
Wheal Coates, Cornwall

[SW 698 499]

Introduction

Wheal Coates is situated in the southern part of the Perranporth–St Agnes–Porthtowan coastal strip (see (Figure 7.23)). It is in an area of considerable importance in understanding mineralization processes in Cornwall, and should be considered in conjunction with the descriptions of the neighbouring Cameron Quarry, Trevaunance Cove and Cligga Head GCR sites.

Wheal Coates Mine is situated 0.5 km southwest of Cameron Quarry, and lies directly south of St Agnes Head. Various outcropping lodes of the Wheal Coates sett, especially the Towanwrath Lode, are excellently exposed in the cliffs north of Chapel Porth. At the top of the cliff are the preserved remains of the engine house (see (Figure 7.24)) and associated mine buildings above Towanwrath Shaft. However, the excellent cliff exposures in the lower part of the cliff are only accessible from the beach, reached from the north side of Chapel Porth at low tide. All other worked features are in steep cliff sections. The cliffs are formed of dark-grey hornfels with some strong psammitic bands. The most important lode, the Towanwrath Lode, is situated directly below the engine house, 600 m north of Chapel Porth. Other minor lodes are marked by small trial adits. The mine produced tin (cassiterite) and some copper. Foster (1878) described the mine, and a detailed account is contained in Dines (1956). Although described as rich in minerals, the old mine has been active only intermittently and was worked until 1889. In 1911 the mine was dewatered and batch sampled, and output was recorded as 10–14 lbs of 'black tin' per ton. Dines (1956) recorded an output of 335 tons of 9% copper ore and 700 tons of 'black tin' in 1836 and between 1861 and 1889, but the mine was finally closed in 1913. It is recorded that in 1912 production was 17.5 tons of 'black tin'. Of the several lodes tried, only one, the Towanwrath Lode, was fully exploited, although little is known of ancient workings on the sett. Where the lode crops out in the cliff it has been eroded to form a large sea cave.

Description

The lodes of the Wheal Coates sett are in metamorphosed 'killas', traversed by a quartz-feldspar porphyry ('elvan') dyke, and overlie the St Agnes Granite. It is reported that the granite margin along the Towanwrath Lode lies some 500 m offshore (Dines, 1956).

The Towanwrath Lode courses E22°N and underlies 10°–18° south-east, cropping out in the cliff 550 m north of Chapel Porth. In this section the lode follows the footwall of an elvan dyke which is 2.5 m wide and dips 70° south-east and strikes ENE–WSW. In the cliff section the lode is 1.5 m wide, although in the mine it is reported to have been between 0.5 m and 3.5 m wide and to depart from the elvan, so that both the hangingwall and footwall were in killas. The lode is mostly formed of brecciated killas cemented by banded quartz; the whole is covered by red (hematitic) staining. Underground the lode consists of quartz with veins of red and brown hematite, some pyrite and clay minerals. Cassiterite occurs patchily in the quartz and is associated with some tourmaline. Richest areas were found to be from the killas area of the hangingwall, which in places is altered to a dark tourmaline schist and is traversed by interlaced veinlets of cassiterite, mainly associated with clay. Veinlets on the foot-wall were less extensive and less numerous. It is reported that fractures in the hangingwall elvan do contain some lode mineralization veinlets, the elvan perhaps acting as a barrier to movement of solutions (Dines, 1956).

On the footwall (cliff section) there are a number of near-vertical branch lodes (in the St Agnes area these are locally known as 'droppers'). They consist of thin (a few centimetres) persistent veins of quartz, fringed by tourmaline and a red hematitic alteration. A copper lode, called 'Kitty Lode', coursing E23°N and underlying 32°N, crops out 200 m south of the Towanwrath Shaft. However little is known of the workings on this and other old copper lodes in the mining sett.

