Huglith Mine, Shropshire

[SJ 405 016]

Introduction

Huglith Mine [SJ 403 015]–[SJ 407 016] lies within the West Shropshire Orefield in the Shelve–Habberley district (Dines, 1959), approximately 2 km south of Habberley (see (Figure 4.35)) for location and geological map). The mineral deposits in this region are hosted by two geologically diverse districts either side of the Pontesford Fault (Pattrick and Bowel, 1991), also known as the 'Habberley Fault', which defines the eastern margin of, and strikes parallel (NNE–SSW) with, the W-dipping Stiperstones Quartzite Formation (Arenig) ridge (Dines, 1959). The fault separates the Precambrian Ba-Cu region of the orefield from the Ordovician Pb-Zn-Ba region in the Shelve area to the west, although the western margin of the fault is actually composed of Shineton Shales Formation of Tremadoc (Cambrian) age. Huglith Mine lies to the east of the Pontesford Fault and is one of a number of mines that worked barite and copper ores from the Neoproterozoic Wentnor Group strata (Pattrick and Bowel, 1991) (see (Figure 4.35)). Barite and lead and zinc ores were mined from flags and shales of the Mytton Flags Formation (Arenig) of the Shelve Inlier to the west of the fault (Pattrick and Bowell, 1991).

Economically important barite and copper deposits were mined at Huglith episodically from the early 19th century until 1945, when the mine closed. Initially copper ores were worked at the site, but from the early 20th century barite was the principal ore; by 1936 the mine was producing over 20 000 tons of barite per year and was the largest mine of its kind in the county. The ore was 95% pure, the main impurity being silica. Records indicate that in total 295 108 tons of barite were produced from Huglith Mine before its closure in 1945.

There were originally two mines at Huglith, No. 1 and No. 2, but only No. 2 was developed significantly. The mine worked three major barite-rich veins that were up to 120 m in length and 2–6 m in width (Carruthers *et al.,* 1916). The veins were principally worked via stopes with associated shafts, the latter of which were sunk to depths of over 70 m in some cases.

Description

The geology of the Habberley area is summarized in (Figure 4.35). Two sets of faults are shown to trend east-west and ESE–WNW; both these fault sets are mineralized and have a predominantly horizontal movement. The veins occupying the faults are wide but show no evidence of brecciation, although more than one phase of barite deposition is indicated.

The exposed Bayston–Oakswood Formation strata that host the Huglith deposits dip easterly (Pocock *et al.,* 1938; Dines, 1959) and are buff-and grey-coloured coarse sandstones grading into sandy shales and mudstones. These units are interpreted to be of fluvial origin and are red or purple in colour, but in places are stained green or blue when in close proximity to the mineralized veins. This is due to the oxidation of secondary copper minerals within the vein. Some brown staining from hydrocarbon seeps is also evident.

The vein deposits typically comprise thickly banded pink, red and sometimes white barite which swells up to 6 m in thickness in places. The pink colouration of the barite is attributed to absorption of iron from the ferruginous Neoproterozoic strata (Dines, 1959). Traces of secondary copper minerals (in the form of chalcocite stringers and encrustations of azurite and malachite) and quartz with occasional calcite (Dines, 1959) are also evident in the vein infill. Pattrick and Bowel (1991) suggested that the banding observed in the Huglith barite deposits, and in the mineral deposits to the west of the Pontesford Fault, indicates that the mineralizing fluids were likely to have entered the region in a series of contemporaneous pulses, and that these controlled the development of the vein system in the West Shropshire Orefield. To this end, the same authors suggested that this could only have been achieved in a well-connected, open fault-fracture system.

The three principal veins worked at Huglith were the Main Vein (also known as 'No. 2 Vein'), the Riddleswood Vein and the Mud Vein, which occupy steep, S-dipping (70°) oblique-slip faults and generally trend ENE–WSW along bearings varying between 068° and 073°. The Main Vein occupies a fault that shows dextral (right-lateral) movement with a lateral displacement of some 300 m. To the west, mineralization in the Main Vein is truncated sub-surface by the Pontesford Fault, and to the east, the vein is observed to taper and eventually terminate along strike after approximately 800 m.

