Craig Rossie

[NN 980 125]

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Introduction

The acid volcanic rocks around Craig Rossie in the Ochil Hills form only a small part of the outcrop of the Lower Old Red Sandstone, Ochil Volcanic Formation. In general this formation consists of a wide variety of basaltic and andesitic lavas interbedded with volcaniclastic rocks for which the GCR sites of Sheriffmuir Road to Menstrie Burn and Balmerino to Wormit provide adequate reference. In contrast, acidic flows are areally restricted and are confined to high stratigraphical levels within the volcanic pile. The Craig Rossie rhyodacite, on the NW limb of the Ochil Anticline, is well exposed in hillside exposures, in the cliffs of Craig Rossie itself and in a quarry at [NN 9770 1277] (Figure 9.29). The flow is of local distribution and is believed to occupy a topographical low in the pre-existing volcanic landscape. It is a feldspar-biotite-quartz-phyric rock that shows well-developed flow-banding picked out by colour variation.

The hill of Craig Rossie is a good example of an escarpment with dip slope. The summit and the eastern escarpment (Figure 9.30) have been affected by major landslips, formed after the retreat of the last ice sheet from the area less than 15 000 years ago.

Description

The Ochil Volcanic Formation in the Craig Rossie area generally consists of altered and weathered basalt and basaltic andesite lavas, which are commonly vesicular and autobrecciated (Geikie, 1900; Francis *et al.,* 1970; Taylor, 1972). These rocks are not conspicuously porphyritic but olivine-, feldspar-, clinopyroxene- and hypersthene-phyric types are present as well as aphyric forms. Interbedded in this succession are trachyandesites, rhyodacites and some volcaniclastic rocks. The Craig Rossie rhyodacite is immediately overlain by a trachyandesite which is the youngest flow in the Ochil Volcanic Formation of this area. A unit of volcaniclastic rocks of uncertain origin is present within the succession a little beneath the rhyodacite. It consists of gravel- to pebble-sized clasts of volcanic material, generally of poorly rounded to subrounded shape, in a massive, greenish-grey, poorly sorted sandy matrix. It is not known whether the matrix is entirely derived from volcanic rocks or whether it includes quartz grains derived from sedimentary rocks.

The Craig Rossie rhyodacite is brown, dull red or pink in colour. It contains phenocrysts, particularly of pale-coloured feldspar but also of quartz and biotite, in a fine-grained crystalline matrix. Its petrography and geochemistry are described by Francis *et al.* (1970) and by Taylor (1972). As far as is known, the rhyodacite is a single lava and no separate flow units have been recognized. Its most striking feature is the widespread occurrence of colour-contrasted flow-banding due to subtle mineralogical differences. This flow-banding developed as the cooling magma passed through a viscous phase, developing folds just prior to solidification. The folds are usually open in form but locally become overfolded. Undeformed flow-banding is seldom parallel to the base of the flow. A feature of the rhyodacite in the quarry [NN 9770 1277] is the presence of xenoliths, 5–10 cm across, of coarse-grained igneous material. These may be of gabbroic or dioritic rock by analogy with those found at the Rossie Braes Quarry [NO 249 120] near Auchtermuchty in Fife, where fragments of layered cumulate have also been found (Thirlwall, in Armstrong *et al.,* 1985, p. 36). Other features noted include amygdales of calcite and red chalcedony near the supposed top of the rhyodacite and patches of fine-grained sedimentary rock, which have have been recorded as infilling fissures or spaces between auto-brecciated blocks near the base.

The volcanic sequence at Craig Rossie dips to the NW at between 20 and 30°. It is cut by at least two significant NW-trending faults that throw down the base of the rhyodacite to the SW and NE respectively. Other smaller faults with similar trend are also present, together with related joints. Small crush zones associated with the faulting have voids infilled with chalcedony.