Mineralogically perhaps one of the most important features of the Wheal Coates sett was the presence of remarkable pseudomorphs of cassiterite after feldspar, found about Adit Level (Davey, 1832). The original feldspars were Carlsbad-twinned orthoclase (see (Figure 7.25)). These classic mineral pseudomorphs were found where tongues of coarse-grained granitic rock about the Adit Level were cut by the lode. These pseudomorphs were found mostly in light-red (hematitic) sand (compare with the Cameron Quarry GCR site).

Small opencast workings are seen higher in the cliff and on the cliff top are the remains of the engine house on the Towanwrath Shaft. Small dumps in the area are mostly formed from red hematite-stained killas, but some blocks still contain arsenopyrite, chalcopyrite, cuprite and native copper. Some of this material may be derived from the copper Kitty Lode. Although the granite margin lies some 500 m from the coast along Towanwrath Lode, several tongues of granite are reported to intersect the mine workings.

Various other small stoped workings can be viewed in the cliffs below the derelict engine-house. These all show a similar association of quartz with strings of red and brown hematite. Associated with these are patches of fibrous tourmaline in slaty metamorphosed killas, the latter sometimes containing abundant andalusite. In the cliff section of the Towanwrath Lode, on the footwall side, there are several vertical smaller branching structures ('droppers'), consisting of the same mineralogical association. They are regarded as being formed by hydraulic fracturing caused by fluid pressure.

Interpretation

Studies of the St Agnes mineralized area suggest that the dip of the Towanwrath Lode is clearly an exception to the regional pattern and should be compared to the observation of Dines (1956) that a copper lode striking ENE–WSW and dipping 32° north outcrops 200 m south of the Towanwrath Shaft.

Wheal Coates is considered to be a tin mine but there also seems to be an anomaly (reversal) of the St Agnes ore mineral paragenesis. Although farther south the Porthtowan copper-producing area is encountered, in the Wheal Coates sett both N- and S-dipping lodes carry some copper. It may be that Wheal Coates reflects the boundary between the tin and copper zones. Both copper and tin have been produced, but tin occurs only in relatively poor amounts compared to the main St Agnes area.

The mineralization at Wheal Coates is related to main-stage hydrothermal mineralization as described for the St Agnes area, and is illustrated in the mineral zonation scheme described and figured by Alderton (1993, fig. 6.30). This figure also shows the modelled migration of the focus of fluid convection away from the granite during cooling and erosion of the overlying sediments, after Sams and Thomas-Betts (1988).

