Afon Stwlan

[SH 671 446]

Introduction

Metalliferous quartz veins are widely developed throughout the Ffestiniog–Porthmadog belt, and largely unsuccessful attempts have been made to exploit them. A mineral vein striking across the Afon Stwlan GCR site (Figure 5.41), which was tried but not extensively worked, has since been superbly exposed by the construction of the service road to the Llyn Stwlan hydroelectric feeder reservoir. Not only does the exposure reveal very rich sulphide mineralization, but also critically it shows the effects of Acadian deformation, thus providing an age constraint for the mineralization.

Little is known of the history of working at Afon Stwlan. The site, but not the exposure, was mentioned by Foster-Smith (1977). It was, however, apparently part of a sett of workings known as 'Moelwyn', which in 1919 was being worked by the Union Zinc Mining Co. (Dewey and Smith, 1922). At this time, the site was producing sphalerite, of which there were apparently 1700 tons lying in stock. The workings referred to by Dewey and Smith (1922), however, lie farther down the hillside, towards Tan y Grisiau Reservoir, where extensive spoil-heaps and opencuts reveal abundant sulphide mineralization, dominated, as stated by Dewey and Smith (1922), by sphalerite. The Afon Stwlan exposure, although smaller in extent, is more informative geologically.

Description

The NE–SW-trending vein is exposed at approximately 390 m OD on the upslope side of the first hairpin bend on the service road, in a position high above the Tan y Grisiau Reservoir (Figure 5.42). Here the vein is hosted by dark-grey mudstones of the Nant Ffrancon Subgroup of Arenig to Caradoc age, clasts of which within the vein reveal thermal spotting, a contact metamorphic effect of the nearby Tan y Grisiau Microgranite. The vein consists of a rib, up to 0.3 m in width, of almost solid sphalerite and galena in quartz, with several parallel quartz-sulphide stringers and clay-gouge planes. The sulphide is largely fresh, apart from a little superficial hydrozincite replacement of sphalerite in the upper, near-surface part of the exposure.

In polished section, the mineralization can be seen to consist of sphalerite and galena, both of which contain inclusions of other sulphides. The galena carries pyrite and chalcopyrite inclusions, while the sphalerite contains pyrrhotite blebs, and also shows the development of chalcopyrite-disease. Quartz and chlorite are the gangue minerals, but are less abundant than the sulphides, a common feature in the better-developed metalliferous veins of this district.

Deformation is well displayed in the outcrop, particularly on the northern (hangingwall) side, where a thin (2–4 cm) quartz vein displays well-developed boudinage. The vein sulphides are also deformed, showing textures in hand specimen indicative of recrystallization; for example the galena has a 'steel-ore' texture. A large polished block, made from a loose block of sulphide found below the track, reveals boudins of quartz and the flowage of galena in between the relatively competent quartz bodies. Polished sections reveal that sphalerite and chalcopyrite have undergone cataclastic shattering within the relatively ductile galena matrix.

Interpretation

This exposure is critical in that it provides clear evidence for constraining the age of the quartz-sulphide veins of the Ffestiniog–Porthmadog belt, proving them to be pre-tectonic with respect to the Acadian compressional deformation (Mason *et al.,* 1999). This places them within the group of pre-tectonic metalliferous veins of North Wales, along with the Dolgellau Gold-belt veins and the copper-rich veins of the Snowdon Caldera (Mason *et al.,* 1999).

The Ffestiniog–Porthmadog belt lies to the north of the gold-belt and to the south of the Snowdon Caldera. The northernmost occurrences of worked gold mineralization, in the Cwm Prysor-Prince Edward mining district, lie *c.* 9 km to

the south-east of this site, while the Sygun Copper Mine, within the south-eastern perimeter of the Snowdon Caldera, is *c.* 6.5 km to the north-west.

