Turf Copper Mine

[SH 741 255]

Introduction

The famous Turf Copper Mine (Figure 5.11) has many features of importance in both metallogenic and environmental terms. Copper, leached since the end of the last Pleistocene glaciation from the nearby 200 million-ton-plus Coed y Brenin porphyry copper deposit, travelled downslope in solution, to precipitate at this site in the native metal form, replacing organic debris in an accumulating peat deposit in boggy, deciduous, woodland, developed over low-permeability glacial drift.

Historically, the peat was dug and burned here so that the ashes could be smelted for their copper content: the operation was said by Henwood (1856) to have been highly lucrative, who had been informed of one year in which 2000 tons of peat ash had been sold at a profit of about £20 000. Most of the work was done early in the 19th century, and Henwood (1856) provided interesting details of the working. The conversion of the peat to ash was done with extreme care to avoid the peat bursting into flames, as the consequent slagging would make the contained copper difficult to smelt. Apart from the peat cutters, all utensils employed in the works had to be made of copper, as iron tools were rapidly destroyed. Ashing of the peat required a slow burn over an 8- to 10-day period, and any peat containing less than 2.5% copper was left undug, being uneconomic at the time.

In geochemical terms, the area remains highly anomalous. The remaining peat and underlying drift still carry very high copper levels and a distinctive copper-tolerant flora has developed, characterized by abundant thrift (*Armeria maritima*), whose pink flowers, usually seen on sea-cliffs, cover the site in early summer. Turf Copper Mine is of major botanical importance and is a key site in the study of metal-tolerant plant communities.

Description

Turf Copper Mine consists of a low-lying, boggy area surrounded by coniferous forest on all sides. Due to the removal of the 'ore', only the residual low-grade peat remains in places; elsewhere the site has been stripped down to the glacial drift. The best time to visit the site is in May or June, when drifts of the copper-tolerant thrift flowers colour the landscape and bear testimony to the anomalous geochemistry (Figure 5.16).

Henwood (1856) visited the site when its workings were still relatively fresh, and he provided a detailed description of the deposit. The peat bed was 'eighteen inches to two feet' in thickness (*c.* 0.45–0.6 m), and lay upon several centimetres of stony debris derived from the local rocks, which evidently included pyritized sedimentary and intrusive rocks. Below the stony layer lay a second peat bed, which was also cupriferous, but not to an economic extent. The peat beds lie on glacial till, which was proved, in the immediate vicinity of Turf Copper Mine, by drilling during the porphyry copper exploration programme, to be greater than 30 m in thickness (Rice and Sharp, 1976).

According to Henwood (1856), the richest part of the deposit occurred at the base of the upper peat bed. Here, the peat, consisting of a mixture of grass and rotten oak and hazel wood, was sometimes dug and sent direct for smelting. In this rich peat, native copper was observed coating leaves, and replacing acorns and hazelnuts: occasionally it preferentially replaced certain layers in wood, so that upon being cut it would exhibit alternating layers of metal and wood.

Interpretation

The origin of the copper impregnating the peat at the Turf Copper Mine site perplexed prospectors for many years, and the slopes around the site are riddled with trial diggings in search of some conjectured 'Mother-Lode', from which the copper was supposed to have been derived. Ramsay (1866), however, gave the first clue as to its genesis by remarking that the rocks in this part of Coed y Brenin contain minor copper mineralization diffused throughout. The mineralization to

which Ramsay (1866) was referring is the now-famous Coed y Brenin porphyry copper deposit, seen at the Bryn-Coch and Capel Hermon GCR site (see GCR site report, this chapter).

It was suggested by Allen and Jackson (1985) that the original zone of supergene enrichment in the Coed y Brenin porphyry copper deposit had been removed by glacial erosion during Pleistocene times. This would have had the effect of exposing fresh sulphides to weathering agents. Groundwaters would thus have become strongly enriched in leached copper, subsequently re-deposited in a chemically favourable environment within the peat bog at this site, where hollows in clay-rich glacial till impaired drainage. Precipitation of the copper involved complex replacement of humifying organic matter.