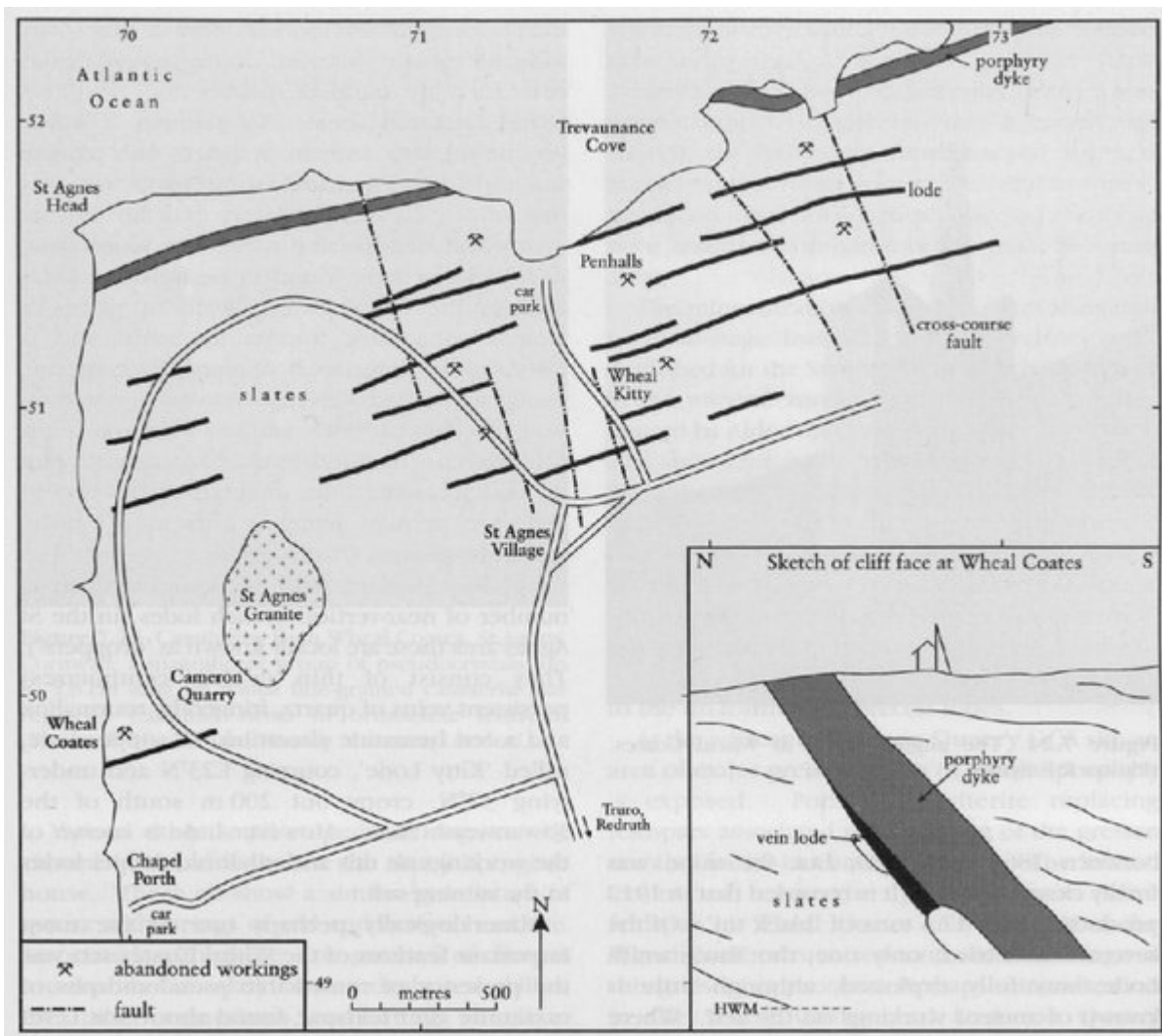
Structures, as seen in the cliff section, which controlled both the major mineralized lode and the elvan, appear to be a series of earlier S-dipping faults. These seem to have formed prior to the tin-tourmaline breccia lodes.

At the adjacent Cameron Quarry GCR site an area of major greisenization of granite porphyry is exposed. Pods of cassiterite replacing feldspars associated with jointing of the greisen are also found in Cameron Quarry. The limited extent of cassiterite pseudomorphs after feldspar in Wheal Coates may show that the Wheal Coates structures controlled the fringe of this greisenizing process. Perhaps mineralization in the Wheal Coates and Cameron Quarry developed during two distinct episodes.

