Trevaunance Cove, St Agnes, Cornwall

[SW 723 517]

Introduction

In the northern section of the cliffs of Trevaunance Cove, through to Trevellas Porth, well-exposed examples of N-dipping tin-bearing lodes and S-dipping copper lodes associated with the Cligga Head and St Agnes granites can be studied. In the south-west cliff section old adits are still partially accessible. These adits were driven on the Trevaunance Lode of the Polberro Mine (see (Figure 7.30)) of the St Agnes mining region (Dines, 1956).

Old prints show the cliffs surrounding Trevaunance Cove to be the sites of considerable mining activity, with images of engine houses, water wheels and ore-processing sheds, the latter seemingly immediately above the cliff edge. Few traces of this mining activity now remain, although some dumps are still in place, along with leats and the occasional wheel pit. To the south-west of the cove there was an interesting small harbour (rebuilt many times) which served the mines and local mining community. Unfortunately between 1915 and 1934 a series of storms slowly destroyed the piers of the harbour, leaving only the granite foundations now exposed at low tide.

Around the granite outcrop of St Agnes Beacon a number of important mines were worked. The greatest and richest concentration lay on the north-east side of the St Agnes Granite, between the village of St Agnes and the sea. Here the major mines were West Wheal Kitty, Wheal Friendly and the Polberro mines. For a time the Polberro sett was the biggest tin producer in Cornwall. East of St Agnes village the plateau between Trevaunance Cove and Trevellas Coombe was also extensively mined. The two most important mines were Penhalls and Wheal Kitty which amalgamated in 1907, closed in 1919, but then were reworked in the period 1926–1930. Towards the southern end of Trevellas Coombe lay the Blue Hills Mine, which worked tin from many old mining setts which were active throughout most of the 19th century. The most northerly of the lodes cut through the Trevaunance Cove cliffs. Specialized small-scale tin streaming is still active in Trevellas Coombe at the Blue Hills Tin Streams (see Stanier, 1998). Production figures for the various mines are presented in (Table 7.2).

Washings brought down from Wheal Kitty stamps and processing plant ended up on the beach at Trevaunance Cove. Sands on the shore of Trevaunance Cove still today contain detrital cassiterite, including 'wood tin', which after a heavy storm can be concentrated so as to be of sub-economic proportions. Samples are recorded to have given a recovery of up to 8 lbs of 'black tin' (unrefined ore) per ton. Up until 1940 the deposit was exploited and treated in a small mill near the beach.

Dines (1956) gave detailed coverage of the mines and minerals of the St Agnes area, and further information is presented in Barton (1963). Of many research papers those by Bromley and Holl (1986), and Alderton (1993) are the most valuable.

(Table 7.2) Output of representative St Agnes mines. Based on Mines of West Cornwall, and Dines, 1956).

Mine outputs

	Black tin (tons)	Approximate period
West Wheal Kitty	10 070	1881–1915
Wheal Kitty	9510	1853–1918
Polberro	4300	1837–1895
Penhalls	3610	1834–1896
Blue Hilts	2120	1858–1897

Description

The importance of the readily accessible lode examples in Trevaunance Cove are best understood by considering their local mineral and mine environment. Polberro, like so many other large mines, was an amalgamation of various ancient smaller workings, some of which are known to have been at work in the 1600s. In the 1830s the concern employed 480 persons, and in 1846 the mine was visited by Queen Victoria, being thereafter known as 'Royal Polberro Consols'. In 1864 the workings had reached a total depth of 100 fathoms. Underground work ceased shortly before 1900, although the sett was subsequently incorporated with those of other St Agnes mines. Wheal Friendly, whose engine house stands on the west side of Trevaunance Cove, survived until 1895 when it was 195 fathoms deep. It then became part of West Wheal Kitty, whose levels extend beneath St Agnes village. West Wheal Kitty had been started in or about 1863 and closed during the First World War. The Kitty and Penhalls sett is bounded on the west by Trevaunance Cove and on the east by Trevellas Coombe. The Penhalls section is to the north, close to the shore of Trevaunance Cove. The mines are very ancient; Kitty is mentioned by Borlase (1758), and other parts of the sett by Pryce (1778). The lodes trend roughly ENE, the most important being 'flat' lodes dipping 50° near-surface and becoming progressively flatter in depth. Pike (1866) described some remarkable 'heaves' or throws in Penhalls Mine.

