Devon Great Consols, Devon

[SX 431 735]

Introduction

The largest mines of Devon were situated in the Gunnislake–Tavistock area, and their output of copper, arsenic and pyrite dominated the mineral production of the county. By far the largest producer was Devon Great Consols, north of Gunnislake, on the Devon County bank of the Tamar. A shipping quay was constructed at Morwellham, on the Tamar, and linked to the mine by an inclined railway track.

The five mines of the group, which constituted Devon Great Consols, were from west to east Wheal Maria [SX 416 737], Wheal Fanny [SX 420 734], Wheal Anna Maria [SX 427 735], Wheal Josiah [SX 428 733], and Wheal Emma [SX 435 735] (see (Figure 7.36)). The amalgamated mines worked the largest sulphide lode in South-west England. The east-west Main Lode has been proved for almost 4 km and varies between 2 m and 10 m in width. It has been stoped continuously for much of the 4 km length. Several other lodes have been proved to the south. Throughout the length of workings on the Main Lode there are about 12 shafts to various depths. Details of the mine development are presented in Dines (1956).

Virtually all the surface features of the mines have been obliterated, although the line of the Main Lode can be ascertained by a succession of depressions. Much of the surface debris is calcined waste. By the time of final closure of the mines most of the copper ores had been worked out, but it is reported that a considerable amount of arsenopyrite still remains on the walls of the veins.

Between 1845 and 1906 the mines produced over 0.75 million tons of 6.5% copper ore, 70 000 tons of crude arsenic, and 10 000 tons of pyrite.

During the life of the mines demand for arsenic fluctuated considerably, and at times arsenic was left in the stopes or thrown away on the dumps. As a result, dumps can still be found which are extremely rich in arsenopyrite, which oxidizes relatively slowly. The main gangue minerals in the mine are quartz and siderite, while fluorite is only locally important. Work commenced in the various mines situated on the Main Lode about 1884, which were later amalgamated as Devon Great Consols. By 1897 workings had reached 200 fathoms below adit-level. Large-scale operations ceased about 1902, but various parts of the mine were intermittently worked for another 23 years, and dumps were reprocessed for copper and arsenic.

Most of the dumps have now been removed or reworked for arsenic and fluorspar. The flues and surrounding area at Wheal Anna Maria [SX 427 735] still contain some arsenolite (As_2O_3). The whole area is now part of the Tavistock Woodlands Forestry Scheme, with the exception of part of Wheal Josiah, north of Hawkmoor House Farm [SX 433 735] and the eastern part of Wheal Emma around Thomas's Shaft [SX 440 737].

A well-preserved dump has been located in the general area of Wheal Josiah (see (Figure 7.37)), specimens from which are typical of the primary mineralization seen on the Main Lode and the South Lode (a loop of Main Lode). The dump contains a lot of massive arsenopyrite and comby quartz, the latter containing well-crystallized siderite and francolite (a variety of apatite). Large blocks of siderite are also plentiful.

Description

A detailed account of the development of Devon Great Consols with outputs for the individual mines was given by Dines (1956), while Durrance and Laming (1997) provided a discussion of the formation of the deposit.

The country rock is metamorphosed 'killas' (mostly marly slates and thin limestones) of Upper Devonian age. The strike of the Main Lode is essentially east-west at Wheal Josiah within the Wheal Josiah sett, and the strike then changes from east-west to E12°N. The Main Lode had a gossan, which extended to depths of 20–40 fathoms, and at depth the lode typically varied from 5 m to 9 m or more in width. In some areas rich ore-shoots 12 m wide carried chalcopyrite and arsenopyrite. The deepest shaft was Richard's Shaft at Wheal Josiah, 300 fathoms below surface. The major drainage cross-cut was known as the 'Blanchdown Adit'.

In the Gunnislake–Tavistock area the lodes are cut by late NW–SE-trending cross-courses, some displacing the earlier veins by several metres. In Devon Great Consols, the Great Cross-Course heaves the Main Lode some 225 m in a right-lateral (dextral) sense. Most of the cross-courses dip westwards at moderate tosteep angles but carry only a little galena and sphalerite mineralization.

The lodes all have strikes between ESE–WNW more-or-less paralleled by the associated quartz-feldspar porphyry ('elvan') dykes, and mostly dip steeply either north or south. At Devon Great Consols the central parts of the lodes rich in copper were worked first and the outer parts worked later for arsenopyrite. Some of the arsenopyrite occurred in large lensoid bodies up to 2 m thick.

Surface alteration of the veins is a marked feature of this area and extends to considerable depths. Dines (1956) recorded gossans in Devon Great Consols from 75 m to 110 m.