Much of the mined area is now forested, which makes navigation difficult; however, surface exposure of the workings around the Main Vein is still generally good, and parts of the Riddleswood Vein workings are also accessible. The line of the Main Vein can clearly be traced up Westcott Hill [SJ 406 014] along an ENE–WSW bearing, and there are many sections where the vein has been worked to the surface. Large stopes dominate the Main Vein workings up the hillside, and it is possible to observe the vertical extent of these down-dip of the fault planes. In places remnant patches of pink-white barite are evident on either side of the fault planes, as are stringers of unworked, heavily brecciated vein that appear to branch off at low angles to the Main Vein. Where the vein has been worked to great depths, 'arches' of barite have been left in place at higher levels; these structures can be seen bridging gaps between fault planes where the vein infill has been worked out. These were presumably left intact for stability reasons.

Dines (1958) also reported good exposures of the vein at the portals of the Adit Level and the Badger Level. The vein can be seen to split into several parts at an opencast area in front of the Adit Level; around this area, brecciated country rock between the branched vein is cross-cut by stringers of barite.

A cross-cut was driven northwards from the Main Vein to intersect the Riddleswood and Mud veins between the years 1932–1936. Between the Main Vein and Riddleswood Vein some 15 S-dipping stringers and veins of barite were intersected; these were up to 0.15 m thick in places. From Riddleswood Vein towards Mud Vein a further 14 stringers were crossed, all N-dipping.

Various underground surveys have been conducted at Huglith Mine in an attempt to investigate the remains of mining activities and sub-surface deposits. However, these surveys have been dependent on low water-levels for access to the underground workings, some of which have also suffered collapse. Striking azurite pearl strings have been observed within the adit levels and shafts associated with the Main Vein, and more spectacular remnants of the Huglith ore mineralization may be expected in the underground workings where erosion has not played such a significant part.

The remains of the Adit Level and Badger Level, together with various shafts (including the main shaft) and buildings (winding engine-house, compressor and boiler, metal chimney and smithy) associated with the mine works, can be seen at the base of Westcott Hill to the west of the exposed Main Vein. A Forestry Commission track lies just to the west of these features. North of this area a tramway entered the mine; this entrance is now a large open stope dipping at 70° south, towards the vein. Above the Adit Level the vein is stoped out to the surface, forming a gash in the wooded hillside, and above this the Badger Level can be reached farther up Westcott Hill, following the ENE trend of the vein. Above the Badger Level, large and dangerous open stopes have been used to work the vein up the hillside.

Various access points to the main underground workings via the east and south faces of Westcott Hill were also used when the mine was producing ore. To the north and north-east of the latter are the disused shafts (now commonly backfilled) and exposed stopes associated with the Riddleswood Vein, the line of which can similarly be followed up the hill along a ENE–WSW bearing. Today there is no apparent access to the Mud Vein workings, and, like many of the adit-level workings at Huglith, they are likely to be flooded. Further studies of the sub-surface mineralization at this site are consequently restricted by limited access to the underground mine-workings.

No workable or significant sulphide-bearing ores have been observed at Huglith Mine, but the mines to the west of the fault have yielded significant amounts of zinc and lead ores (principally sphalerite and galena) with patches and stringers of copper ore (chalcopyrite) at depth.

Interpretation

Various studies relating to the genesis of the West Shropshire Orefield have been undertaken over the years, the most widely accepted of which are those by Hall (1922), Dines (1959), and Pattrick and Bowell (1991). Few works discuss solely the genesis of the mineral deposits at Huglith Mine, but the latter authors provided a comprehensive review of the current models of the genesis for the entirety of the West Shropshire Orefield, which encompasses the many smaller mined districts either side of the Pontesford Fault. The work by Pattrick and Bowel (1991) incorporates evidence from fluid-inclusion studies, sulphur isotopic ratios and sphalerite chemistry to support the various hypotheses proposed in the review.

The findings of sulphur isotopic ratio studies using barite samples from Huglith Mine and from the west side of the Pontesford Fault led Pattrick and Bowell (1991) to conclude that the source of mineralizing fluids is the same for the entire West Shropshire Orefield. The vein and vein breccias that comprise the orefield in the region are best developed in the more competent strata of the Ordovician rocks on the west side of the fault, and this fact has been used to identify a paragenetic sequence for the mineralization in the region. Barite and galena tend to dominate at higher levels in the orebodies on the west side of the fault, and textural evidence from microscope studies conducted by Pattrick and Bowell (1991) has allowed the order of mineral precipitation to be deduced. Several initial stages of quartz, sphalerite and calcite precipitation are followed by a penultimate phase of galena, chalcopyrite and barite, and a final phase of barite precipitation. These latter phases are significant, as by deduction the Huglith barite and copper deposits can be assigned to a late stage in the formation of the West Shropshire Orefield.