The Trevaunance Mine, now long abandoned, was very profitably worked for tin from the middle of the 18th century. One of many mines around the St Agnes area, it eventually became part of the larger Polberro Mine in the 19th century, and later part of St Agnes Consols.

Polberro Mine is known for very rich deposits along the Trevaunance Lode. Very important mineralogically were the remarkable crystallographic 'habits' of the fluorite specimens obtained from these mines. Although not now available within today's small number of exposures, good specimens can still be studied in major collections. Specific aspects of the fluorite and their importance to mineralogical studies were described and figured by Embrey and Symes (1987). As described, a great many old setts were later incorporated into the Polberro group, including Wheal Trevaunance and the Pell Mine, which yielded fine specimens of fluorite, with crystals showing the 'four faced cube' form to perfection. West Wheal Kitty was a group of some 30 older setts, one of which was Wheal Rock where Raspe found the first stannite specimens in 1785. Many old specimens of superbly crystallized chalcopyrite found in collections are believed to have come from the mines of the West Kitty group.

The country rocks of the St Agnes district are Lower Devonian 'killas' containing prominent grit bands. At both Cligga Head and St Agnes Beacon there are two small granite outcrops where the country rocks are thermally metamorphosed. Quartz-feldspar porphyry ('elvan') dykes coursing ENE–WSW are recorded from some of the mines. The general lode trend is ENE, in some cases nearly vertical, while others have a flat northerly dip of between 20° and 35°. The area is traversed by numerous fault-fissures which tend to heave the mineral-bearing lodes so as to cause the flat N-dipping lodes to be repeated, occurring as a series of N-dipping sections (Dines, 1956). The 'flat' lodes have yielded mainly tin from contorted and crushed killas that is highly tourmalinized and impregnated with cassiterite. The vertical lodes are normal fissure-veins. Several north–south, nearly vertical quartz-filled later cross-courses are also reported from the mines.

North of the beach at Trevaunance Cove, and along to Trevellas Coombe, cliff exposures of a typical S-dipping copper lode are present. Although only 0.5 m wide, it can be seen to contain brecciated killas, veined and lined by quartz. Chalcopyrite can be recognized along with pyrite and chlorite, and it is reported that the vein also carries some tin.

In the north cliffs of Trevaunance Cove a complex system of lodes is exposed, dipping both north and south and bifurcating in places. Two of the thin structures, only a few centimetres in width and about 1.5 m apart, dip to the north at about 35°–40°. Small trial adits can be seen on one of these N-dipping veins where it has been offset by a small fault. It is difficult to follow the veins on the beach as large boulders obscure the in-situ rock sequence. The vein is cut by a small nearly horizontal vein which further complicates the sequence, although this cannot be followed through the rock sequence. The near-horizontal lode appears to be the earliest of the complex. The N-dipping lodes can be seen to be brecciated and tourmalinized and clearly 'moved' by S-dipping lodes. This area therefore provides small-scale evidence for the believed nature of the complexity of early to late tin mineralization and copper lodes in the St Agnes area, as described by Dines (1956).

The Trevaunance Lode is exposed in the cliffs of the southern side of Trevaunance Cove, which, when reasonably exposed, can also be seen to be brecciated. The vein can be followed by a line of overgrown pits towards the Polberro Mine.

Interpretation

Veins in the Cornish orefield are commonly vertical or steeply inclined, dipping at 60° or more, although flatter structures do occur. Many of these flatter, near-horizontal veins occur in the St Agnes district. Structural evidence seems to indicate that some of these structures are associated with thrust planes.

As in the case of a cooling magma, the fall in temperature is probably the most important physical change, along with pressure consideration, which controls crystallization of the different minerals. The deposits of the St Agnes region demonstrate the control of decreasing temperature on mineralization. This is exhibited on a large scale in the metalliferous deposits inland from the north Cornish coast at St Agnes Head and Cligga Head (see Alderton, 1993, fig. 6.30), where distinct mineral zones occur. Higher-temperature tin-tungsten mineralization occurs nearer the coast, followed inland by copper and then lower-temperature lead-zinc mineralization (see (Figure 7.40)). In the St Agnes region some of the lead-zinc veins appear to have similar trends to both the higher-temperature copper and tin lodes, which is not normally the case in South-west England, as they typically form cross-course veins.

