# Ton Mawr Quarry

[ST 115 823]

## Introduction

This relatively small quarry, situated near Taff's Well to the north of Cardiff (Figure 5.83), exposes an excellent example of the Dinantian-hosted, metasomatic cavity-fill mineralization which is developed to varying degrees throughout the Dinantian outcrop in South Wales. Fresh exposures of this type of mineralization are limited to the few working quarries in the area, and, in both mineralogical and practical terms, Ton Mawr Quarry provides an excellent representative example (Bevins and Mason, 2000).

The metasomatic cavity-fill type of mineralization has long been known from the Taff's Well area. Greg and Lettsom (1858) referred to the large calcite crystals once found in quarries at Casten Coch, in the rock-faces which now overlook the A470 near to its junction with the M4. More recently, specimens of calcite and barite from the neighbouring, much larger, Taff's Well Quarry were illustrated by Bevins (1994). However, the paragenesis of the cavity-fill mineralization, as seen at the Ton Mawr Quarry GCR site, has not been studied in any detail, in comparison to the oxide-facies iron ores and the MVT lead-zinc vein mineralization, and their relationship merits examination.

## Description

Ton Mawr Quarry (Figure 5.84) exploits Dinantian-age limestones which dip regularly northwards at up to 30°, due to Variscan tilting. The abundant mineralization falls into two categories. Firstly, there are iron oxide deposits, which take the form of limestones reddened due to hematite impregnation, with occasional pod-like masses of more massive goethite (iron ore), overgrown by quartz, often of a smoky to amethystine colour. These are, however, relatively minor examples of the major iron ore deposits which were formerly worked along the Dinantian outcrop from Rudry westwards to Llanharry, and are described in the Mwyndy Mine GCR site report (this chapter).

Secondly, there are the crystalline, metasomatic cavity-fill deposits, which are the focus of interest at this site. Two generations of calcite are present; firstly there are large, irregular cavities, which have previously been noted in the area reaching up to several metres in diameter, and which are filled with massive to crystalline calcite. The calcite varies from white through to yellowish in colour; the coloured varieties contain small goethite inclusions. Crystals, which have a typically scalenohedral habit, exceed 15 cm in length, and are almost invariably covered in a second generation of rhombic calcite, giving the crystals a 'stepped' appearance; although impressive in size terms, they are generally, in the words of North (1916), to be 'of such a nature as to be looked at rather than collected'.

The second generation of calcite, already referred to as coating the large scalenohedra, occurs abundantly in complex, multiply stacked groups of planar solution-voids, typically 200–300 $cm^2$ in area and 10–40 mm in depth. In orientation terms, they are virtually flat-lying and appear to have propagated upwards through the hematized and dolomitized limestone via open joint-fractures. The ubiquitous calcite-fill manifests itself as coatings of sharp, lustrous rhombic crystals, often of a reddish colour, and reaching 15 mm in size. Less frequently, attractive pink to white, bladed barite is present; specimens indicate that the barite is early in this paragenesis as it is overgrown by the rhombic calcite generation.

## Interpretation

The formation of the metasomatic features seen in Ton Mawr Quarry is of considerable scientific importance, for the dissolution of the limestone in this manner indicates that it was attacked by particularly aggressive groundwaters. The development of the mineralization is constrained at Ton Mawr by two important observations. Firstly, the flat-lying, stacked, planar cavities are discordant to bedding, which dips regularly to the north as a result of Variscan tilting. The

cavities appear to have formed by the horizontal migration of aggressive fluids outwards from conduits such as joint fractures: therefore, the stacked metasomatic cavities probably post-date the Variscan tilting. Secondly, the fluids have metasomatically attacked dolomitized and hematized limestone, carrying scattered iron ore pods. Extensive replacement of hematized limestone appears to have been the mechanism by which the calcite crystals lining these cavities have taken on a reddish colouration in places, due to included fine-grained residual hematite. It can therefore be surmized Q.S. Mason, unpublished interpretation) that the formation of the stacked, planar cavities also post-dates the oxide-facies iron mineralization.

The more irregular, large cavities lined with the 'giant calcite' crystals strongly resemble those described from the underground workings of the Llanharry iron mine, near Llantrisant, by Rankin and Griddle (1985). At Llanharry, cavities up to 3 m in section were noted to be lined with scalenohedral calcite crystals up to 0.6 m in length. Rankin and Griddle (1985) also reported that the calcite crystals contained goethite inclusions and were coated by a final generation of rhombic crystals. The highly irregular shape of many of the coarse, calcite-lined cavities at Ton Mawr Quarry is suggestive of filling of pre-existing, possibly palaeokarstic voids.