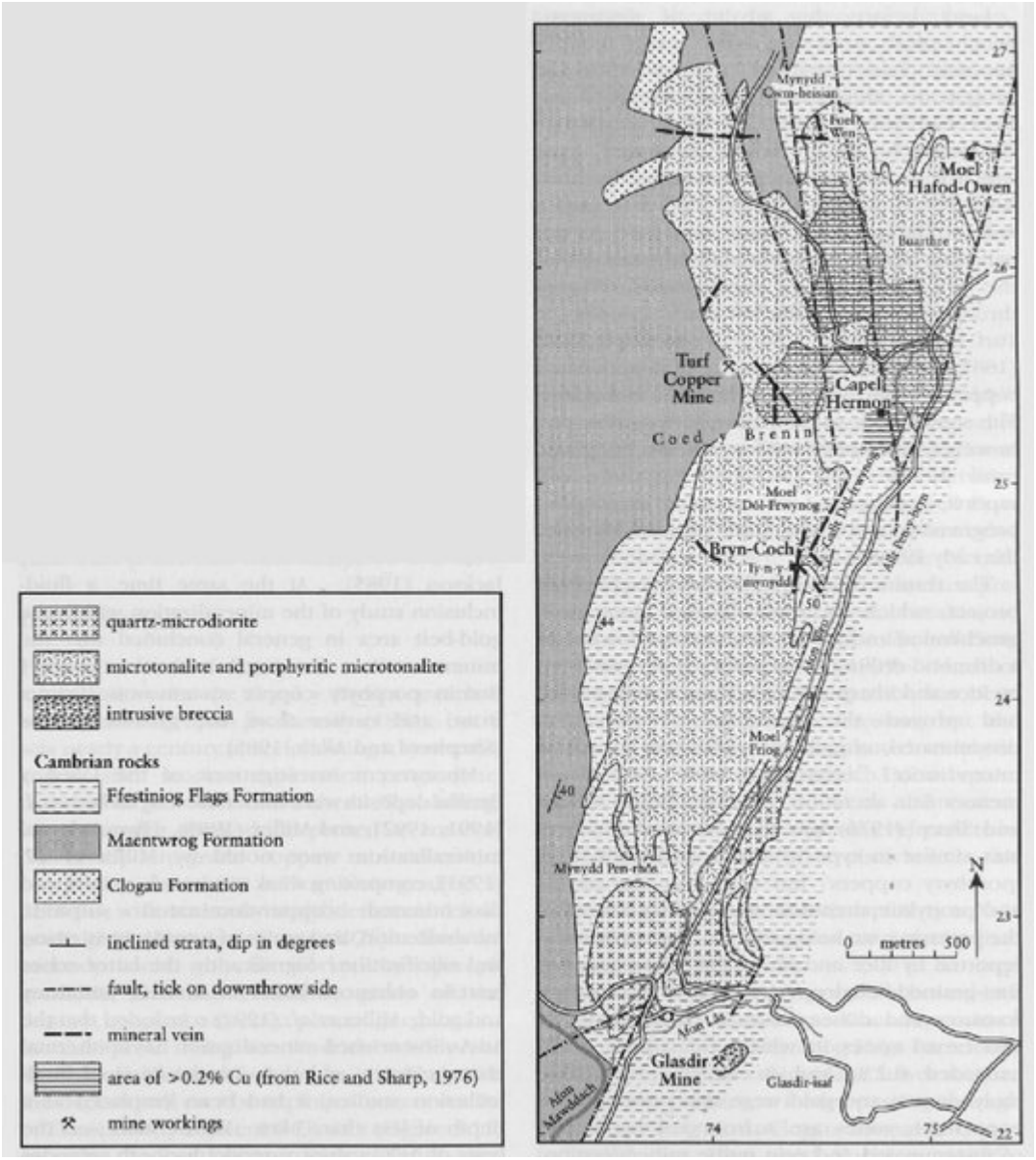
The thick overburden proved by the Riofinex drilling programme is worthy of note. Two holes drilled in the Turf Copper area indicated grossly different overburden thicknesses, of 4.5 m and 36.8 m, and further research led to the recognition of a buried valley, running through the area in an approximately east–west direction (Rice and Sharp, 1976). Rice and Sharp (1976) deduced from their data that the upper reaches of the Afon Wen formerly flowed along this valley into the Afon Mawddach approximately 1 km below Ferndale. During Pleistocene times, a glacier flowing southward from the Trawsfynydd ice-divide (Allen and Jackson, 1985), followed the Mawddach valley but overflowed in the narrow section of that valley below Cefn-Deuddwr, forcing moraine up into the palaeo-Wen valley, thereby blocking it. In the post-glaciation environment, the Wen was turned to the SSW to flow along its present, steep-sided valley. The fact that the Turf Copper deposit rests upon the till of the buried valley therefore confirms its post-glacial age.

Several other areas in Coed y Brenin contain peat with high copper concentrations, but they tend to be more restricted in size. A good example is a small tract of bog in a field, *c.* 450 m south-west of Bryn-Coch, but small areas covered in thrift are encountered throughout Coed y Brenin, indicating that copper anomalies are widespread in this pervasively mineralized area.

Conclusions

Recent mobilization of copper, where groundwaters have reacted with highly disseminated bedrock sulphides exposed by glacial erosion, has resulted in the formation of local secondary copper concentrations in the reducing, humic environments of peat bogs in the Coed y Brenin area, the largest example of which constitutes the Turf Copper Mine. The occurrence of a metal-tolerant flora, epitomized by abundant thrift, is of particular note and its use as a geochemical prospecting tool is important.

References



(Figure 5.11) Map of the Coed y Brenin porphyry copper system, showing the localities of the Moe! Hafod-Owen, Thrf Copper Mine, Glasdir Mine, and Bryn-Coch and Cape Hermon GCR sites. After Allen et al. (1976).

(Figure 5.16) Photograph of sea thrift (Armeria maritima) growing as a copper-tolerant plant at the Turf Copper Mine GCR site. (Photo: S. Campbell.)