SHERIFFMUIR ROAD TO MENSTRIE BURN

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Introduction

This well-exposed part of the Ochil Hills shows many of the characteristic features of the volcanic and volcaniclastic rocks of the Lower Old Red Sandstone, Ochil Volcanic Formation. The 600 m-thick sequence in the Ochil Fault scarp, from the summit of Dumyat down to the bottom of Menstrie Glen (Figure 9.28) consists of subaerial lava-flows interbedded with volcaniclastic rocks variously interpreted as being of pyroclastic and sedimentary origin. Detailed descriptions are given by Francis *et al*. (1970) and accounts of the petrology and geochemistry of lavas in the western Ochils in general are given byTaylor (1972) and Thirlwall (1979). A suite of dykes and sills adds to the interest of this site, which complements the Balmerino to Wormit GCR site at the NE end of the Ochil Volcanic Formation outcrop. The site also forms part of the classic Ochil Fault escarpment view, as seen from Stirling Castle and the Wallace Monument.

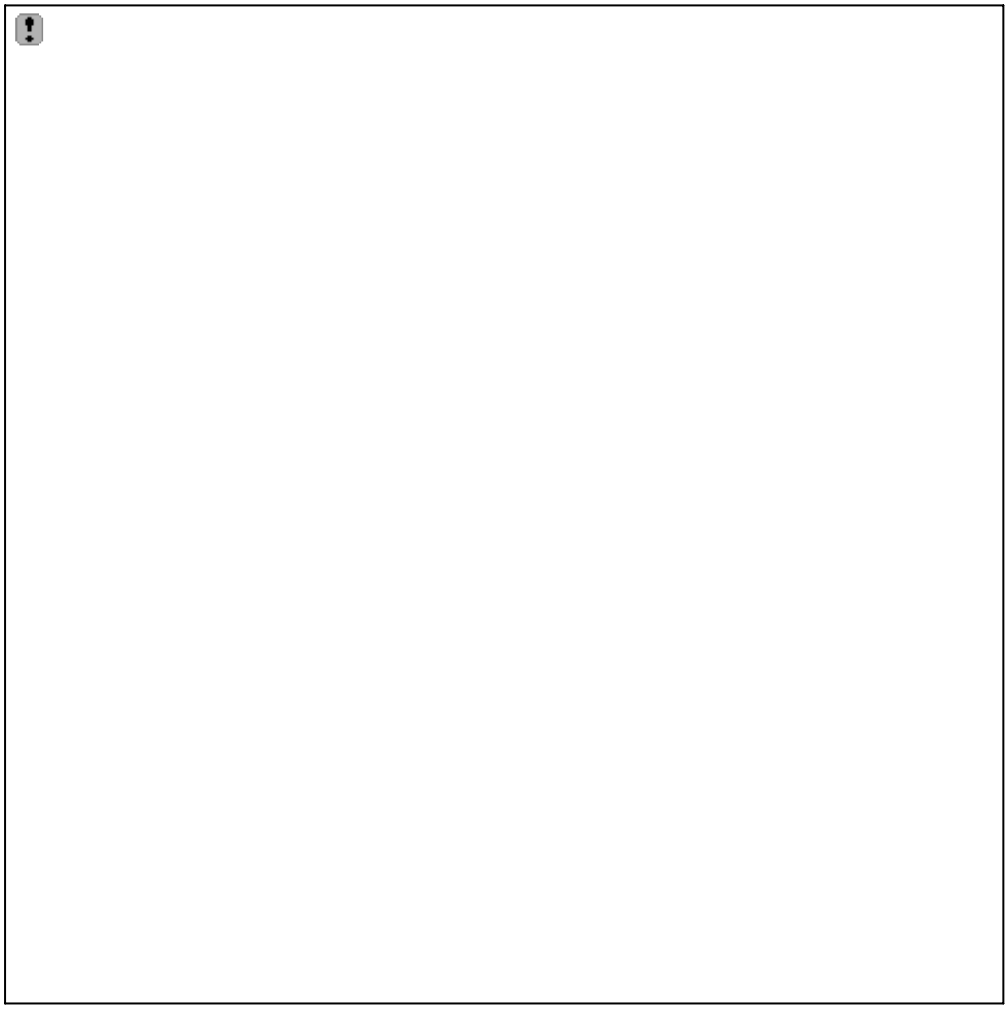

Figure 9.28: The Ochil Fault scarp above Menstrie. The scarp face exposes a 600 m-thick sequence through the Ochil Volcanic Formation, dipping gently to the north (right). Menstrie Glen is in the bottom right and the prominent summit is Dumyat. (Photo: BGS no. D2066.)

Description

A measured section of the volcanic succession, derived from this area, has been given by Francis *et al*. (1970, pp. 31–32) (Figure 9.27). It consists of at least 20 lavas, from 3 to 30 m thick, interbedded with volcaniclastic rocks in units up to 50 m thick. In the past the latter rocks have largely been described as of pyroclastic origin.

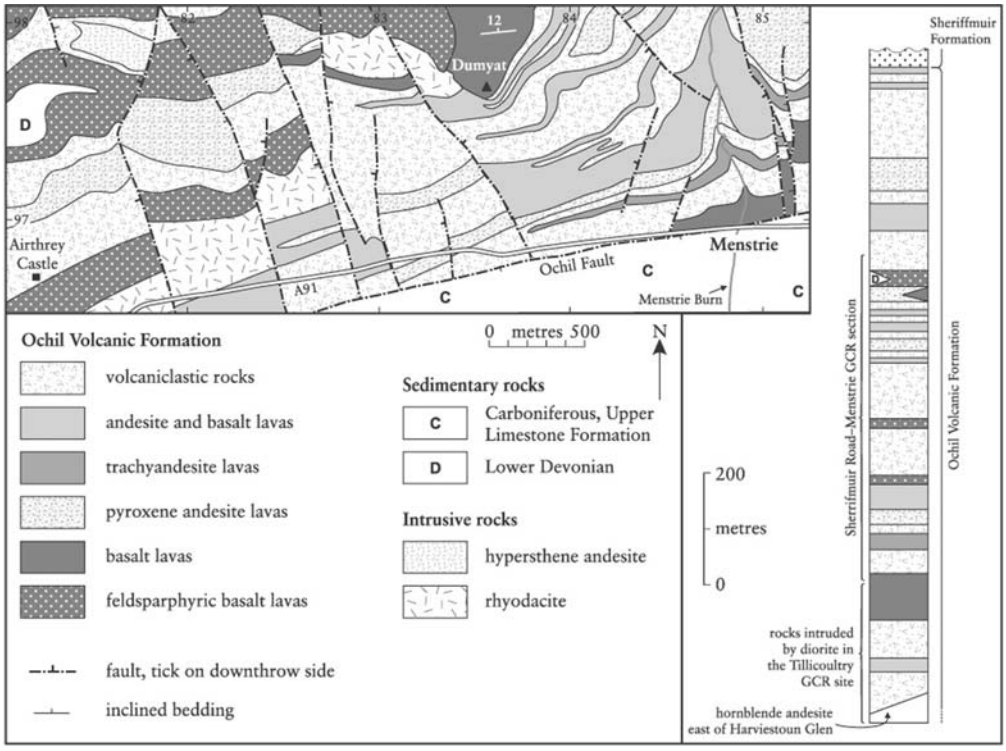

Figure 9.27: Map and generalized vertical section of the Sheriffmuir Road to Menstrie Burn GCR site.

