Wheal Penrose, Porthleven, Cornwall

[SW 634 252]

Introduction

Wheal Penrose is a former lead-zinc mine situated 400 m east of Porthleven. The lodes occur in partly metamorphosed country rock ('killas) of Devonian age (Mylor Slate Formation).

The dumps above Porthleven Sands lie within and alongside a triangular plot formed by the minor roads traversing south-west from Penrose Hill. This site is focused on some of the still available dumps of Wheal Penrose. The dumps mostly carry sphalerite, although galena and other sulphides are also still present, along with some important secondary minerals, which can still be collected. Slippage of the dump causes loose blocks to liner a small area of the field alongside the wall.

Wheal Penrose is said to have been exploited in Roman times, it was known to be working in the 17th century and was then worked intermittently, finally ceasing work in 1872. Dines (1956) has provided the most complete reference to this mine, and reported an output for the period 1843–1844 of 175 tons of lead ore, although large quantities of siderite were obtained from the dumps after the mine was abandoned. During the period 1868 to 1869 it is recorded that many fine specimens of secondary minerals were collected from the mine workings at a level just above the adit.

The former large dump of the neighbouring Wheal Rose Mine [SW 638 247] originally stood beside the track from Porthleven to Loe Bar. These dumps originally contained ore specimens and many rare secondary minerals. These dumps have now been removed and the area levelled.

Description

Three more-or-less parallel base-metal-mineralized cross-course veins are found in the vicinity of Porthleven, these being the Porthleven Lode (which cuts through the harbour area), the Wheal Rose Lode and the Wheal Penrose Lode (sec (Figure 7.46)). The Wheal Rose and Wheal Penrose lodes are considered in this site description. A series of quartz veins containing siderite and occasional sulphides outcrop in the low cliffs between Porthleven and Loe Bar. At the former Wheal Rose site, the main lead-vein trends NNW and occupies a major fault structure, extending from the coast at [SW 639 245] as far as Great Wheal Fortune at Breage [SW 627 290]. Although a major structure, mineralization is recorded as being intermittent.

A vein parallel to that at Wheal Rose occurs a short distance to the north-west and is believed to be the mineralized southerly extension of the 'Great Fluccan', a large, partly mineralized NNW–SSE-trending tear fault, which cuts off the lodes at the westward end of Great Wheal Fortune and Wheal Vor, and which may extend across Cornwall from the north to south coast (Dearman, 1963).

Gleeson *et al.* (2000) suggested that contact of all three Pordileven veins with their host lithologies varies from sharp and planar to irregular and brecciated. Wall-rock fragments are often incorporated into the vein. The vein mineral assemblage is dominantly of siderite and quartz, along with galena, sphalerite, chalcopyrite and arsenopyrite (see (Figure 7.47)). Throughout the area there is also a series of minor E–W-trending late- to post-Variscan normal faults outlined as quartz veins carrying some minor pyrite.

At Wheal Rose the lode courses N25°W and underlies 28°E, and is thought to be the continuation of the Woolf 's Cross-course of Wheal Vor. Although the detail of mine development is not well-known, Dines (1956) stated that development was carried out from the New Engine Shaft, on the cliff edge about 550 m north-west of the Bar [SW 639 245]. The lode consists of galena with pyromorphite, sphalerite, siderite, pyrite and quartz. The galena yielded silver to the amount of 60 oz per ton of lead. Cunnack (unpublished ms) stated that two parallel lodes were worked but this does

not agree with available mine plans. Siderite is said to have constituted most of the lode material. Russell (1944) recorded a range of secondary minerals, including anglesite, while phosgenite, laurionite and paralaurionite are present at Wheal Rose. In the Russell Collection, now in the collections of the Natural History Museum, is a specimen of the rare lead carbonate mineral dundasite from Wheal Rose, occurring as spherical aggregates on quartz with associated slender prisms of cerussite.

Dines (1956) believed the lode at Wheal Penrose, which courses at N20°W to be the southerly extension of the 'Great Fluccan' of Wheal Vor, which here carries lead and zinc ores. Cunnack (unpublished ms) recorded that not far north of the coast the lode is crossed by two east-west fissures that also carry galena; these are often exposed on the foreshore, to the west of the mine when the sand has been removed by storms. There are no plans of the workings, only a longitudinal section dated 1841 which seems to show the lode being worked from various shafts. The major shafts on the lode were Thomas's Engine Shaft, 140 m from the cliff edge, Flat Rod Shaft and Highburrow Shaft. Dines (1956), quoting Cunnack, gave details of several more shafts along with the mine development, most of the surface evidence for which has now been obliterated.