Adjacent to the Turnavore Shaft of Polberro Mine, veins were described as containing a topaz-cassiterite-pyrite-sphalerite assemblage (Dines, 1956). The following paragenesis was determined by Dines (1956):

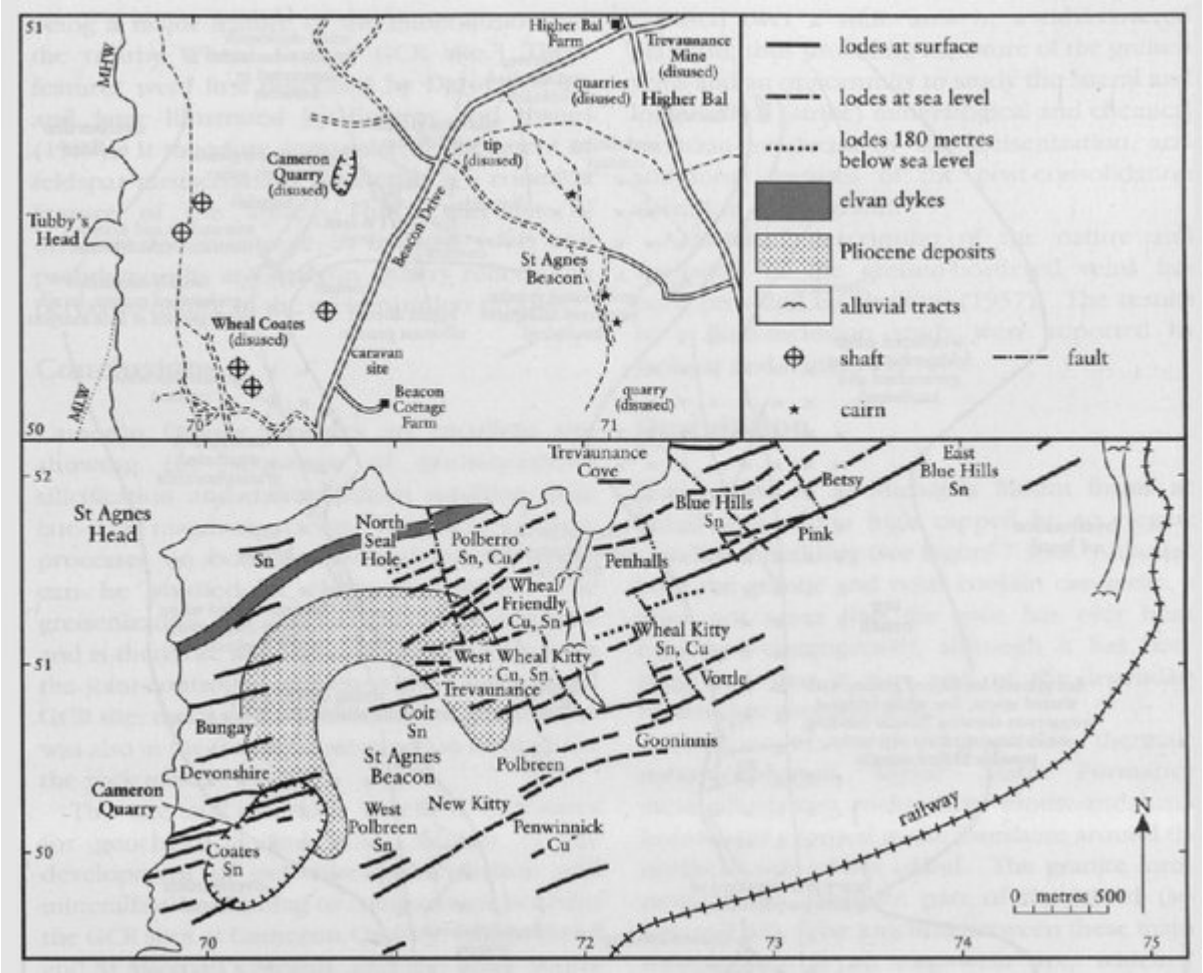
1. quartz-topaz-cassiterite;
2. brecciation and development of clay by 'topaz' replacement; and
3. sphalerite-pyrite-arsenopyrite.

