C. *et al.,* 1988). Within this zone the bleached rocks exhibit significant depletion in several elements including Cl, Ni, S, Zn, Cu, Fe, Li and Mn, together with net additions of such elements as As, B, K, Rb, Ca, F and Si. The zone is veined by numerous tourmaline veins (Fortey and Cooper, 1986). The age of this metasomatism has been dated at 401 ± 3 Ma (Cooper, D.C. *et al* 1988).

Apatite-chlorite-quartz veins, very similar to that at Scar Crag, although without sulphides, occur in Ennerdale at Brown How (Clark, 1963) and Crag Fell (Young, 1987a). The presence of albite in some of these veins suggests a pegmatitic origin. The relatively high temperatures for deposition of early ore minerals in the Scar Crag Vein may be consistent with such an origin. It is conceivable that this very distinctive style of mineralization may be genetically related to either the late stages of the Ennerdale Intrusion or the metasomatism within the Crummock Water thermal aureole.

The development of supergene minerals within the Scar Crag Vein is almost certainly related to geologically recent weathering.

Conclusions

The quartz-chlorite-apatite-ore mineral assemblage within the Scar Crag Vein appears to be unique in the Lake District, and possibly in Britain. The relative abundance within it of a variety of cobalt sulpharsenides, together with its situation within the Crummock Water thermal aureole offers considerable scope for further research.

References