Interpretation

The dumps at the Wheal Penrose GCR site (see (Figure 7.48)) are now much smaller than previously, but are still of considerable mineralogical interest as they contain most of the secondary lead minerals (especially lead chloride minerals) found formerly at Wheal Penrose and recorded from Wheal Rose. These also include notable specimens of cerussite, anglesite, and mimetite. There is some discussion as to how the secondary minerals formed. Dines (1956) reported that mine waters were brackish due to incipient leakage of water into the workings, suggesting therefore that seawater action on the vein led to the formation of the secondary assemblage. Other authors have suggested sea-spray action on dump material as being responsible for generation of the lead chloride minerals. It would seem that normal secondary enrichment (supergene) processes have not been involved in the formation of these minerals.

Throughout the areas of main-stage granite-related Sn-W–Cu high-temperature hydrothermal deposits of South-west England, most of the metal production came from large numbers of E–W-trending (varying to SW–NE-trending) veins (lodes). Distinct to these structures were a suite of N–S-trending to NW–SE-trending Pb-Zn-Fe lodes, which are known as 'cross-courses'. These veins tend to cross-cut the main lode system, and were therefore interpreted as being later than the granite-related mineralization. It was concluded that these structures must represent the final stage of granite-related mineralization. However, later studies, such as those by Sawkins (1966b), and Alderton (1978) determined from fluid-inclusion studies that the metal-bearing fluids were of low-temperature and high-salinity character, similar to those in Mississippi Valley-type deposits. Subsequently, Shepherd and Scrivener (1987) suggested that the fluids were related to basinal brines expelled from surrounding sedimentary basins.

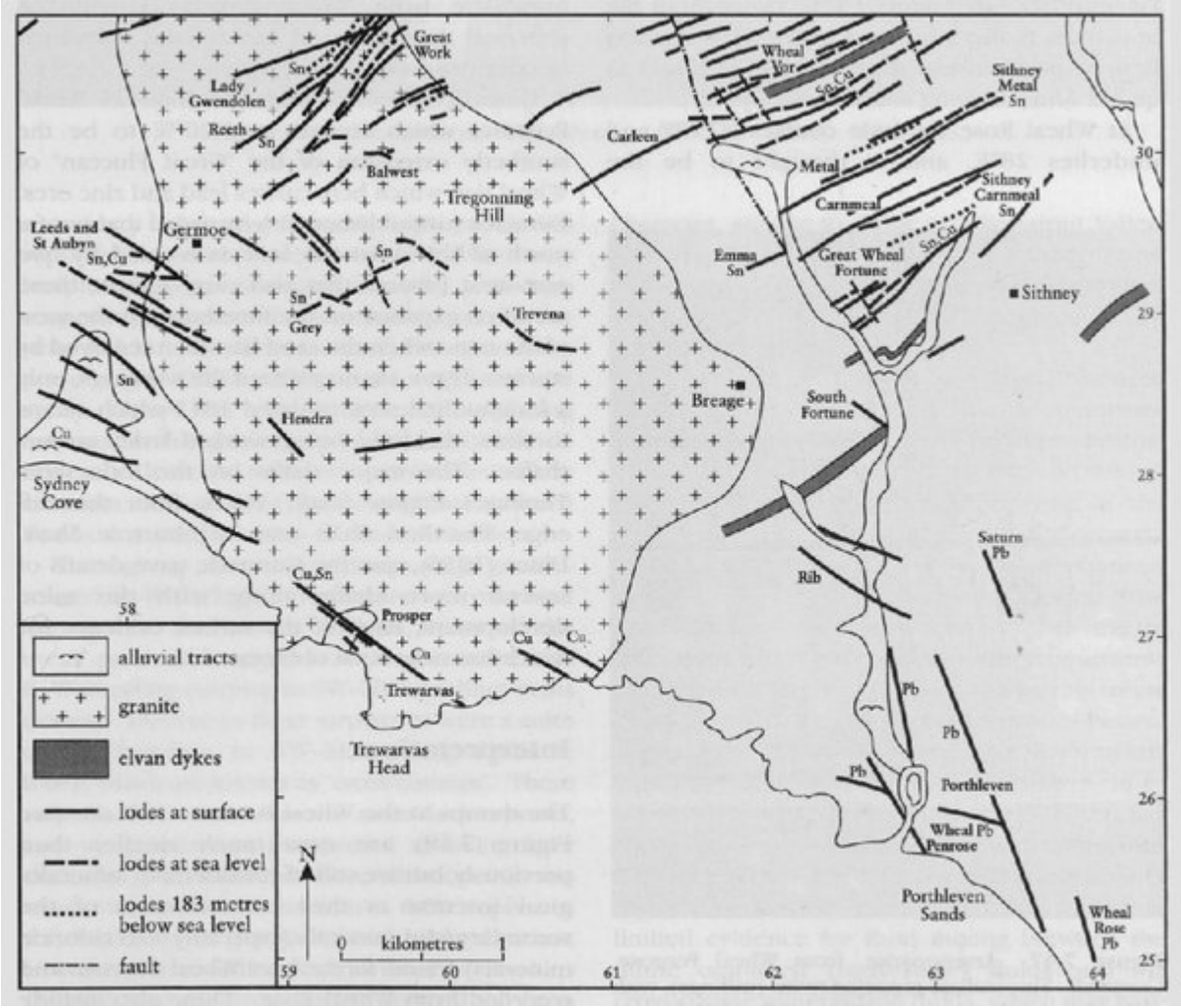
Gleeson *et al.* (2000) recently presented detailed results from a fluid-inclusion investigation in relation to fluids derived from basinal brines. Samples for this study were collected from cross-course mineralization veins in the Porthleven and Menheniot areas of Cornwall, which were then compared to those obtained from Permo–Triassic sedimentary rocks from the Western Approaches Basin. The micro-thermometric data indicate that the ^{S}cross-course fluids have a similar composition to the saline fluids present in the Permo–Triassic basinal sequence. It has been suggested that fluids moved laterally from the basin into the Palaeozoic host-rocks along repeatedly re-activated structures, where they were heated by the Cornubian Batholith to produce the observed temperatures of the base-metal mineralizing fluids. There is limited evidence for fluid mixing between the dilute east–west (main-stage) fluids and the cross-course mineralizing fluids, which may have played a part in the precipitation of base-metal sulphides.