The lavas are mainly basalts, basaltic andesites and andesites with a few ‘trachyandesites'. The basalts and andesites are normally only distinguished from each other by their geochemistry. They range from fine- to medium-grained and from micro- to macro-porphyritic in texture. Most are feldspar-phyric (labradorite–andesine) but clinopyroxene (diopsidic augite), orthopyroxene (bronzite) and olivine phenocrysts are also present in many rocks, and there are some hornblende-phyric andesites (Thirlwall, 1979). Thirlwall noted that the rocks described as trachyandesites by Francis *et al*. (1970) and classed as dacites by Taylor (1972) are not notably more alkaline than many other Ochil andesites. The term is, however, considered as a useful misnomer to describe these sparsely porphyritic and slightly more siliceous rocks. The lavas are usually grey when fresh but more commonly purplish where altered and weathered. They may be vesicular or amygdaloidal, and autobrecciation is common, but this is difficult to detect unless the voids between blocks or fissures contain infiltrated sediment. Flow texture and jointing are developed in some of the flows.

The volcaniclastic rocks, which form a significant part of this succession, consist of crudely and thickly bedded, massive, commonly matrix-supported breccias and conglomerates with only one example of volcaniclastic siltstone noted. The largest clasts are up to 1.2 m across, with an average size being 30 cm or less. They are extremely poorly sorted, with the matrix consisting mainly of volcanic detritus of sand to silt grade.

A sill of possible rhyodacite, over 100 m thick, forms pink-weathering crags and screes on the main fault scarp and in the foothills NW of Blairlogie. This intrusion forms an important marker as it is displaced upwards by faults to the higher slopes west of Dumyat. The rock in the centre of the sill contains scattered microphenocrysts of albitized plagioclase and altered amphibole and orthopyroxene in a cryptocrystalline matrix of quartz and alkali feldspar. The marginal aphyric rocks are pale and blotchy and show some resemblance to the autobrecciated lavas.

The succession is broken by a number of significant faults, mostly trending NNW. Locally these

and related joints are mineralized (Dickie and Forster, 1976); the age of mineralization is possibly early Permian (Hall *et al*., 1982).

Interpretation

According to Francis (1983), the more-proximal zones of central volcanoes of assumed heights of 1–3 km and diameter 40 km at the time of extinction, would not survive erosion to become buried. He suggested that volcanic outcrops of much greater linear extent are likely to represent overlapping or interdigitating products of more than one volcano. The extent of the linear outcrop forming the Ochil and Sidlaw hills far exceeds that of one edifice (Francis, 1983, fig. 22). The volcanic rocks preserved are suggestive of the lower proximal to distal zone of composite volcanoes (Williams and McBirney, 1979) with both moderately thick lavas and massive to thickly bedded volcaniclastic debris-flow (or laharic) breccias and conglomerates predominant (rather than pyroclastic ash-fall or distal ash-flow tuffs and agglomerates). Only one possible vent structure has been identified in the Ochil Hills (now under the waters of the Upper Glendevon Reservoir) (Francis *et al*., 1970), and it is uncertain whether the diorites of the Tillicoultry GCR site and elsewhere represent roots of volcanoes or late stage intrusions. In the above context, the Sheriffmuir Road to Menstrie Burn succession of basalts, andesites and volcaniclastic rocks represents at least one 600 m-thick fragment of a composite (or strato) volcano, the whole volcanic pile locally being over 2400 m thick in the Ochil Hills. There is little evidence for the alternative view that the lavas were erupted from fissures.

Thirlwall (1988) reported a clinopyroxene-whole rock Rb-Sr age of 416.1 ± 6.1 Ma from a lava a little to the north of this GCR site (NN 835 019).

Conclusions

The importance of this site lies in the thick sequence of the Ochil Volcanic Formation laid out largely on the scarp face of the Ochil Fault. The succession is of national importance in understanding the origin and architecture of a major volcanic pile and it complements that of the Balmerino to Wormit GCR site at the NE end of the Ochil Hills. On a regional scale, this calc-alkaline assemblage, with its associated geochemical and radiometric data, contributes to the understanding of late Caledonian subduction and closure of the Iapetus Ocean in northern Britain.

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