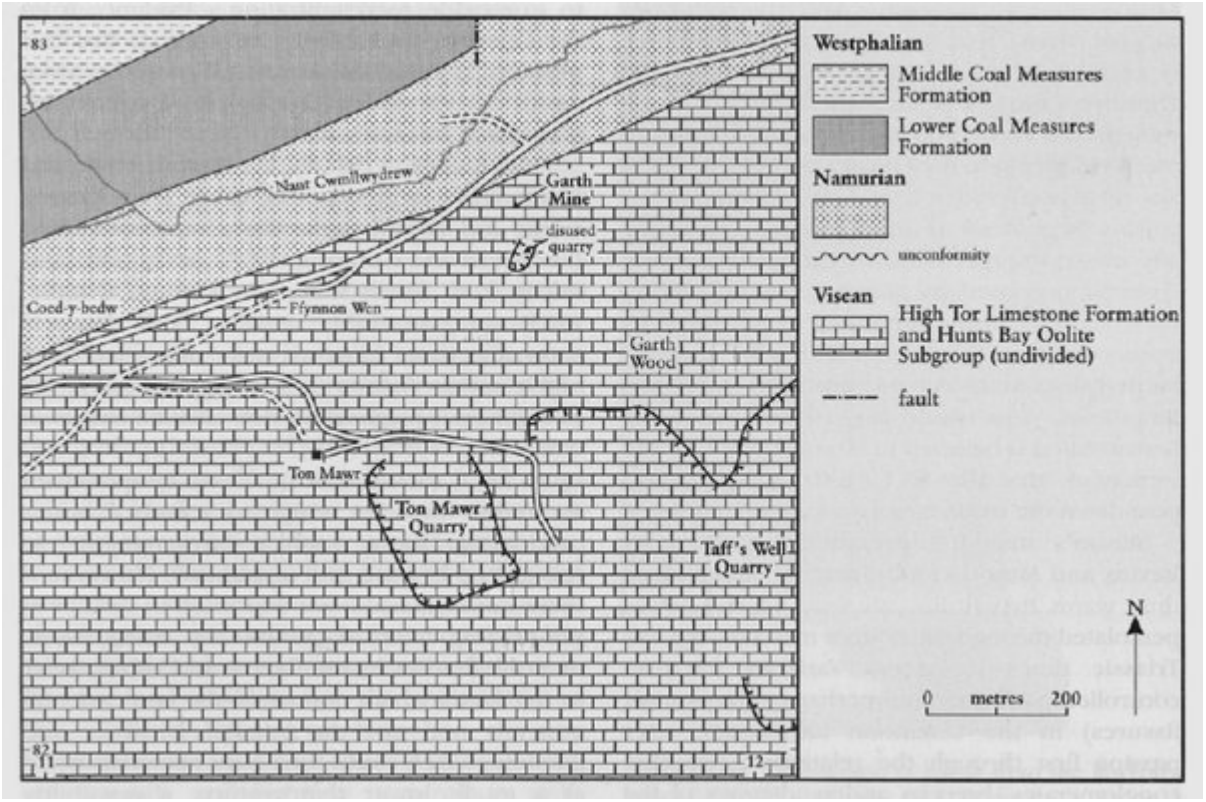
Barite was apparently the earliest 'spar' mineral to crystallize during this metasomatic episode, as it is overgrown by the rhombic calcite and, in addition, has been seen in the neighbouring Taff's Well Quarry to be over grown by the coarse, scalenohedral calcite. The generalized paragenetic sequence of the mineralization at Ton Mawr Quarry is, therefore, iron oxides-quartz-barite-coarse calcite-rhombic calcite, the mineralizing process involving metasomatic replacement of host-rock carbonate throughout.

The fact that such parageneses, and various modifications thereof, have been reported throughout the iron-oxide mining district (Rankin and Griddle, 1985) is suggestive of an extensive, open system in which the introduced fluids superimposed successive generations of mineralization as they attacked the carbonate host-rocks; the more the host rocks were attacked, the more permeable pathways were created through them. It is perhaps surprising, therefore, that the cavity-fill assemblage of the iron-oxide mining district nowhere contains base-metal mineralization (Bevins and Mason, 2000). Such mineralization, of Mississippi Valley-type (MVT) affinities, is widespread in the Dinantian rocks that crop out to the south of the South Wales Coalfield. However, it is apparently restricted in its occurrence within the Dinantian strata to linear, re-activated Variscan fractures, only spreading out laterally to fill cavities where developed in the overlying marginal conglomeratic facies of the Triassic Mercia Mudstone Group and the marginal shelly limestones of the succeeding Lower Lias, as described at the Ogmore Coast GCR site.