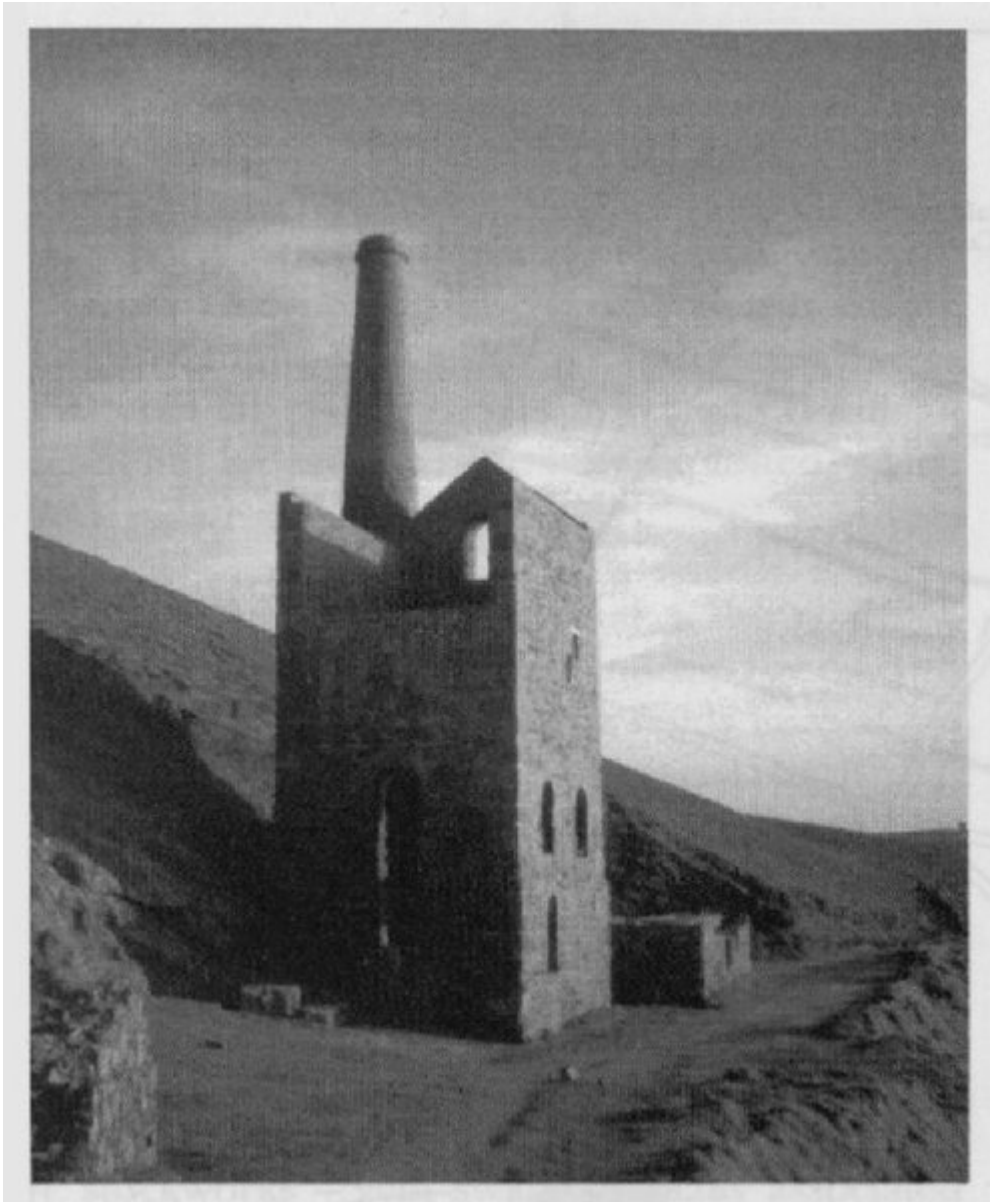
Conclusions

Wheal Coates is best known for its dramatic position overlooking the sea and its restored industrial mining remains. At Wheal Coates, a S-dipping tin lode is developed in the footwall of an elvan dyke in country rocks close to the St Agnes Granite. It is possible that the elvan controlled the emplacement of the lode, and this accounts for the anomalous dip, as compared to the main St Agnes area. However, to the south, within the copper zone, lodes dip both to the south and north. The elvan appears to have been a barrier to movement of mineralizing fluids rather than as a fluid channel-way, as at the Great Wheal Fortune GCR site. The site is crucial in understanding the mineralization history of the St Agnes orefield.