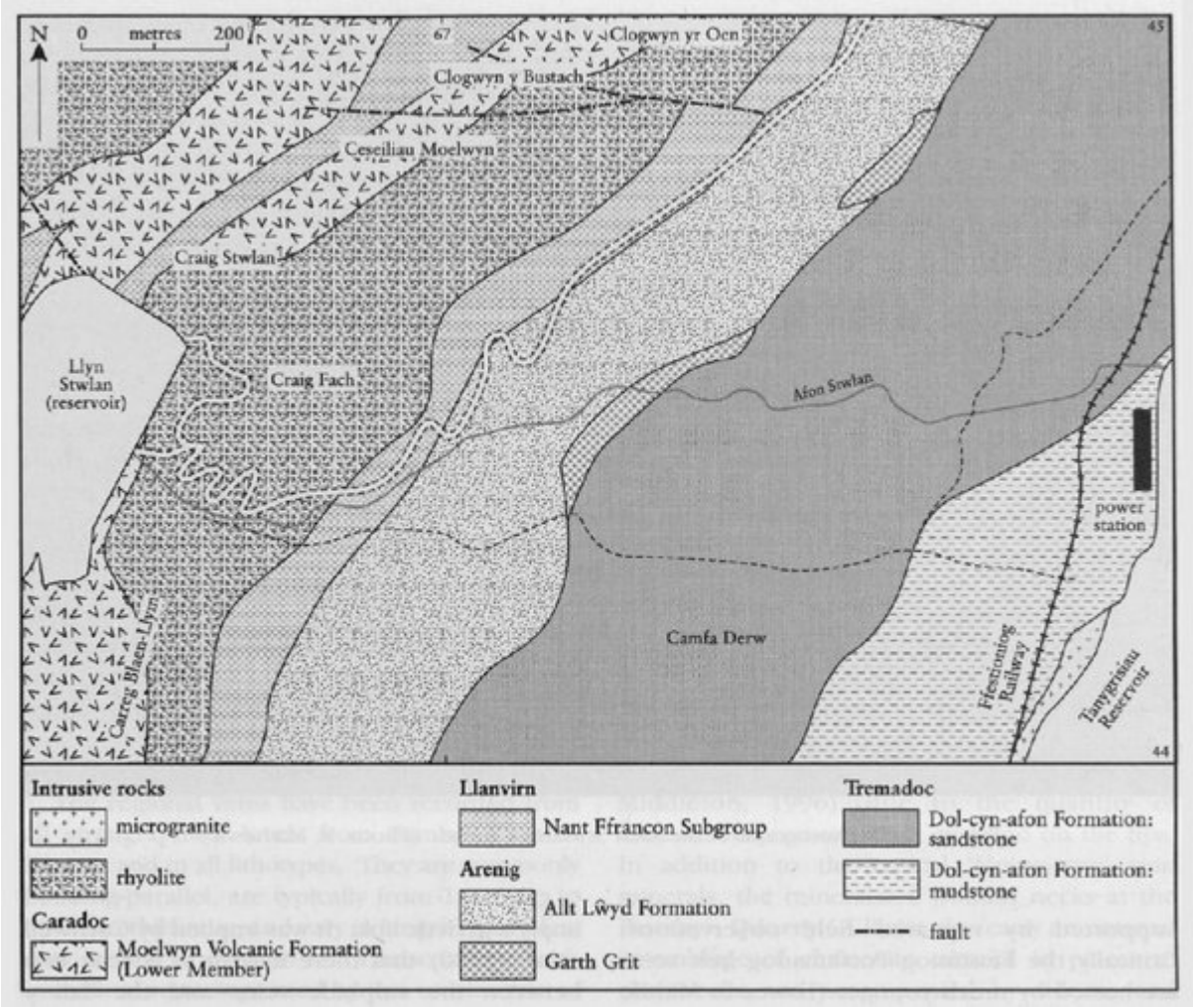
It has been reported (Lynas, 1973; Mason *et al.,* 1999) that the Gold-belt veins are restricted to Cambrian strata below the top of the Ffestiniog Flags Formation, a contention supported by repeated field observations. Critically the Ffestiniog–Porthmadog belt veins are hosted by much younger (Lower to Middle Ordovician) rocks, and additionally they cut the Tan y Grisiau Microgranite, both at the Coed Llyn y Garnedd GCR site and in roadside exposures to the south-west of Tan y Grisiau, at [SH 6925 4409]. This would suggest that the Ffestiniog–Porthmadog belt veins could be coeval with those of the Snowdon Caldera. In fact, the Ffestiniog–Porthmadog belt veins bear a much greater textural resemblance to the Snowdon Caldera veins than to the Gold-belt veins. The latter group of veins is quartz-rich and tends to occur as composite ribbon-rock zones, a feature not evident in the Ffestiniog–Porthmadog belt. Also, the larger Ffestiniog–Porthmadog belt veins tend to have high sulphide:quartz ratios, as do the Snowdon Caldera veins, whereas in the gold-belt the inverse is generally the rule.