Interpretation

The mineralization at Devon Great Consols is of hydrothermal origin, and only traces of cassiterite are present, the recorded total output for Devon Great Consols being 21 tons of 'black tin'. Discussion of the formation of the deposit has always focused on the depth of granite below the mine. It is believed that major mineralization is centred over a concealed granite ridge between the Dartmoor and Bodmin Moor granites (proved at depth in Frementor Mine). However there are no records of granite or granite veining even in the deeper workings of the Devon Great Consols mines. It is believed that the surface of the granite therefore plunges westwards. Because the granite batholith here has a steep northern face the zones are imposed horizontally rather than vertically, and there are comparisons geologically between this area and the Botallack area of west Cornwall. The presence of siderite in the gangue, rather than hematite, reflects the calcareous nature of the host rocks. The slates are marly, and thin limestones are often present.

The question of mineral zonation provides much interest in this area, as the expected tin reserves at depth were not realised at Devon Great Consols. It was believed originally that the tin zone was always present below the copper zone, and several attempts were made to find tin in the lower depths of the mines. It was assumed that the rich copper areas would give way at depth to tin-rich horizons (see Barclay, 1931). The Richard's Shaft of Devon Great Consols was tested to 550 m depth. A well-defined lode of quartz, chlorite and tourmaline was found to carry only trace amounts of tin. In fact there is little evidence for mineral zonation (as compared to Cornwall) in this area. The tin zone is present in the granite area to the south, at Gunnislake. There is no so-called 'emanative centre' in the vicinity, so hypothermal tin was rarely found, and the mine is a good example of how an incomplete understanding of the zonal scheme of mineralization could lead to loss of capital.

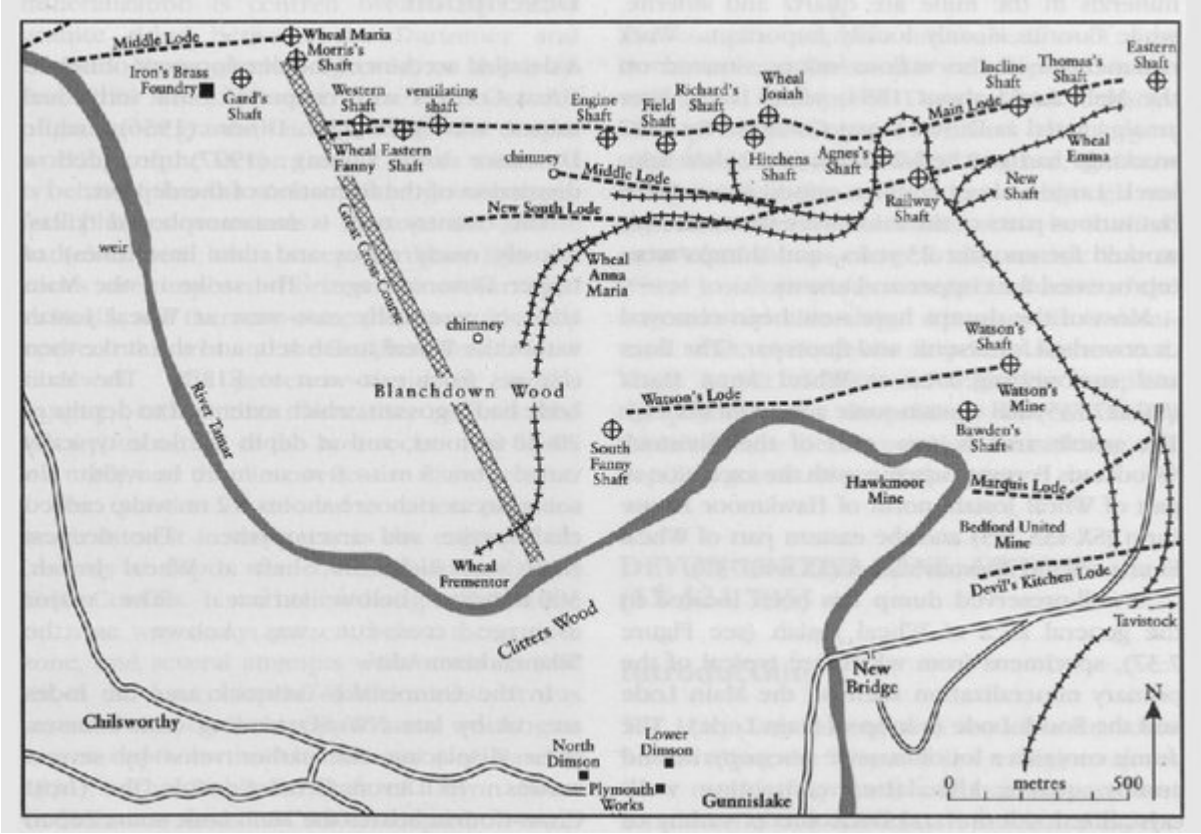
Four major phases of ore emplacement are recognized, namely:

1. an earliest phase that caused intensive tourmalinization of the killas around the main fractures and the introduction of disseminated fine cassiterite;
2. fracture infilling of quartz and some chlorite, with cassiterite, wolframite and abundant arsenopyrite;
3. re-opening, and further infilling of chlorite, quartz, chalcopyrite and arsenopyrite; and
4. finally, infilling of all cavities and fractures, and sealing with fluorite and extensive siderite.

