Darren Mine

[SN 680 832]

Introduction

Darren Mine (Figure 5.57) is a critical site in the interpretation of the early (A1) assemblages of the Central Wales Orefield primary paragenesis, situated as it is within a cluster of mines all historically famed for the silver content of their lead ores. Galena concentrates sold from Darren and neighbouring mines in the latter half of the 19th century contained up to 30 oz of silver per ton, whereas many Central Wales mines yielded grades of only 3–5 oz per ton. Research at this site in the 1980s (Mason and Hughes, 1990; Mason, 1998) clarified why the silver content of ores raised at these mines was significantly greater than at other mines. The galena of the A1-c assemblage, which dominated the orebodies worked at Darren and its neighbouring mines, was found to contain common and richly argentiferous (up to 18 wt% Ag) inclusions of tetrahedrite, a feature absent from mines with low silver grades, which worked tetrahedrite-free galena belonging to later (A2) assemblages.

In the Central Wales Orefield, outcrop workings on several chalcopyrite-bearing mineral lodes have been reliably dated by radiocarbon methods back to the Early Bronze Age (Timberlake, 1988). Although such research has yet to be carried out at Darren, it is widely believed that the original workings are of great antiquity. The lode crosses a hill-top, and at the summit, a hill-fort of probable Iron Age origin lies close to old opencut workings. A boulder containing galena was discovered in the ramparts of the hill-fort in 1985 (Hughes, 1990), reinforcing the suspicion that the lode had already been excavated by the time the fort was constructed.

The working of Darren Mine from Elizabethan times onwards is well documented (Hughes, 1990). By the end of the 18th century, the mineralization had been extensively stoped away, 19th century operations being little more than reworking over what was left, with a few exceptions. The mine finally closed in the 1880s.

Description

The mineralized fracture known as the 'Darren Lode' trends almost north-east-south-west across the hill and cuts greenish-grey, banded mudstones of the Rhayader Mudstones Formation, passing up into grey mudstones and thin sandstones of the Devil's Bridge Formation, both of Llandovery age (Cave and Haim, 1986). The lode is filled with brecciated sedimentary rock clasts in a cement of quartz and sulphides. The lode is not currently well-exposed but its width (> 5 m in places) may be appreciated where it crosses the hill-top, a short distance to the north-west of the Iron Age hill-fort.

The primary mineralization at Darren Mine (Figure 5.58) is dominated by the A1-c assemblage, an important member of the early phase of mineralization in the Central Wales Orefield. The ore consists of quartz with (in order of crystallization) chalcopyrite, ullmannite and gersdorffite, tetrahedrite, bournonite, and galena. Chalcopyrite, tetrahedrite, bournonite, and galena occur as coarse, intergrown aggregates lining cavities in milky quartz, while tetrahedrite and boumonite also occasionally occur in easily visible masses up to 3 cm in diameter. In contrast, ullmannite and gersdorffite are only visible in polished section, where they may be observed as inclusions in galena (accompanied by numerous small tetrahedrite and bournonite grains). Cavities in the quartz also contain rare traces of late-stage (A1-d), red to orange, translucent sphalerite. Other gangue minerals present comprise chlorite, commonest around breccia clasts, traces of albite, and rutile, all occurring, as at the Brynyrafr Mine GCR site, within intraclast fissures. In addition, ferroan dolomite and calcite occur as fillings to quartz cavities. A2 mineralization is represented by very minor late calcite and marcasite.

Secondary mineralization is widespread at Darren Mine, although the minerals occur in small amounts and are generally micro-crystalline. Joints in the breccias are lined with thin coatings of a variety of species, including cerussite, hydrocerussite, wulfenite, beaverite, mattheddleite, leadhillite, anglesite, caledonite, linarite, brochantite, langite, malachite and native sulphur. Arsenates such as beudantite and mimetite are also locally present. An interesting feature

is the occurrence of erythrite as thin, pink coatings derived by the weathering of cobalt-bearing gersdorffite. A temporary exposure of the lode created during stope capping activities in 1992 revealed, unusually, hydrocerussite, leadhillite and other minerals *in situ;* this exposure is now buried. More recently redgillite has been recorded from Darren Mine (Pluth *et al.,* 2005).

