Tynebottom Mine, Cumbria

[NY 739 418]

Introduction

Tynebottom Mine is a comparatively small mine which is known to have been worked for lead between 1771 and 1873. The recorded total production of lead concentrates amounts to 11 529 tons (Dunham, 1990).

The mine was developed at the intersection of the ENE–WSW-trending Dryburn Washpool–Browngill Vein, one of the main feeder channels of mineralization in Alston Moor, with a roughly NW–SE-trending vein known as Windshaw Bridge Vein'. At Tynebottom these lead ore-shoots were present in both of these veins and in metasomatic replacement flats associated with them in the Tynebottom Limestone (Dinantian).

The mineralogy of the Tynebottom deposits has attracted much research interest. Erythrite has long been known to be common at Tynebottom (Dunham, 1931), although the source of the necessary cobalt and arsenic within the primary assemblage has more recently been explained by the work of Ixer *et al.* (1979). Further works by Vaughan and Ixer (1980), and Ixer (1986) have added much to the understanding of the ore mineralogy of the deposit. It is almost certain that the unique assemblage of silver minerals, described by Ixer and Stanley (1987) on the basis of specimens in the A.W.G. Kingsbury collection now held by the Natural History Musuem, London, did not originate at Tynebottom Mine, an error quite unknown to these authors at the time of their investigation.

The mine is a notable locality for a variety of unusual supergene minerals (Braithwaite, 1982; Bridges, 1987; Bridges and Young, 1998). Well-developed calcite crystals, in a variety of crystal habits, obtained from Tynebottom Mine may be seen in numerous major mineralogical collections.

Description

Extensive sections of the veins and associated flat deposits are accessible via two adits driven into the deposits from the south bank of the River Tyne (Figure 3.5). In addition, good representative specimens of mineralized material are present in abundance on the adjacent spoil-heaps.

Tynebottom Mine was developed near the intersection of the Dryburn Washpool–Browngill and Windshaw Bridge veins where they cut the Tynebottom Limestone (Dinantian). Associated with both veins were extensive metasomatic replacement flats within the limestone. Dunham (1990) recorded that the flats extended for a distance of at least 244 m along the Dryburn Washpool–Browngill Vein, and for a similar distance along the Windshaw Bridge Vein, west of its intersection with the latter vein. The flats are said to have averaged about 6 m in width but to have increased to as much as 15 m wide near the intersection of the two veins. The accessible underground workings at Tynebottom provide extensive sections through unworked portions of the flats, and in places the veins. The extent of these workings gives a very clear impression of the form and extent of the payable mineralization. Wallace (1861) suggested that workings were restricted to portions of the flats in which economically recoverable lead ore concentrations were found. The full extent of the metasomatic alteration, and hence the true extent of the flats, may be considerably greater. Trials of the veins in the Whin Sill, which lies at a shallow depth beneath the Tynebottom Limestone, found only carbonates (Dunham, 1990).

Within the Tynebottom flats the limestone has typically been replaced by fine-grained quartz and chalcedony, producing a very hard, dark-grey, siliceous rock in which occur disseminated crystals of galena, marcasite and pyrite. Numerous vugs within the flats are lined with quartz, calcite, and ankerite and in places purple fluorite (Dunham, 1990). Ixer *et al.* (1979) reported small amounts of glaucodot associated with arsenical marcasite. Vaughan and Ixer (1980) identified the ore minerals as pyrite, marcasite, galena and sphalerite, with minor amounts of glaucodot, gersdorffite, chalcopyrite, pyrrhotite and ullmanite. A re-investigation of specimens described by Ixer *et al.* (1979) has revealed the presence within the quartz of traces of the rare earth mineral synchysite (Ixer and Stanley, 1987).