Further characterization of the mineralizing fluids has been provided by the use of fluid-inclusion studies. Thermometric analysis of fluid inclusions in barite and calcite samples collected at Huglith Mine, as well as from several other localities either side of the Pontesford Fault, has indicated that the mineralizing fluids that sourced the West Shropshire Orefield were highly saline $CaCl_2$-rich brines, and contained $MgCl_2$ salts in addition to NaCl (Pattrick and Bowel, 1991). Homogenization temperatures yielded from barite inclusions indicate that precipitation occurred from comparatively low-temperature fluids, with an upper temperature limit of 120°C. Given the nature of mineralization in the region, Pattrick and Bowell (1991) inferred that precipitation of the barite deposits at Huglith Mine and on the west side of the Pontesford Fault occurred at shallow depth (< 1 km) under hydrostatic pressure.

Considering these data, an appropriate model for the precipitation of barite (and late calcite) at Huglith Mine and at other localities on the east side of the Pontesford Fault in the West Shropshire Orefield has been proposed by Pattrick and Bowell (1991) to involve the large-scale mixing of two separate fluids. The sulphate source for the barite is suggested to be an oxidized, sulphate-bearing low-salinity fluid in the upper regions of the vein system, which represented an overlying reservoir; several years previously Pattrick and Russell (1989) suggested that this may have been a type of early Carboniferous seawater derived from evaporitic margins. Pattrick and Bowell (1991) proposed that a late mixing event of the latter fluid with an earlier input of a rising, high-temperature, high-salinity, Ba-rich brine in the upper regions of a well-connected fracture-system (followed by subsequent cooling of the fluids) would explain the existence of barite in the uppermost reaches of the orefield, as at Huglith Mine. The lack of sulphide minerals in the Huglith Mine workings suggests that either sulphides may be present at greater depth or that the section of the fracture system beneath Huglith Mine only opened in the later stages of mineralization, when sulphide precipitation had ceased in other parts of the orefield.

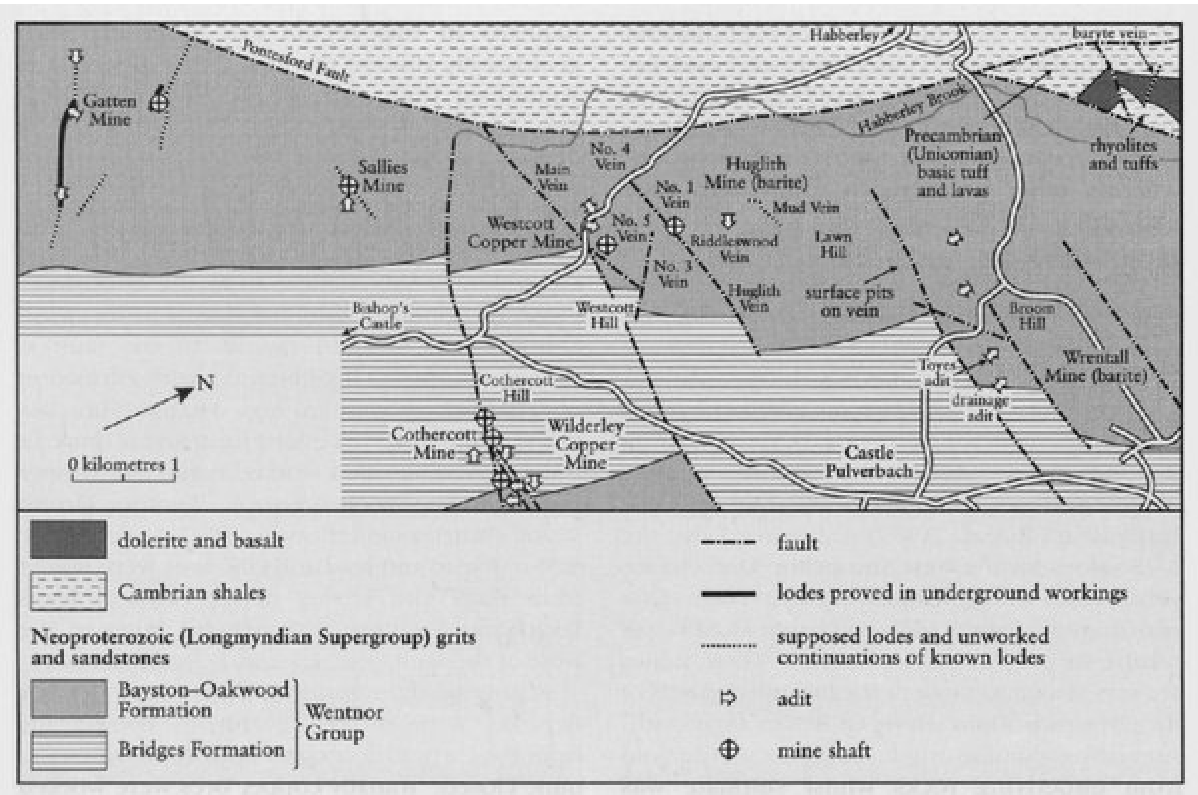
Hall (1922) suggested that the copper ores commonly associated with the barite veins may be the result of alteration at depth of a primary ore, and noted the widespread distribution of secondary copper ores that occur between the Stiperstones Ridge and Longmynd area. Murchison (1839) regarded these deposits as having emanated from 'trap rocks' (igneous rocks) in the area prior to secondary alteration. Pocock *et al.* (1938) also suggested that the copper minerals present at Huglith Mine are the result of secondary alteration, and not primary vein infills *in situ.* Their presence has led to suggestions that significant Cu-sulphides exist at depth (Dines, 1959), and this hypothesis is further supported by the inferred presence of late high-salinity Cu-rich fluids to the west of the Pontesford Fault (Pattrick and Bowell, 1991).