Interpretation

The localized group of richly argentiferous lodes in the Darren–Goginan area, typified by the Darren Mine, represents a particular cluster of ore deposits in which the A1-c assemblage dominates the mineralization and carries particularly abundant argentiferous tetrahedrite, accompanied by bournonite. Both minerals occur in this assemblage at most of its localities, but not in the concentrations encountered at the Darren and neighbouring mines. This, however, is a feature of the A1-c assemblage, which is noteworthy because certain constituent minerals occur in greater proportions in certain areas (Mason, 1994, 1997, 1998). Thus, there is the concentration of siegenite-rich mineralization in the area north of Talybont, typified by the Erglodd Mine GCR site, the concentration of tucekite occurrences in the area to the northwest of Plynlimon, represented by the Eaglebrook Mine GCR site, and the cluster of particularly tetrahedrite-rich deposits of the Darren-Goginan area.

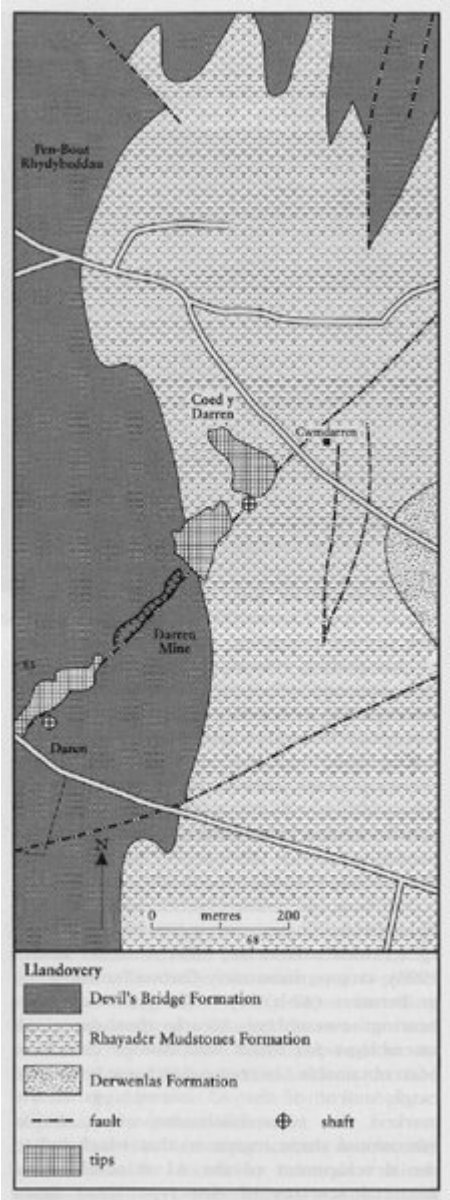
Such variations in the mineralogy of a single assemblage, hosted by similar strata across the orefield, tend to suggest that there were subtle variations in the geochemistry of the ore-forming fluids from place to place within the orefield as a whole. Given that the models postulated for the Central Wales Orefield mineralization (Fletcher *et al.,* 1993; Mason, 1994, 1997) involve a single crustal source of lead and other metals which was repeatedly tapped as successive phases of mineralization took place, it is possibly the case that the spatial variations in mineralogy reflect a similar source terrain within which geological features, for example the distribution of acid or basic volcanic rocks, had an influence on the geochemistry of the fluids derived from their leaching and therefore the mineralogy of the resultant regional assemblages.

Darren Mine also provides an interesting demonstration of the value of mineral production statistics. The mine is officially credited with producing just over 1650 tons of lead ore concentrates (containing just over 21 000 oz of silver) and 50 tons of copper concentrates, between the years of 1849 and 1879 (Jones, 1922). These figures give the impression that this was a relatively modest working. However, a visit to the site immediately conveys the picture of an old and extensive mine, and a study of the mine's history (Hughes, 1990) shows that it was intensively worked during the 17th and 18th centuries, during which much of the richest mineralization was worked away. Official compilation of mineral production statistics was only commenced in 1845, however, and Darren provides an excellent illustration of the fact that the official returns represent an unknown percentage of the total. The geological relevance of this is that, when examining a pre-19th century mine, post-1845 production figures are not a reliable tool to use in estimating the true size of the mineral deposit worked.