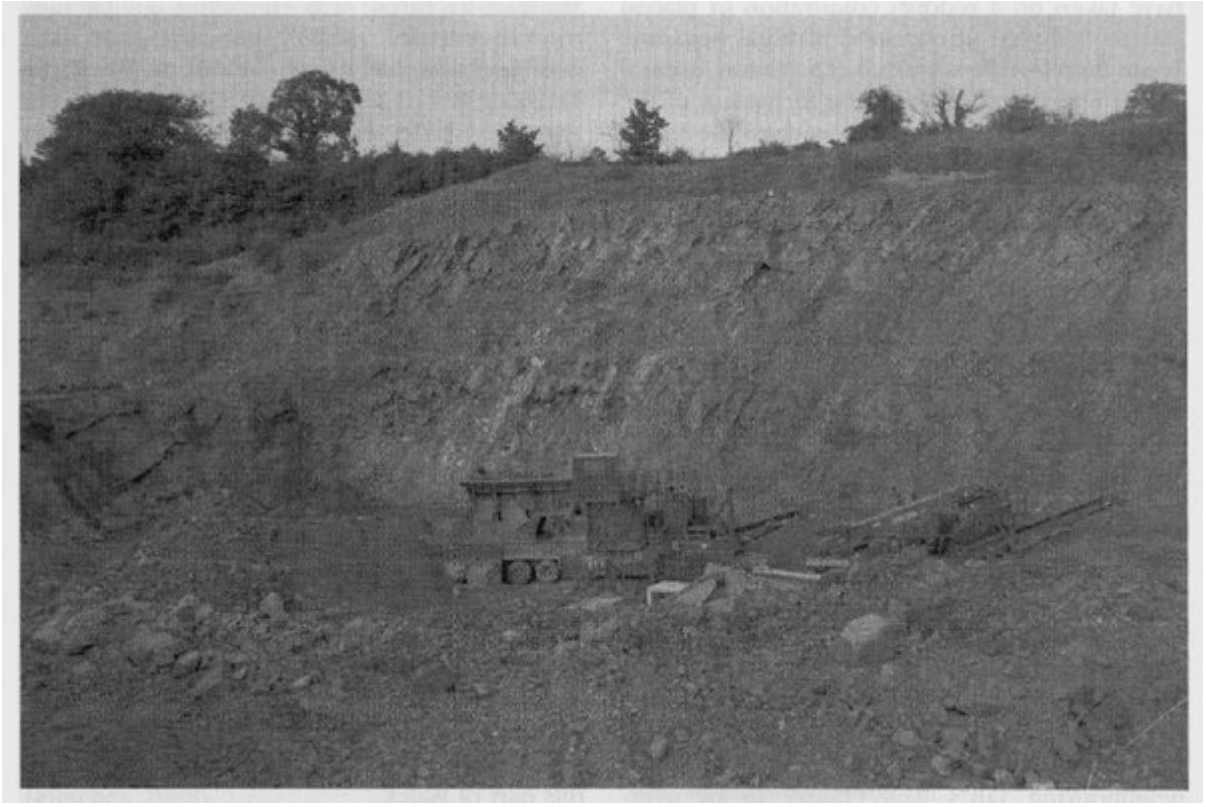
## Conclusions

The occasionally spectacular, vuggy mineralization exposed in the working Ton Mawr Quarry was formed by the reaction between dolomitized and hematized Carboniferous limestones of Dinantian age and aggressive hydrothermal fluids migrating through the tilted strata. The sequence of deposition indicates a transition from barite deposition through to calcite, although the lack of base-metal ores in the cavity-fill assemblage is a curious feature. It is inferred that the cavity-fill assemblage represents a mineralizing event developed after the oxide-fades iron mineralization event and before the later Mississippi Valley-type base-metal-bearing mineralization event in this part of Wales.

**References**




*(Figure 5.83) Map of the Ton Mawr Quarry GCR site. After Institute of Geological Sciences 1:10 000 Sheet ST18SW (1979).*



*(Figure 5.84) Photograph of the Ton Mawr GCR site showing well-bedded limestones dipping to the NNW (Photo: L. Garfield.)*