Maen-gwyn Farm

[SH 425 825]

Potential GCR site

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Introduction

This site records the original intrusive relationship between two components of the Coedana Complex, namely the Coedana Granite and its low-grade hornfels. Country rock relationships are rare among the Precambrian intrusions of southern Britain, and in all other instances where they are preserved they are generally associated with volcanic successions. The sedimentary nature of these hornfels serves to detail part of the pre-intrusion history of the complex.

The hornfels were studied in detail by Greenly (1919) who regarded them as equivalent to the Church Bay Tuffs, now interpreted by Gibbons and Ball (1991) as part of the Gwna Group, and by Phillips (1991a) as part of the New Harbour Group, Monian Supergroup. Subsequent, but unpublished, views of Greenly revoked this (1919) interpretation and instead considered the hornfels as a sedimentary sequence, with a volcanic component, into which the Coedana Granite was intruded. Greenly provided a detailed petrological study of the hornfels, dividing them into cryptocrystalline and crystalline varieties, which were further, subdivided by Horák (1993) into four sub-types. Only three can still be observed in outcrop, the predominant sub-type being the fine-grained quartzo-feldspathic hornfels and the next most common, a slightly coarser muscovite-bearing variety.

The hornfels occur both as a marginal country rock to the granite, on its north-eastern and south-western sides, and as xenolithic masses within the intrusion. In many instances, particularly where the hornfels rim the granite, they have responded in a brittle fashion to deformation and this has resulted in movement along the original intrusive contact. This site has been chosen as it consists of a small mass of hornfels that is both submerged in and cross-cut by granite, so demonstrating unequivocally the original relationship between the two units. The green-schist-facies metamorphic grade and deformation state of the hornfels provide useful information on the emplacement environment of the granite.

The intrusive age of the Coedana Granite has been dated at 614 ± 4 Ma (U-Pb zircon method) (nicker and Pharaoh, 1991), which is consistent with the metamorphic ages derived from the hornfels (e.g. Moorbath and Shackleton, 1966; Fitch *et a/.,* 1969). Further details of the ages are given in the introduction to Chapter 7.

Description

The site (Figure 7.4) encompasses typical muscovite hornfels. The hornfels are fine-grained and generally steel-grey in colour, but locally they show centimetre-scale variations in the mica and quartz content that defines an original (S_0) sedimentary layering. The low-grade nature of the hornfels also preserves a second fabric (S_1) which, being virtually parallel to S_0, forms a composite fabric in the rock.

To the north-west of the farmhouse, a small rocky knoll exposes both the fine-grained and muscovite-bearing varieties of hornfels enclosed within the granite. The hornfels have pale colours and are more bleached than the exposures in the farmyard. Banding on a centimetre scale represents the S_0 layering. Parallel to that structure is a more closely spaced (millimetre scale) fabric designated as S_1. This composite fabric dips steeply to the south-west. In the middle of the north-western side of the site, two small granite veins up to 6 cm wide cut the hornfels at a low angle to the composite fabric and are traceable for a distance of a few metres. A few metres towards the south-western end of the outcrop, two larger granite veins cut the hornfels at a high angle to the fabric and the southwestern end of the exposure is entirely within coarse-grained granite. The granite cutting and enclosing the hornfels is non-porphyritic and biotite-bearing, with pink K-feldspar; it has a weakly developed ductile foliation striking 290°. It is noteworthy that this site is just 500 m to the

south-east of Greenly's type locality for the Coedana Granite, near to Coedana Chapel. There, weakly porphyritic granite shows a well-developed, NE–SW trending, ductile foliation.