Interpretation

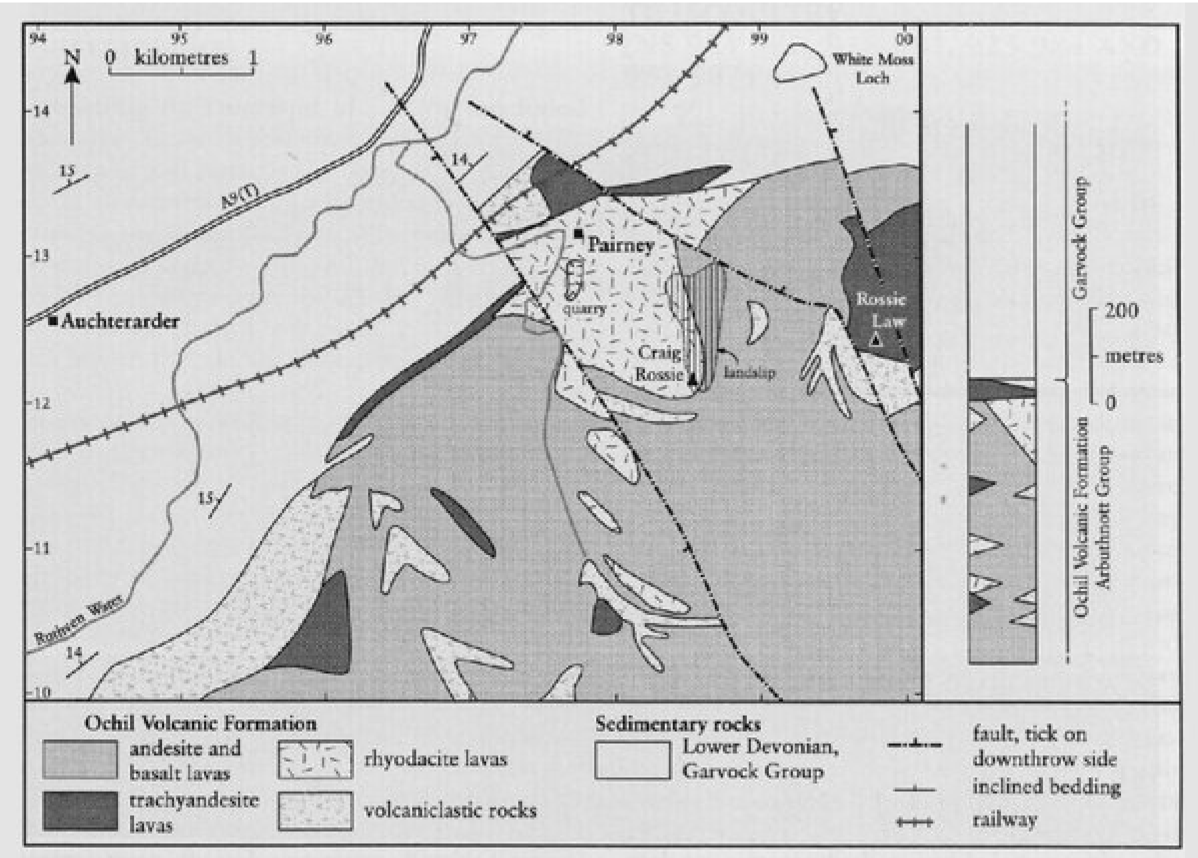
Armstrong (in Francis *et al.,* 1970) concluded that the Craig Rossie rhyodacite occupies a depression in pre-existing lavas, is of lenticular form and thins out both eastwards and westwards. The evidence for the topography is to be found in the Pairney Burn and in an adjacent gully eroded along a NW–SE fault. Here the flow overlies an amygdaloidal basalt and the base can be traced. If the base is parallel to the flow-banding, the underlying basalt should occur along strike in a deeply cut glacial channel a short distance to the NE. Since the basalt does not occur here, the rhyodacite base must descend north-eastwards from the visible outcrops in a manner discordant to the flow-banding and thus presumably occupies a depression.

The rhyodacite forms a minor acidic part of the generally basalt and basaltic andesite assemblage of the Ochil Volcanic Formation. While noting the marked silica gap between the more basic rocks (SiO_2 < 62%) and the rare 'rhyolites' (SiO_2 > 74%), Thirlwall (1983b) believed that the acid rocks could be generated by fractional crystallization from some of the more mafic lavas, even though extensive liquid lines of descent are not present. In this context, it is not surprising that rhyodacitic flows are restricted to high stratigraphical positions in the volcanic pile.