Consequently, available evidence suggests that the Ffestiniog–Porthmadog belt veins more closely resemble those of the Snowdon Caldera, although this does not necessarily imply a genetic link. It was implied by Cornwell *et al.* (1980) that there may be a genetic link between the sulphide veins and the Tan y Grisiau Microgranite. However, the fact that the Ffestiniog–Porthmadog belt veins contain clasts of thermally spotted mudstone, as at this site, shows that they post-date the intrusion and its metamorphic effects. Further investigations into the genesis of the pre-tectonic metalliferous veins of the Ffestiniog–Porthmadog belt are needed before any further conclusions may be drawn.

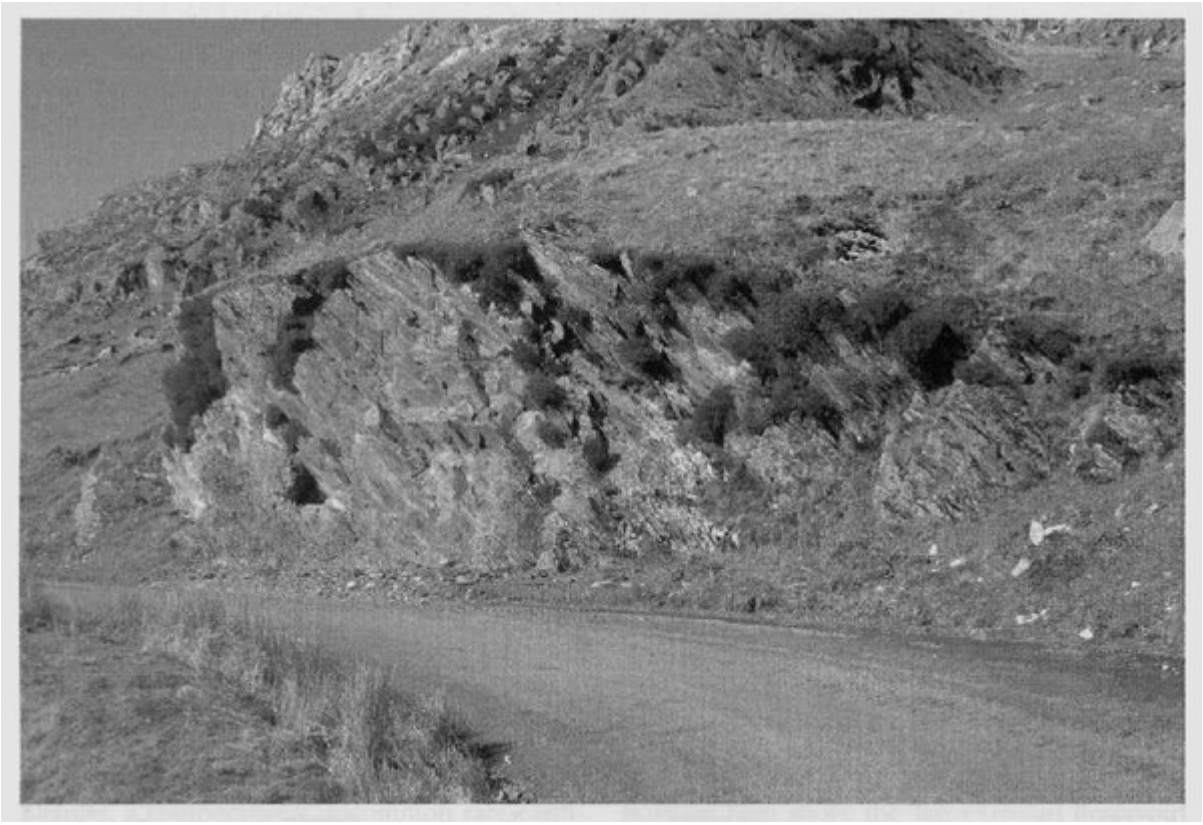
Conclusions

Sulphide-rich Pb-Zn-Cu vein mineralization, of widespread distribution in the Ffestiniog–Porthmadog belt, is particularly well-developed in a cutting on the service road to the Llyn Stwlan hydro-electric feeder reservoir. The exposure at Afon Stwlan provides critical evidence which indicates that the veins are pre-tectonic in relation to Acadian deformation. The genesis of the veins, however, is more problematic; field evidence suggests that they are more likely to be linked genetically to the mineralization in and around the Snowdon Caldera to the north-west, rather than to the Dolgellau Gold-belt to the south-east. They are geographically close to the Tan y Grisiau Microgranite; however they post-date the metamorphic effects of that intrusion.

References



(Figure 5.41) Map of the Afon Stwlan GCR site. After British Geological Survey 1:50 000 Sheet 119, Snowdon (1997).



(Figure 5.42) Photograph of the Afon Stwlan GCR site. (Photo: R. Mathews.)