Interpretation

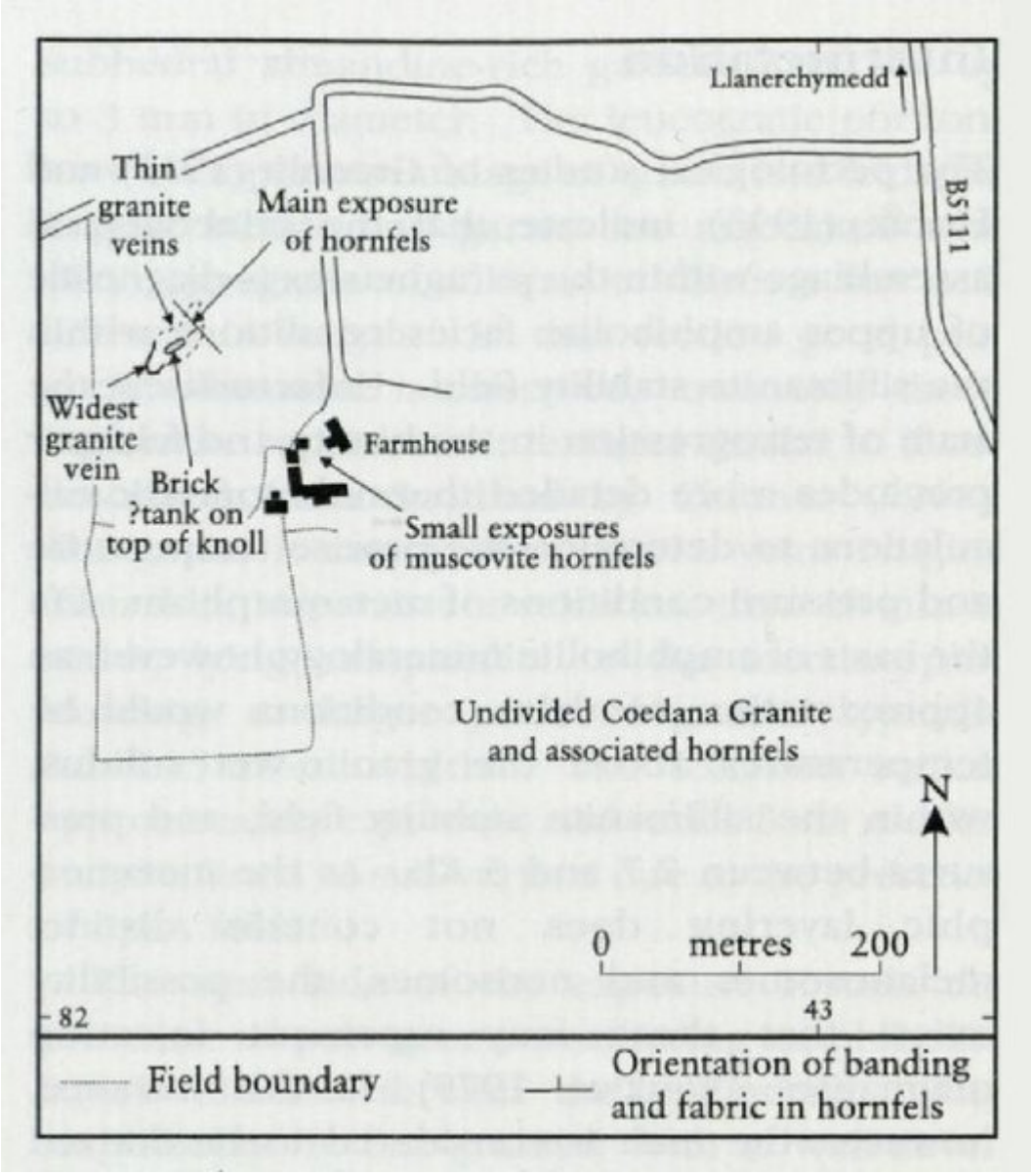
The hornfels represents quartzo-feldspathic sedimentary rocks whose composite fabric records a pre-intrusion history involving two episodes, S_0 representing the formation of the original sedimentary layering, and S_1 a tectonic foliation associated with a folding deformation observed locally. Both of these structures are interpreted as having developed prior to the intrusion of the Coedana Granite, because veins of the latter cut across the composite fabric. The weak, post-magmatic, ductile fabric seen in the granite veins is equated to the extensive brittle deformation seen in the hornfels; other than post-dating S_1, the age of this deformation is not known.

The mineral assemblage of the hornfels: chlo-rite-muscovite-biotite, is indicative of low-grade metamorphism in the greenschist facies. Isotopic data derived from metamorphic muscovite from the hornfels yielded dates of 596 ± 15 Ma by the Rb-Sr method (Moorbath and Shackleton, 1966) and 598 ± 10 Ma by K-Ar analysis (Fitch *et al.,* 1969). Such values are consistent with this metamorphism (and cooling) occurring after the intrusion of the Coedana Granite at 614 ± 4 Ma (Tucker and Pharaoh, 1991). These data also demonstrate that the foliation and folding observed in the hornfels are Precambrian in age.

Conclusions

The rocks exposed at this site have an important bearing on the evolution of the Coedana Complex, and in particular the history of heating and deformation experienced by the country rocks into which the Coedana Granite was intruded. On display here are representatives of both the muscovite-rich and fine-grained varieties of the hornfelsed country rocks along the margin of the granite. Their low-grade, green-schist facies metamorphism contrasts with the upper amphibolite grades attained in the gneisses seen at the Tyddyn Gyrfer site. These exposures demonstrate that at least one phase of ductile deformation (S_i) affected the hornfels, before the intrusion of veins emanating from the Coedana Granite.

References



(Figure 7.4) Locality map of the Maen-gwyn Farm site.