Conclusions

Although much reduced in volume, the dumps at the Wheal Penrose site still provide evidence of the ore assemblage and the important secondary minerals at this site. The ore assemblage is typical of cross-course mineralization, thought to have been derived from basin-generated fluids, although there is a suggestion that the lodes appear to be directly related to other major structures in this area of the South-west England orefield. The site is also noted for the occurrence

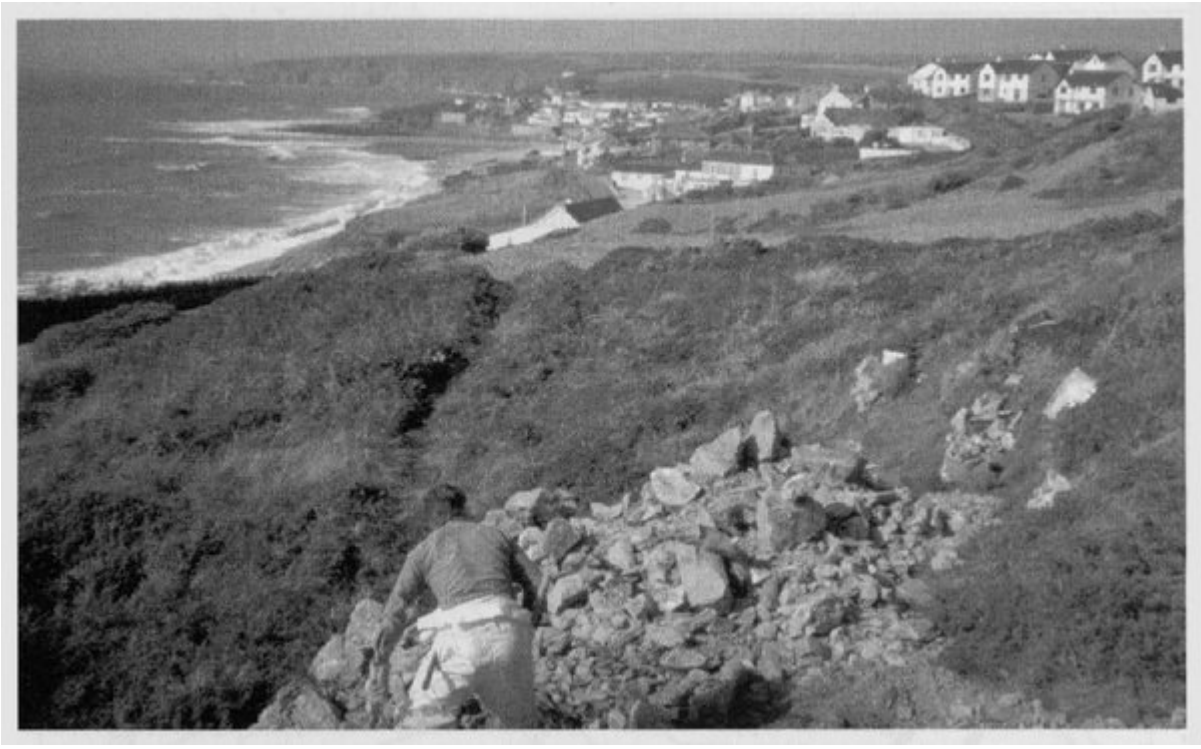
of a suite of rare, secondary lead chloride minerals.

References



(Figure 7.46) Sketch map of part of the Mount's Bay District, showing the Porthleven, Wheal Rose and Wheal Penrose lodes to the east. After Dines (1956).

(Figure 7.47) Arsenopyrite, from Wheal Penrose, Cornwall. Tiny stellate repeated twins (trillings), with yellowish dolomite crystals and dark-brown sphalerite, in cavities of vein quartz (Photo: The Natural History Museum, London.)



(Figure 7.48) Dumps at the Wheal Penrose GCR site. (Photo: R.F. Symes.)