The age of mineralization at Huglith Mine, as for the entirety of the West Shropshire Orefield, is constrained by fault movements and intrusive rocks, which place the mineralizing event between the early Devonian and the Westphalian (Dines, 1959; Ineson and Mitchell, 1975). Radiometric dating (Ineson and Mitchell, 1975), together with other characteristics, have led to the interpretation that the orefield is one of a number of Lower Carboniferous Pb and Zn vein systems hosted by Palaeozoic or older rocks of the British Isles (Russell, 1972, 1976; Pattrick and Russell, 1989), and is contemporary with the carbonate-hosted stratiform base-metal mineralization in central Ireland, also thought to have been formed in response to Dinantian extensional tectonics (Boyce *et al.,* 1983). These deposits are classified as being of the Mississippi Valley-type. An extensional regime would encourage fluid migration, where reactivated Caledonian faults would have provided conduits through which hydrothermal fluids could flow. The Pontesford Fault is interpreted either as part of the Church Stretton Fault System (Smith, 1987) or part of the Pontesford Lineament, a structure that has controlled the geological development of the region from mid-Ordovician to Triassic times (Woodcock, 1984), and would have provided an ideal network of channels for fluid flow.

Conclusions

Huglith Mine is renowned for the economically significant barite deposits that were once mined there. Studies of the associated mineralization and of the surrounding district have aided greatly in unravelling the true genesis of the deposits and in identifying their close association with the westerly region of the West Shropshire Orefield. The barite mineralization at Huglith Mine almost certainly succeeds the sulphide mineralization at Shelve to the west of the Pontesford Fault, and as at other localities within the orefield, the barite deposits at Huglith Mine are considered to be a late phase of the same mineralizing event. The latter was characterized by an initial input of saline hydrothermal fluids that rose through a well-connected fracture-system, precipitating sulphides and cooling with time and vertical extent. Mixing of this fluid with a reservoir of sulphate-rich waters in the upper sections of the vein system led to the later precipitation of barite and calcite deposits high in the orefield stratigraphy, as observed at Huglith Mine. Dinantian extensional tectonics are thought to be responsible for the initial fluid migration in the region, with Carboniferous seawater as a possible fluid source within the Lower Palaeozoic or Precambrian sequences. Thus a modified basinal brine model is favoured, but there still remains a lack of clarity over the exact derivation of the fluids responsible for the mineralization present at Huglith Mine and in the associated district.

References



(Figure 4.35) Sketch map of the Habberley area showing the relationship of mineralization to geology. After Dines (1958).