Ixer and Stanley (1987) described a remarkable assemblage of silver minerals including argentopyrite, sternbergite, pyrargyrite, stephanite and acanthite associated with chloanthite, rammelsbergite, saffiorite, löllingite, skutterudite, niccolite, gersdorffite and cobaltite in specimens claimed to have originated at Tynebottom Mine in the A.W.G. Kingsbury collection, now held by the Natural History Musuem, London. Recent investigations of this collection have shown that many of the claimed localities are demonstrably false, and very serious doubt has been cast on the veracity of many others (Ryback *et* al., 2001). In the light of this, and in view of the general dissimilarity between the associated minerals in these specimens with those in the known assemblages at Tynebottom Mine, it is almost certain that these specimens are incorrectly provenanced in the collection. Similar doubt may also be cast on the Kingsbury specimens which contain skutterudite and cobaltite, described by Ixer (1986). The false provenance of these specimens was unknown to these authors at the time of their research.

The Drybum Washpool–Browngill Vein is well exposed in the Tynebottom Limestone in the bed of the River Tyne, approximately 168 m east of Tynebottom Mine. The vein here carries abundant galena and marcasite; the limestone is replaced by fine-grained silica with disseminated sulphides (Dunham, 1990).

Supergene, possibly mainly post-mining, alteration of the ores at Tynebottom has produced a variety of unusual supergene minerals within the workings. Perhaps best known and most conspicuous are the crusts of erythrite which locally coat sulphide-rich portions of the workings. Erythrite is also common as inclusions, giving a distinct rose-pink colour to calcite stalactites and flowstone (Dunham, 1948). It is worth noting that fine specimens of this material in numerous mineral collections are incorrectly labelled as 'cobaltocalcite'. Small amounts of copper sulphides within the ore contribute to the formation of crusts of deep-green brochantite and blue-green devilline and wroewolfeite, which are locally common in the workings (Braithwaite, 1982; Bridges, 1987; Bridges and Young, 1998). The presence of a little zinc is revealed by snow-white crusts of hydrozincite and, very locally, small amounts of serpierite (Bridges, 1987). Bridges and Young (1998) have also recorded beudantite from this mine. Most recently, Green *et al.* (2003) have described the presence of symplesite and parasymplesite (both iron arsenates) from Tynebottom Mine.

