Sir John's Mine, Cumbria

[NY 762 378]

Introduction

Sir John's Mine is a long-abandoned small lead mine situated on the right (east) bank of the River South Tyne at Tynehead, approximately 4 km south-east of the village of Garrigill, Cumbria. Originally developed, from three adit-levels, to attempt to work lead ore from the Sir John's Vein, the working progressed southeastwards, eventually cutting the Great Sulphur Vein, one of the major mineralized structures of Alston Moor.

Few details of the mine's history are known, although Dunham (1990) recorded a modest output of lead concentrates for the period 1850–1859. The mine was re-opened in 1941, during World War II, in an unsuccessful attempt to locate workable deposits of pyrite in the Great Sulphur Vein. Since then the mine has lain idle. The underground workings are no longer accessible, although the modest dumps contain significant amounts of veinstone characteristic of the Great Sulphur Vein.

Description

At Sir John's Mine, the cyclothemic sequence of limestones, sandstones and shales belonging to the Lower Carboniferous Alston Group is cut by the Sir John's Vein. This forms part of a prominent NW–SE-trending fracture that extends for many kilometres south-eastwards from the area north-west of Alston, through the South Tyne Valley and into Teesdale. Within the rectilinear pattern of fractures of the Alston Block, faults with this trend are generally referred to as 'cross veins'. Whereas in much of the Northern Pennines these important fractures are characteristically unmineralized or only weakly so, in parts of Alston Moor, including the South Tyne Valley, some of these fractures carry workable lead, zinc and local copper mineralization.

At Sir John's Mine three adit-levels were driven to explore the Sir John's Vein. Little is known in detail of the vein contents here, although Dunham's (1990) record of an output of 158 tons of lead concentrates for the period 1850–1859 confirms the presence of galena. There are no surface exposures of Sir John's Vein here today, and all underground workings at the mine are inaccessible. However, from material remaining on the spoil heaps, and by comparison with other nearby workings, it may be supposed that galena was accompanied by quartz and ankerite, with some fluorite and perhaps a little chalcopyrite.

As underground workings followed the Sir John's Vein south-eastwards they intersected the Great Sulphur Vein, approximately 400 m south-east of the entrance of the lowest level. The Great Sulphur Vein is one of the major mineralized structures of the Alston Block, known to 19th century lead miners as 'The Backbone of the Earth' (Thompson, 1933; Dunham, 1990). In detail it is a complex structure comprising a N-facing monoclinal flexure with, for a significant part of its 9 miles (14 km) strike length, a strong shear belt on its northern side. At present levels of exposure in the South Tyne Valley it is seen to decrease in width downwards. It attains its greatest width, of over 365 m, on Noonstones Hill [NY 749 381], a little over 1 km to the west of Sir John's Mine. Over much of its course the main vein mineral is quartz, commonly present as a replacement of limestone, shale and sandstone clasts, although pure bands of white quartz are locally conspicuous. At lower structural levels, at the horizon of the Tynebottom Limestone at Sir John's Mine, there appears to be a more-or-less continuous zone of sulphides comprising mainly pyrrhotite, pyrite, marcasite and minor amounts of chalcopyrite. Galena and sphalerite are conspicuously scarce or absent from most parts of the vein and, although tried at numerous localities, including Sir John's Mine, the vein has yielded little or nothing of economic value. World War II attempts to locate workable pyrite reserves at Sir John's Mine for sulphur manufacture proved fruitless. Dunham (1990) also recorded a wholly abortive attempt to recover gold from the vein at Sir John's Mine.

The structural relationships of the Great Sulphur Vein to other veins within the orefield are unclear. Despite being able to examine the intersection of the Great Sulphur Vein with Sir John's Vein during the 1941 re-opening of Sir John's Mine, Dunham (1990) concluded that whereas the Great Sulphur Vein appears to displace Sir John's Vein, other detailed evidence exposed in the workings suggest that the north wall of the Great Sulphur Vein is in fact displaced by Sir John's Vein. Dunham (1990) provided details of the mineralization within the vein exposed in 1941 in the underground workings at Sir John's Mine. A northern part consisted of a sheared breccia of highly silicified shale fragments. He interpreted a southern part as a replacement of the Tynebottom Limestone, here 20 m thick and dipping north at 40°, composed of quartz and iron sulphides. The Whin Sill, lying immediately beneath the Tynebottom Limestone was seen to be altered to 'white whin' with pyrite in the uppermost 1.8 m.

As already noted, none of the underground workings at this site remain accessible today. However, substantial amounts of quartz veinstone containing an abundance of pyrrhotite, pyrite and marcasite, derived from the Great Sulphur Vein, dominate the material remaining on the dumps at Sir John's Mine. These give useful opportunities to examine and interpret the sulphide-rich facies of the Great Sulphur Vein. In addition to exhibiting complex interrelationships between the iron sulphides, this veinstone is also noteworthy for the presence of small amounts of chalcopyrite, together with a local abundance of tiny acicular crystals of bismuthinite disseminated through quartz (Ixer *et al.,* 1996). Small amounts of native copper identified in this veinstone were assumed by Bridges and Young (1998) to be of supergene origin. However, in view of the apparent absence of evidence of supergene alteration in this rather fresh-looking veinstone, a primary origin for the native copper cannot be ruled out.

Interpretation

From its structural nature, great width and mineralization dominated by quartz and iron sulphides, the Great Sulphur Vein was long regarded as unique amongst the veins of the Northern Pennines. However, in underground workings at Cambokeels fluorspar mine in Weardale [NY 935 383], mineralization in the Slitt Vein, one of the main Quarter Point veins of the orefield, was found to pass downwards into a zone dominated by quartz and iron sulphides almost identical to that found in lower parts of the Great Sulphur Vein. It is noteworthy that the Great Sulphur Vein shares the same WNW–ESE trend as the main Quarter Point veins of the orefield. Exactly similar pyrrhotite-bearing quartz veins were encountered within the Weardale Granite in the Rookhope Borehole. It seems probable that the major fluorite-bearing veins of the orefield may pass downwards into a facies of mineralization similar to that of the Great Sulphur Vein (Dunham, 1990). This vein may therefore be a manifestation of the 'root' zone of a major Quarter Point vein, the uppermost zones of which have been removed by erosion.

The presence of abundant pyrrhotite, accompanied by comparatively common chalcopyrite and concentrations of bismuthinite, might reasonably be interpreted as evidence for these mineral assemblages having crystallized at higher temperatures than those known for most of the fluorite-bearing veins of the orefield. Similar mineral assemblages in the Rookhope area of Weardale have been suggested as supporting evidence for an emanative centre of mineralization above the roof zone of the Weardale Granite (Dunham, 1990). Those in the Great Sulphur Vein at Sir John's Mine and elsewhere in the South Tyne Valley appear to occupy an analogous position above the roof of the supposed lynehead Pluton of the North Pennine Batholith. If so, the mineral assemblages seen at Sir John's Mine may be evidence of an emanative centre of mineralization above this portion of the batholith.

Conclusions

The spoil heaps at Sir John's Mine provide a unique opportunity to examine sulphide-rich veinstone from the deeper levels of the Great Sulphur Vein. These may give important insights into the nature of mineralization at depths not normally seen within the Northern Pennine orefield, and may therefore offer important opportunities for further investigation into the origins of this orefield.

References