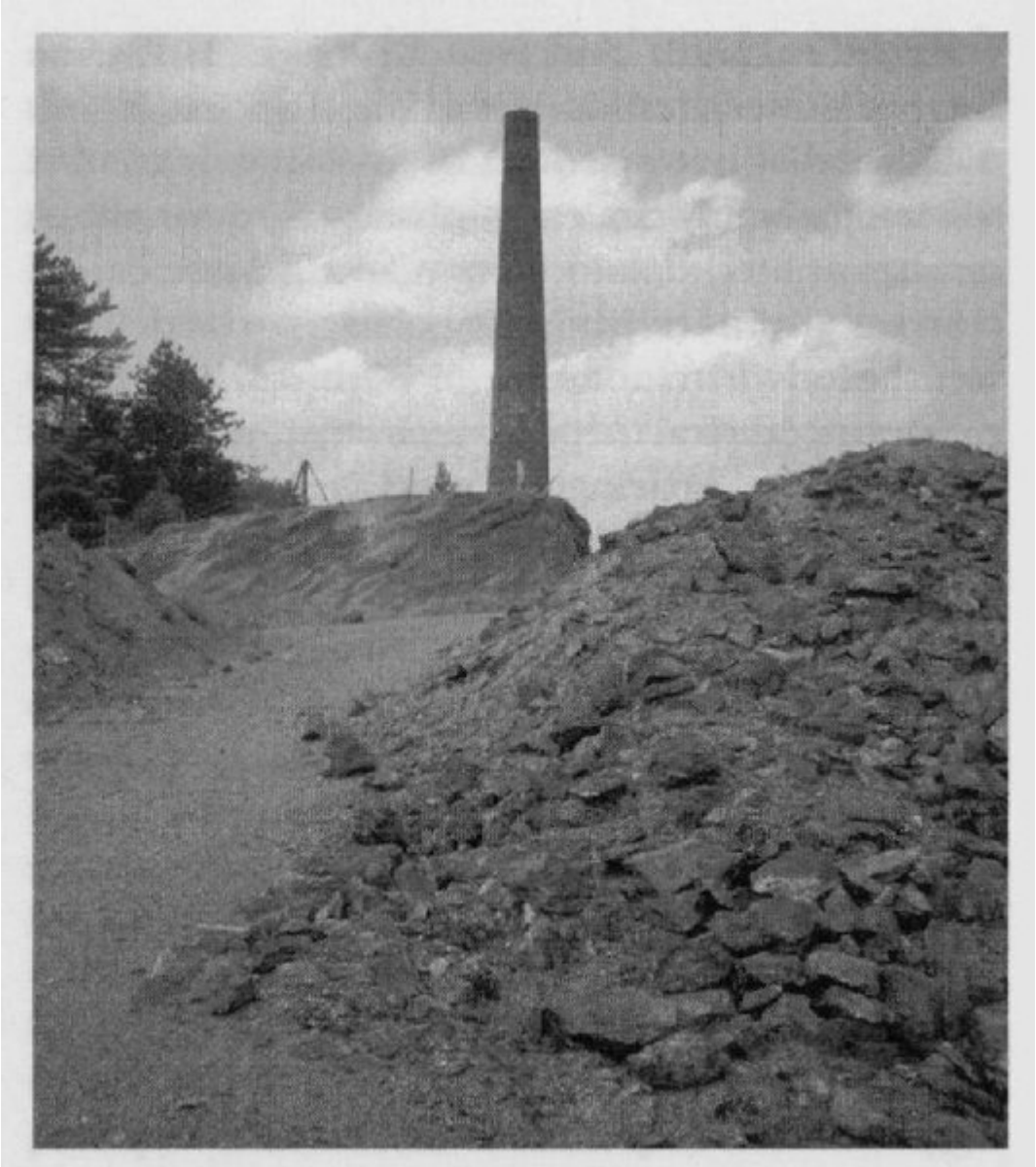
Conclusions

The complex sulphide mineralization of west Devon and east Cornwall is well displayed in the widespread dumps of Devon Great Consols. Devon Great Consols worked the largest sulphide lode in South-west England, the vein being worked for some 4 km. Although no exposures of vein mineralization can be studied, an area of dumps close to the arsenic flue at Wheal Josiah provides material indicative of the original vein mineralogy. Arsenopyrite is dominant while chalcopyrite is poorly represented. Vuggy quartz, siderite and francolite complete the assemblage. Surprisingly few secondary minerals have been recorded considering the depth of gossan originally present.

References



(Figure 7.36) Plan of Devon Great Consols Mine.



(Figure 7.37) Wheal Josiah, showing the mine dump. (Photo: R.F. Symes.)