As such there are some similarities to the Cameron Quarry GCR site mineral assemblage. Essentially, mineralization is of main-stage hydrothermal origin associated with intrusion of the St Agnes Granite, which is part of the main Cornubian Batholith. It has been pointed out that Trevaunance Cove is approximately equidistant from the two principal areas of Li-mica granite seen at Cligga Head and Cameron Quarry. At Trevaunance, however, there is no evidence of the greisenization associated with this type of granite as seen at the Cligga Head and Cameron Quarry GCR sites, although in the Polberro Mine, immediately south of the cove, topaz is recorded as being a prominent early mineral in the vein paragenesis. It is therefore concluded that the apparent differences in the sequence of events at Wheal Coates and Trevaunance Cove are attributable to the presence or absence of early faulting associated with Li-mica granite intrusion. Where faults were present they acted as channel-ways for an early phase of tin-topaz mineralization, followed by superimposed hypothermal tin mineralization; where they were absent the hypothermal mineralization occurred in two stages, conforming to the regional pattern seen around the St Agnes–Cligga Head granite ridge.

Conclusions

Exposures between Trevaunance Cove and Trevellas Porth demonstrate the relationships between early N-dipping tin lodes (brecciated and tourmalinized) and later S-dipping copper lodes. The site therefore demonstrates in microcosm the lode systems of the St Agnes area in terms of their mineralogical and structural characteristics, and evidence seen at the nearby GCR sites at Cligga Head, Cameron Quarry and Wheal Coates for understanding the main-stage mineralizing events related to the Cornubian Batholith, in particular the lateral zonation of the various tin, copper, and lead-zinc mineral lodes.

References



(Figure 7.30) Location map of Cameron Quarry showing the distribution of lodes in the area. After Dines (1956).

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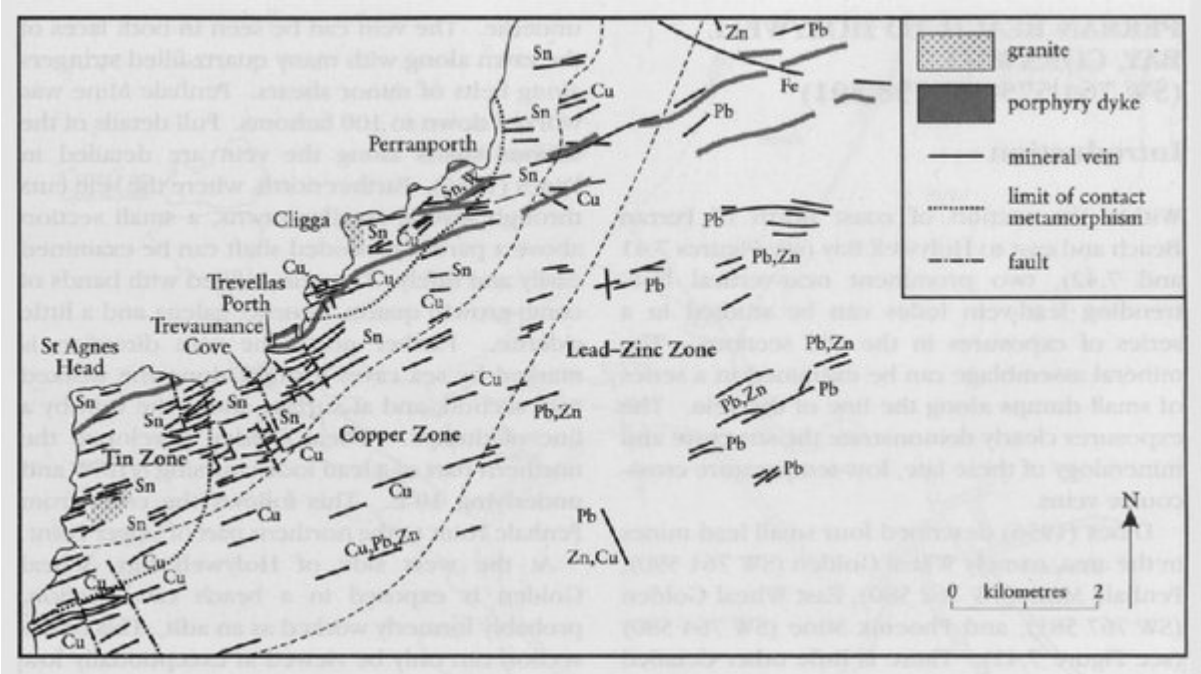

(Figure 7.40) Mineral zonation in the St Agnes–Cligga area. After Alderton (1993).