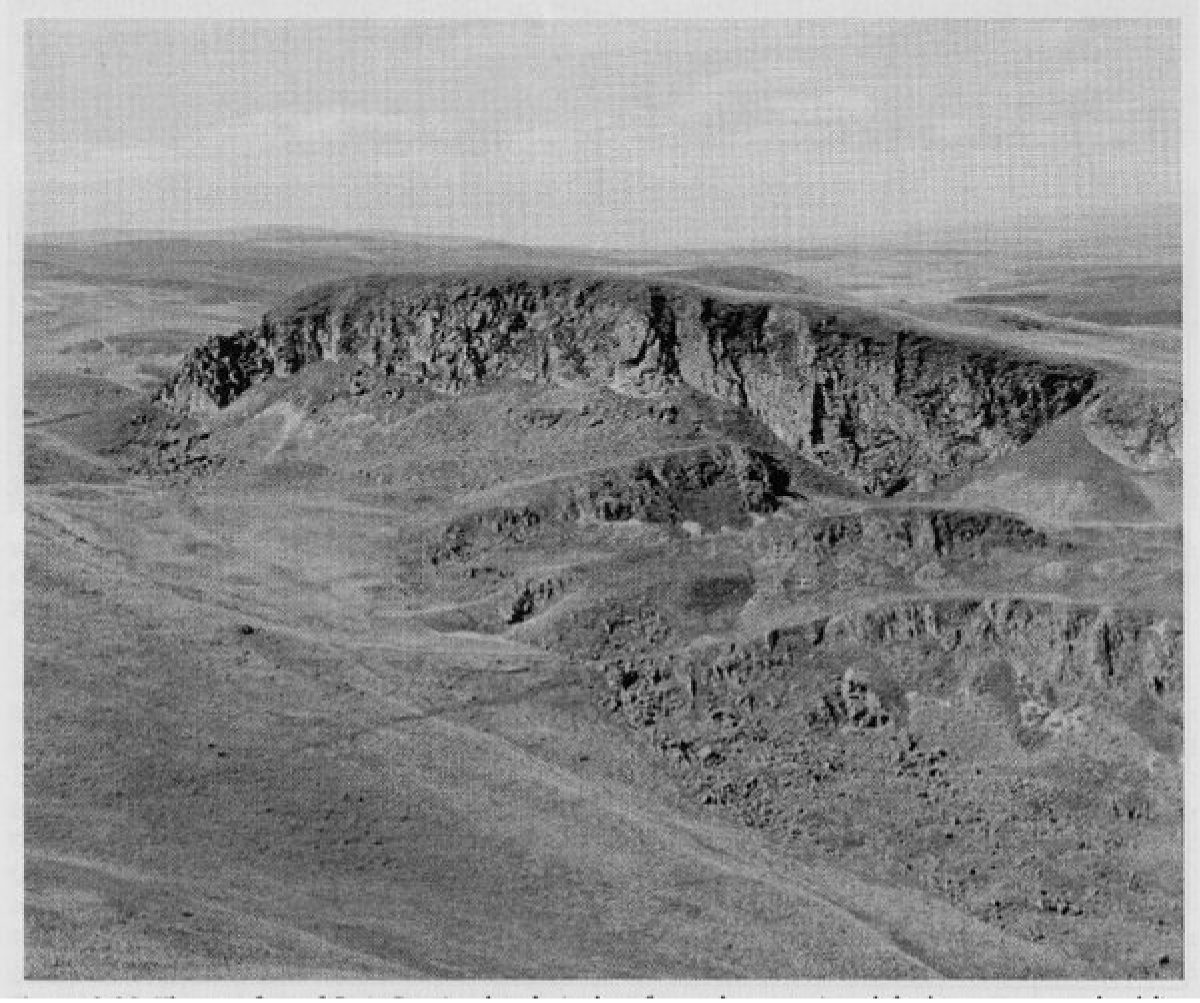
Conclusions

The importance of this site lies in the excellent exposures and geomorphological expression of this rare, flow-banded, acidic lava within the primarily basaltic and andesitic Ochil Volcanic Formation. Craig Rossie thus provides a complement to the areally more extensive GCR sites between Balmerino and Wormit, and in the Sheriffmuir Road to Menstrie Burn area. The pre-existing topography below the flow base is an interesting feature of the site. The rhyodacite is important as a representative end member of fractional crystallization processes which may have operated in the late Caledonian magmas. Further study of the recently found coarse-grained xenoliths may provide information concerning possible parental material and this would add to the conservation value of this site.

References



(Figure 9.29) Map and generalized vertical section of the Craig Rossie GCR site.



(Figure 9.30) The east face of Craig Rossie; rhyodacite lava forms the summit and the lower crags are landslips. (Photo: BGS no. D2181.)