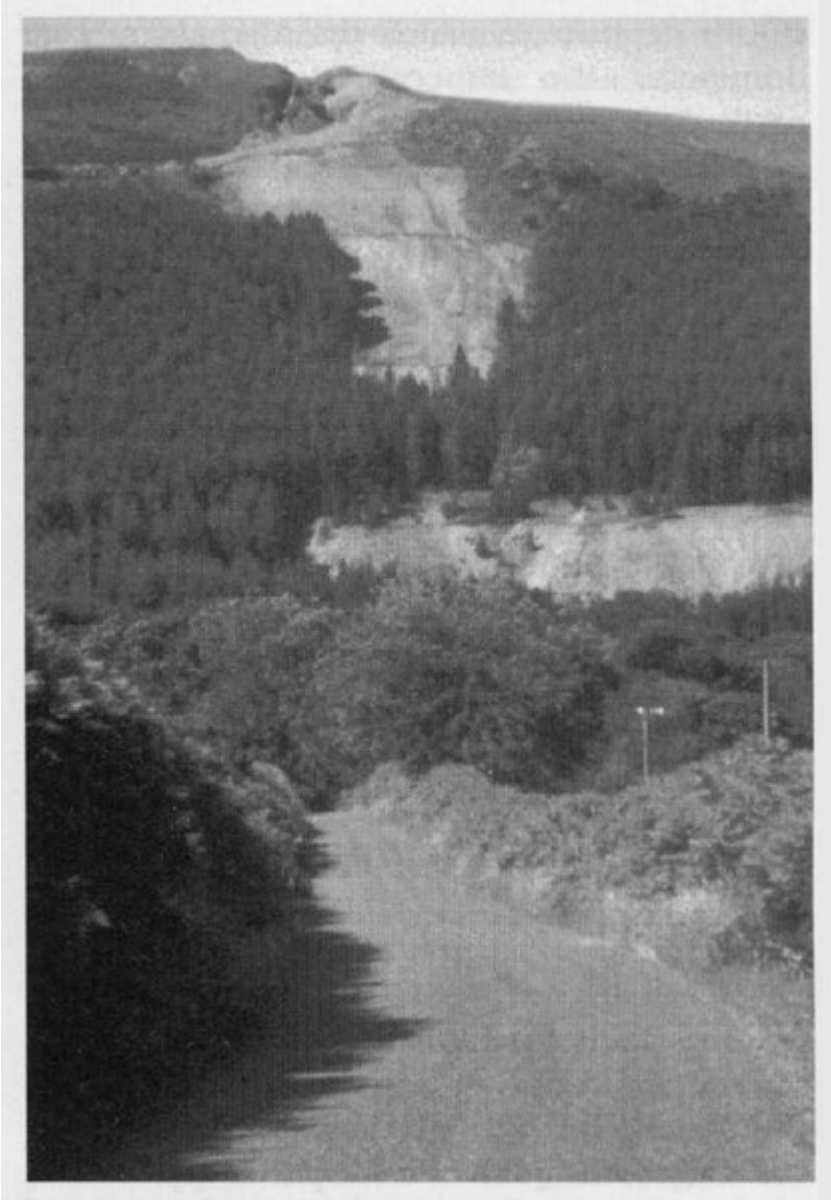
Conclusions

Darren Mine is a key site for studying the early (A1) assemblages of the Central Wales Orefield paragenesis. The A1-c assemblage in the Darren–Goginan area is characterized by a relative abundance of richly argentiferous tetrahedrite, containing up to 18 wt% Ag. This factor alone attracted the Elizabethan miners, whose quarry was principally silver. Until the presence of tetrahedrite inclusions in galena was discovered during the 1980s, the mineralogical reason for the relatively argentiferous character of the ores of the Darren–Goginan area was not known. In addition to the tetrahedrite, the galena also contains bournonite, ullmannite, and gersdorffite, while a range of secondary minerals, including a number of rare arsenates, is present.

References



(Figure 5.57) Map of the Darren Mine GCR site. After British Geological Survey 1:50 000 Sheet 163, Aberystwyth (1984).



(Figure 5.58) Photograph of the Darren Mine GCR site. (Photo: J.S. Mason.)