Interpretation

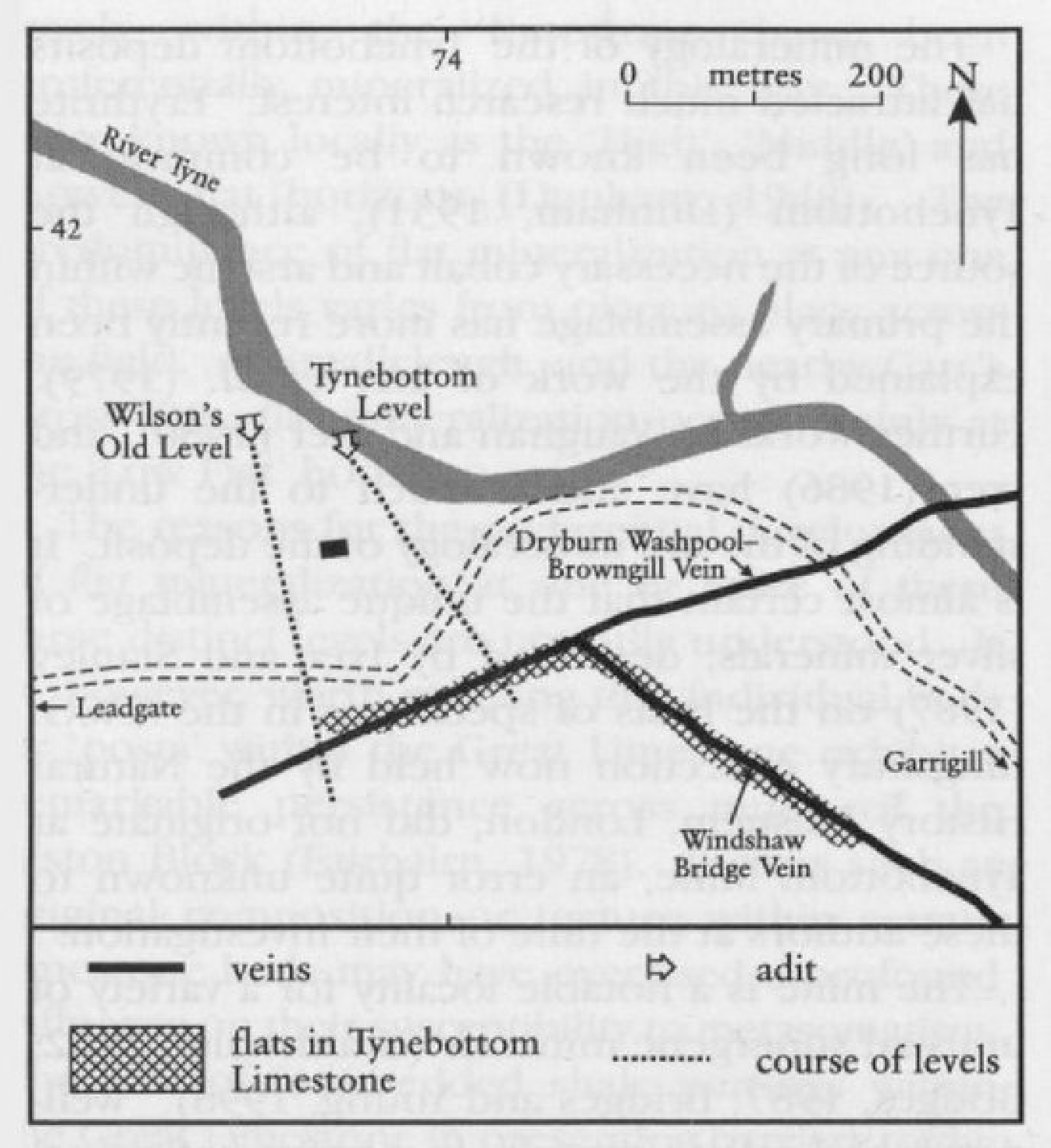
Dunham (1990) has suggested that the Dryburn Washpool–Browngill Vein is one of the principal channels of mineralization in the Alston Moor area. At its intersection with the Windshaw Bridge Vein, mineralization has taken the form of extensive metasomatic replacement of the Tynebottom Limestone. Replacement here has been dominated by the introduction of abundant silica. In this respect the mineralization at Tynebottom closely resembles that in the flats, formerly worked and now inaccessible, at the nearby Rotherhope Fell Mine (Dunham, 1990). The highly siliceous nature of the flats at these localities is rather unusual in the Northern Pennines, where replacement of limestone by carbonate minerals, most commonly ankerite and/or siderite, is more normal.

The deposits of the upper Tyne Valley, of which those at Tynebottom Mine form part, exhibit features characteristic of the central parts of the fluorite zone of the Northern Pennine Orefield, including the abundance of quartz and higher than normal concentrations of chalcopyrite (Dunham, 1990). This mineralogical composition is consistent with the presence beneath this area of the Tynehead cupola on the concealed Weardale Granite (Brown *et al.,* 1987). Ixer and Stanley (1987) regarded synchysite, found in quartz at Tynebottom and elsewhere in the Alston Block, as part of the earliest high-temperature mineralization of the area. The work of Vaughan and Ixer (1980), which suggests formation temperatures of around 235°C for the sulphide assemblages at Tynebottom, also lends support to an area of higher-temperature mineralization in this area. The influence on the mineralization of the Whin Sill, which underlies the deposits exposed in Tynebottom Mine at shallow depth, has been considered by Ixer and Stanley (1987), although these authors concluded that from the available mineralogical evidence its role remains enigmatic.

Conclusions

Tynebottom Mine provides excellent opportunities to study the relationships of metasomatic replacement deposits to the parent veins. Sulphide mineral assemblages have been the subject of important work on the genesis of the orefield and much scope remains for further research. The site is important for the suite of unusual supergene species, which also offers significant research potential. Whereas the major features of the Tynebottom deposits and their constituent minerals are well exposed in the abandoned underground workings, representative specimens showing many important mineralogical and textural features may also be found on the spoil heaps.

References



(Figure 3.5) Sketch map showing main veins and associated flats at the Tynebottom Mine GCR site.