Lidcott Mine, Cornwall

[SX 240 851]

Introduction

Lidcott Mine is an old manganese mine which worked stratabound pyrolusite and rhodonite ores within a chert horizon, part of a Lower Carboniferous sequence of shales and cherts. The mine was worked both opencast and partly underground in a large excavation. The lower levels are not accessible but the ore workings can be studied in the main cavern. Both the cavern and associated dumps are readily accessible. A partially blocked adit-level occurs at a lower level draining into the river.

Manganese ores are widespread in east Cornwall and west Devon, and are part of a band extending from the Launceston area to Milton Abbot, in west Devon. However, deposits are always small and patchy, and ore grade is generally low. Initially the ores were used in the production of glass, or as a reagent in the manufacture of bleach. Later, manganese was used in the manufacture of steels, but these deposits were not able to compete with imported ores.

There appears to be relatively little literature on the Lidcott Mine, although the mine and minerals present were described by Boase (1832), and Dines (1956). Similar manganese ores to those at Lidcott Mine occur in west Devon, which have been well-documented by Durrance and Laming (1997). An important mineralogical reference to the manganese minerals of Lidcott and other mines in this area was presented by Russell (1946).

Description

Lidcott Mine occurs in an area where the country rocks consist of Lower Carboniferous strata, being essentially shales, with chert beds and bedded lavas. These are also associated with altered intrusive masses ('greenstone'). The ore occurs within a chert bed enclosed by black shales and purple-coloured grits.

At Lidcott Mine the ore was followed underground from an open working and confined to a 2–3 m-thick chert bed which dips at 35°–40° NNW and is recorded to extend for about 75 m along strike. The chert is traversed by several 5–7 cm-wide strips of comby quartz, and is often altered to rhodonite plus a little rhodochrosite. Small crystals of pyrite and galena occur in the altered rock. Pyrolusite impregnates walls and cracks in the rock sequence along with some rhodochrosite (Russell, 1946). On both sides of the cavern, the walls are formed from the bedded sequence, and the nature of the patchy orebody can be inferred from the worked pockets along the strike. Minor quartz-rich veins and some calcite veins cut through the rock succession parallel to the strike. The deposit was worked mostly from irregular pockets where the black ore (pyrolusite) and rhodonite occurred. The main cavern area measures about 15 m by 10 m and is some 3 m high. At depth there are several side passages, some of which contain patches of manganese ore. All the old shafts and trenches to the north-east have been filled in and levelled. In the past, dump material adjacent to the workings was used to block the cavern, but the area has now been cleared and is readily accessible.

The mine was active about 1820 and is referenced by Boase (1832), who described the mine as in profitable working and some 20 fathoms deep. Earliest workings were opencast, forming the cavern structure, but later the ore horizons were worked from shafts connecting with an adit-level towards the bottom of the valley. The mine was last worked between 1875 and 1881, when recorded output was 310 tons of manganese ore. The deposit is said to be exhausted.

Blocks on the dumps are mostly of shales, while grey chert blocks present contain rhodonite associated with some rhodochrosite. Both the rhodonite and rhodochrosite are rose-pink and fine-grained with some richer, coarser patches. Although rhodochrosite is intimately intergrown it has a distinctive cleavage; some quartz and pyrite are also present. Large blocks of the main manganese oxide minerals, namely pyrolusite and psilomelane are also plentiful on the dumps.

Rhodonite often occurs as kernels to the manganese oxide ores. The pyrolusite is sometimes botryoidal or occurs as a powdery wad. Blocks of red jasper are also common on the dumps.

The manganese deposits in the Launceston and west Devon area are therefore characterized by the following features:

1. almost invariably occurring in chert beds;
2. having a close association in these beds with intrusive masses of greenstones;
3. an irregular form to the orebodies, which suggests alteration or impregnation of the more siliceous beds in the host rocks. The irregular orebodies are usually linked by cracks, joints and minor faults, and these and the mine walls are stained or impregnated by black oxides of manganese.

Interpretation

The Lidcott Mine GCR site provides a well-exposed and typical example of a suite of small pyrometasomatic replacement orebodies in cherts of east Cornwall and west Devon, of pre-granite age (Alderton, 1993). The ore is predominantly manganese, but disseminated pyrite in the chert has been recrystallized to form cubic crystals, and the chert has often been altered to red jasper. It is possible that the cherts were related to minor volcanic activity of late Devonian to early Carboniferous age, and that manganese mineralization was introduced later, from black siliceous mudstones, probably during Variscan metamorphism. As Lidcott is some distance north of the contact with the Bodmin Moor Granite, the granite does not appear to have directly contributed in any way to the mineralization.

At Lidcott Mine, pockets of ore are found as patchily developed replacements of the chert beds, usually linked by mineralized cracks. It appears that the chert was originally replaced by rhodonite, or an intermediary mineral of which there is no preserved evidence, which was later altered to the black manganese oxide assemblage. The origin of the ores is still a matter of speculation but the lithological control on mineralization and the usual association of mafic igneous rocks suggest that they may have formed from contemporaneous metal-rich solutions associated with volcanism. They appear to be earlier than the main Cornubian Batholith intrusion episode, and therefore do not appear to have a direct genetic association with granite. However later granite intrusions possibly influenced some alteration and remobilization of the orebody. Some lithologies are more favourable to pyrometasomation than others, the replacement ores being invariably found in cherty beds. However, the host rocks may be impure limestones, as at the Treburland Mine, at Altarnun, Cornwall (Russell, 1946).

Scrivener *et al.* (2001) described various manganese assemblages from a number of west Devon mines. Important in these deposits is the early formation of the calcium-manganese mineral kutnohorite. Later silicification and oxidation led to formation of rhodonite and various manganese oxides.

As can be seen elsewhere, for example in the Meldon area of Devon (Dearman and Butcher, 1959), sequences of black pyritous shales, cherts, impure limestones and volcanic rocks commonly contain accumulations of sulphides which when metamorphosed produce pyrometasomatic mineral deposits in the form of skarns and calc-flintas. Strong concentrations of manganese are often associated with such sequences, and manganese minerals are normally well-developed close to greenstone intrusions and within bedded cherts.

In general there appear to be three types of mineralization developed within the Lower Carboniferous succession in South-west England. These are:

1. bedded sulphides, as *at* the Red-a-Ven Mine GCR site, Meldon;
2. bedded iron ores as at the Haytor Iron Mine GCR site; and
3. bedded manganese ores as at the Lidcott Mine GCR site.

All three ore-types have been associated with fumaroles linked to contemporaneous volcanism. All three ore-types have been further modified by metamorphism associated with the Variscan Orogeny and granite emplacement.

Further studies are needed to resolve the sequence of mineralization, especially whether the oxide or silicate phases represent the primary mineralization. Comparisons with the Red-a-Ven Mine GCR site suggest an origin by selected pyrometasomatic replacement of chert by rhodonite. The rhodonite produced during the low-grade metamorphism–metasomatism then broke down to pyrolusite and wad by late hydrothermal action, leading also to the introduction of quartz and some sulphides.

Conclusions

The Lidcott Mine GCR site demonstrates a stratabound relationship between manganese mineralization and replacement of chert beds. At Lidcott Mine manganese ores have developed along with stringers of comby quartz in a massive chert bed enclosed in black shales. The site also still provides an opportunity to study this type of mineralization in detail and to make comparisons with material from other similar sites, for example Lee Wood [SX 437 836] and Week Mine, Milton Abbot [SX 457 807].

References