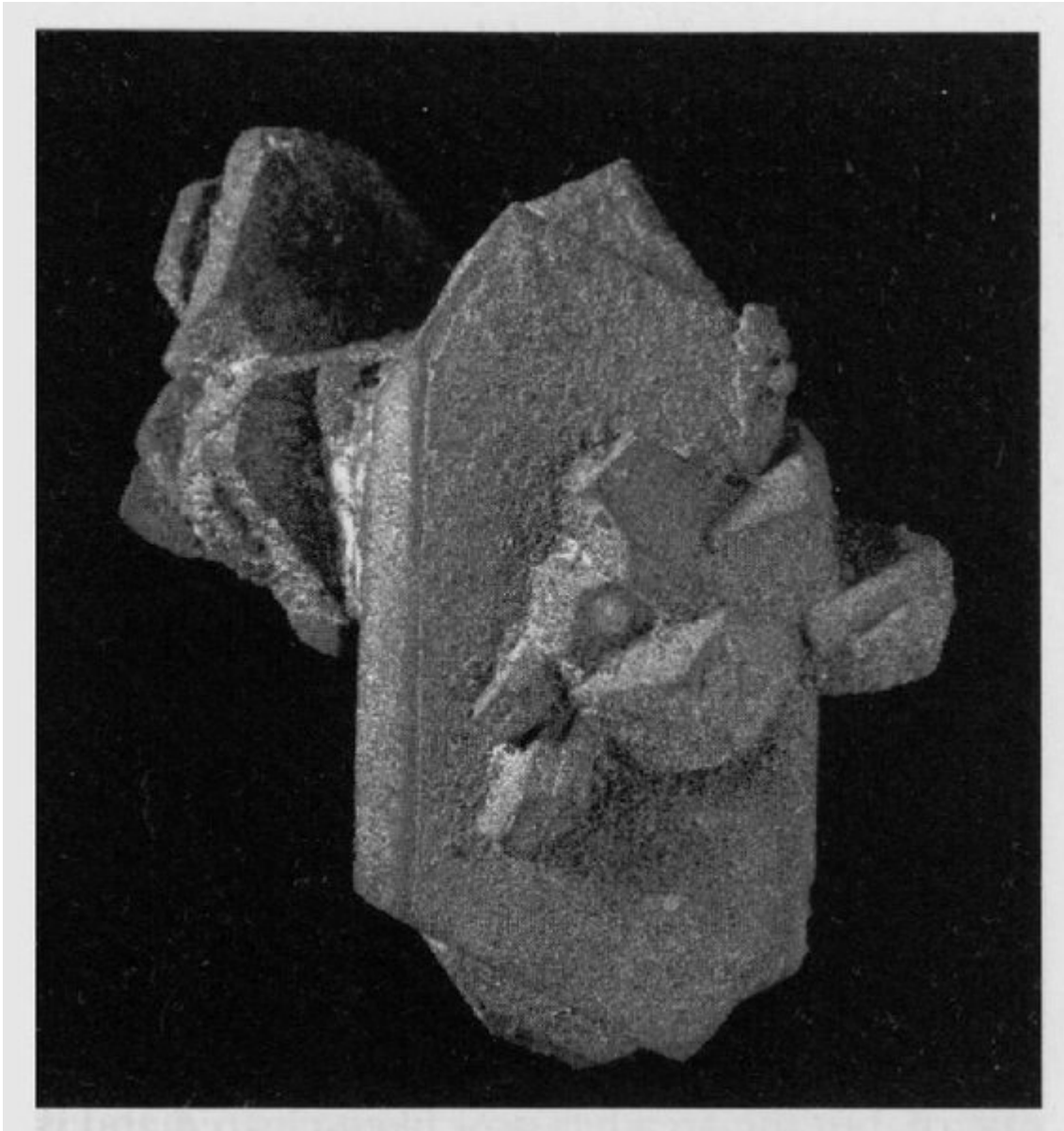
References



(Figure 7.23) Position of major veins and the St Agnes Granite, around Wheal Coates and Trevaunance Cove. The inset map shows a sketch of the Wheal Coates cliff lode. Based on unpublished field notes.



(Figure 7.24) The engine house at Wheal Coates. (Photo: R.F. Symes.)



(Figure 7.25) Cassiterite, from Wheal Coates, St Agnes, Cornwall: a magnificent group of pseudocrystals, up to 5.6 cm long, in which fine-grained cassiterite has replaced Carlsbad twins of orthoclase feldspar. (Photo: 4 The Natural History Museum, London.)