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CRAIG MORE

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Introduction

The Comrie pluton of Perthshire is best known for the classic study of a contact metamorphic aureole made by Tilley (1924), following Nichol (1863) who was the first to observe the hardening of the slates and attribute this to recrystallization close to the igneous contact. The intrusion of the pluton into Dalradian metasedimentary rocks with a variety of pelitic, semipelitic and psammitic lithologies and low regional metamorphic grade made it ideal for these pioneering studies. More recently the high-grade contact metamorphic rocks adjacent to the pluton have been studied in detail (Pattison and Harte, 1985) and a low-pressure environment of contact metamorphism has been established from the mineral assemblages. In a classification of contact metamorphic facies series (Pattison and Tracy, 1991), the aureole is cited as a type example of a particularly low-pressure facies that is notable for the prevalence of spinel and hypersthene and the absence of garnet in high-grade cordierite-bearing assemblages.

The Craig More GCR site has excellent exposures of pelitic rocks throughout the increasing contact metamorphic grade up to the contact with the diorite, and is included in the excursion guide by MacGregor (1996).

Description

The area between the Caravan Park at Old Lodge and the margin of the diorite just east of Craig More represents a complete section through the aureole (Figure8.27). Here the country rocks are the Aberfoyle Slate of the Southern Highland Group of the Dalradian. The unaffected rocks near Old Lodge are greenish pelites said byTilley (1924) to lie in the chlorite zone of regional metamorphism.

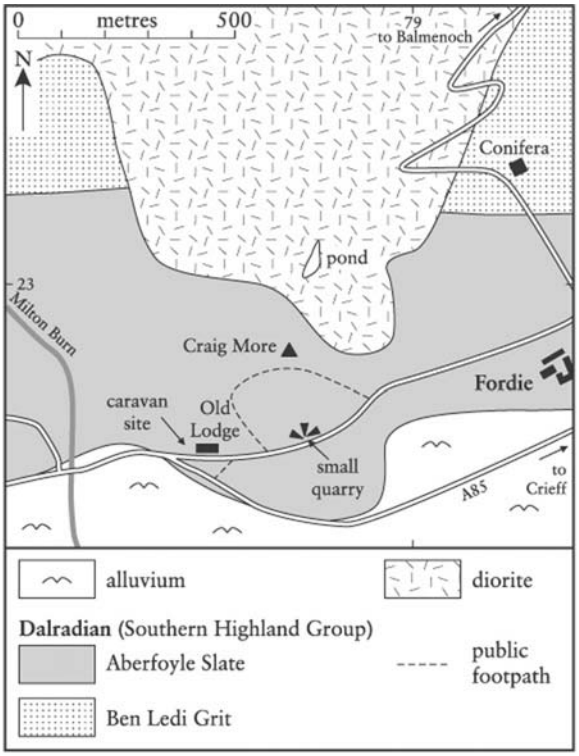

Figure 8.27: Map of the area around the Craig More GCR site, Comrie pluton, adapted from MacGregor (1996).

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In a traverse from outside the aureole up to the igneous contact the following sequence of changes can be observed. About 400 m from the contact dark spots of phyllosilicates begin to appear. These spots are composed of aggregates of chlorite and muscovite whichPattison and Tracy (1991) suggest represent altered cordierite poikiloblasts. Within another 100 m extensive recrystallization is evident from the rapid loss of fissility along strike. In the final 120 m leading up to the contact on the side of Craig More, there is total loss of fissility and massive hornfelses occur containing assemblages with cordierite and K-feldspar. Muscovite has declined in abundance by this stage and the rock is very hard with a purplish colour on fresh surface, in marked contrast with the greenish-grey colour of the soft Aberfoyle Slate outside the aureole.

The contact of the hornfels with the intrusion is well displayed on the wooded slopes east of Craig More. Here a coarse-grained slightly pink granodioritic rock exposed on the lower ground is capped by the hornfels. A contact between chilled dark diorite and high-grade hornfels can be seen, although there is little visual distinction between these lithologies at the immediate contact. The contact appears to be at a shallow inclination, and it seems that the present exposure level is not far from the original pluton roof. White granitic veins cut the hornfelses and may be evidence of local anatexis.

Microgranodioritic dykes (formerly termed ‘porphyrites') radiate from the pluton and many can be seen cutting the aureole rocks. Sulphide is quite abundant locally in the major intrusions and this pluton was actively explored for mineralization in the 1980s.

Craig More is also a good vantage point to view the line of the Highland Boundary Fault which runs ENE–WSW about 1 km south of Comrie essentially along Glen Artney. Small movements on this fault are still felt and one of the first seismometers was built by villagers in Comrie.

Interpretation

The diorites of the Comrie pluton vary considerably in their mineralogy, but include two-pyroxene diorites. These are important because several geothermometric calibrations exist for coexisting ortho- and clinopyroxenes. Mahmood (1986) derived temperatures of 950–1100°C for two samples of diorite using various calibrations; it seems likely that these may be on the high side given more recent calibrations (as reviewed byAnderson, 1996). A large mass of dioritic magma, probably consisting largely of melt judging by the textures, was intruded probably in excess of 900°C. This generated the*c.* 400 m-wide metamorphic aureole around the pluton. Conditions inside the aureole probably reached melting temperatures locally, as the granophyric intergrowth texture of K-feldspar and quartz in some of the high-grade hornfelses suggests anatexis (Pattison and Tracy, 1991). Wilde (1995) has suggested that temperatures of about 750°C were reached in the immediate vicinity of the contact where local melts were injected as granitic veins. Analyses of these veins indicate that they are close to minimum melt compositions at 0.5 kbar. The detailed studies of the aureole mineral assemblages byPattison and Harte (1985) did not place an estimate on the geobarometric conditions, except that the aureole was at lower pressures than the Ballachulish aureole, which they suggested tentatively was between 2.5 and 4 kbar.

The Craig More outcrops provide an outstanding example of a low-pressure aureole in pelitic rocks and, although there are still many uncertainties about the precise pressure and temperature conditions and other factors such as the role of water, progress in these areas is being facilitated by new technological and theoretical developments. The Comrie aureole will continue to be an important case study for metamorphic petrologists.

These outcrops also provide a good example of a Caledonian pluton exposed close to its original roof. The low apparent pressure of the aureole indicates emplacement at a shallow level in the crust, but the reason for the trend of the pluton across the regional strike is not known.

Conclusions

Country rocks close to the southern end of the Comrie pluton, in the vicinity of Craig More, exhibit one of the most spectacular contact metamorphic aureoles in Britain. The GCR site has

historical importance for early studies of contact metamorphism and has been cited as a type example in a recent classification of contact aureoles. Pelites can be traced over a distance of about 400 m, from those showing no evidence of contact metamorphism, through rocks with a range of mineral assemblages, to rocks with evidence of melting. The aureole has several distinctive mineral assemblages, although the absence of garnet is notable. These assemblages have provided useful information on the conditions of metamorphism, up to contact melting at about 750°C adjacent to a body of dioritic magma, which was probably intruded at a temperature of at least 900°C.

Diorites and granodiorites are the main intrusive rocks at this site, and the pluton is exposed just beneath the level of the original roof.

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