Dumbarton Rock - an excursion

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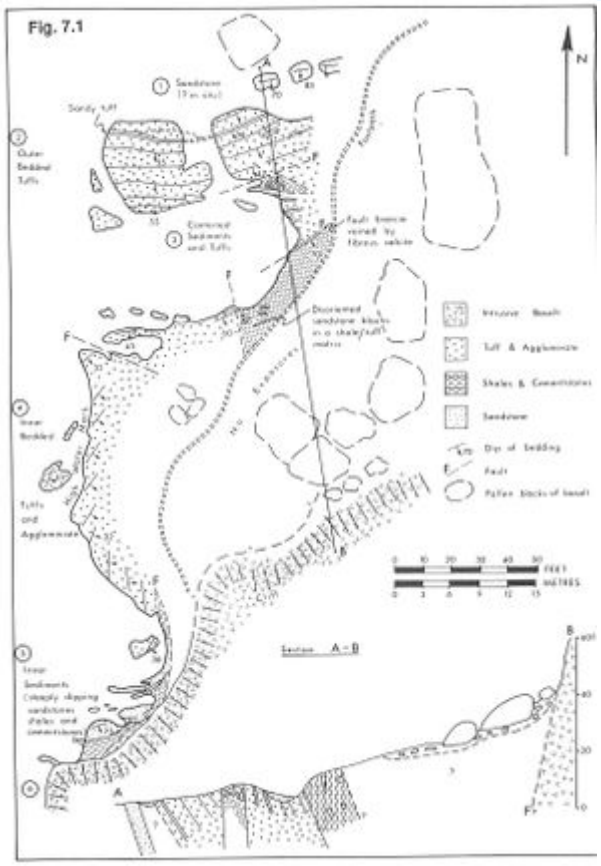

Figure 7.1. Geological map of the north-western part of Dumbarton Rock.

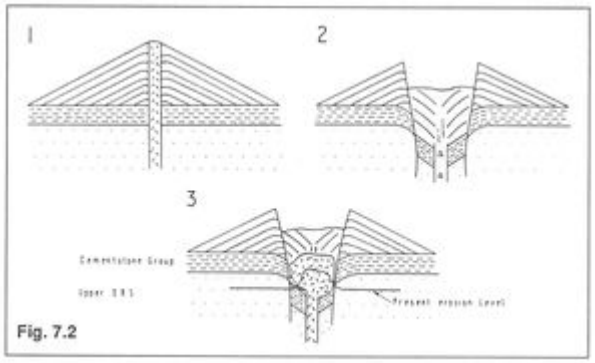

Figure 7.2. Diagrammatic representation of three stages in the development of the Dumbarton Rock vent: 1) active volcano; 2) withdrawal of magma accompanied by fracturing and subsidence; 3) emplacement of plug basalt.
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Contents

Key details

Authors	F.Whyte and D.S.Weedon
Theme	An intrusive basalt plugging the root of a Lower Carboniferous volcano.
Features	Contact relationships, columnar jointing, amygdales, microphenocrysts, bedded tuffs, glacial striae and small-scale roches moutonnées.
Maps	O.S. 1: 50 000 Sheet 63 Firth of Clyde B G.S. 1: 63 360 Sheet 30 Glasgow 1: 50 000 Sheet 30W Greenock
Terrain	Rocky shoreline conditions exist and suitable footwear should be used: no climbing is entailed ; best visited at half to low tide. From Glasgow proceed to Dumbarton, 11 km (7 miles) and follow signs to Dumbarton Rock, which is approached via Castle Road. Parking is easy in the vicinity of the base of the Rock. Access to the shore is along the path from this point, between the rock outcrop and the sawmill (SSSI).
Distance	The total distance from the starting point to the shore section and return is not more than 0.5 km (0.4 mile).
Time	One to two hours on the exposure.

Introduction

In early Carboniferous times widespread volcanism occurred within the Midland Valley, predominantly extrusive in nature. This is seen in the Central (Glasgow) Region as the lavas of the Campsie and Kilpatrick Hills to the north, and those of the Renfrewshire heights to the south. Seemingly these were fed from localized vents along pronounced fissures. By its characteristics Dumbarton Rock stands out as a type example of such a feeder vent. Within its circumference it shows inwardly-dipping agglomerates, typical of a sub-aerial volcanic cone, together with large blocks of slumped overlying Cementstone alongside a central plug of intrusive basalt.

The intrusive basalt has columnar cooling joints, most of which are inclined radially outwards from the centre of the Rock at a steep angle suggesting that the plug narrows downwards, thus enhancing the impression of an unfilled crater.

In the immediate vicinity of the parking area the steep-sided cliffs provide an excellent area in which to study the general nature of the intrusive basalt. It should be noted that although the surface shows an orange/yellow rind of weathering this is very thin and unlike the normal deeper-weathering of basic igneous rocks of the Midland Valley. A fresh surface reveals a fine-grained black igneous rock, micro-porphyritic in part. The micro-phenocrysts are dominantly of plagioclase feldspar, but those of olivine and augite may be present. Using MacGregor's classification (1928) the

intrusive basalt appears transitional between Jedburgh and Dalmeny types.

Locality 1. Exposures of sandstone

These may be erratic blocks but their conformity of strike with those of the nearby outer bedded tuffs indicates strongly that they are in place. It is suggested however, (Whyte 1966, p.110), that their steeper dips, 70°-85°, in contrast with the lesser dips of the outer bedded tuffs, 30 °-50°, implies faulted contacts between them.

Localities 2 and 4. Outer and inner bedded tuffs

These are mainly composed of fragments of volcanic rocks (with subordinate fragments of sandstone, cementstone and shale) in a matrix of fine tuff, calcite and chlorite. A prominent bed of sandy tuff occurs within the outer bedded tuffs.

Locality 3. Contorted sediments and tuffs

Within this fault-bounded zone the rocks are brecciated, veined with fibrous calcite and show small folds related to the faults. Disorientated sandstone blocks in a shale and tuff matrix probably formed by explosive disintegration of shale and sandstone strata accompanied by tuff intrusion.

Locality 5. Inner sediments

Inner sediments, comprising steeply dipping sandstones, shales and cementstones belong to the sequence of rocks immediately underlying the original volcano, and attained their present position, (as did the outer and inner tuffs), by a subsidence of the central part of the volcano, prior to the emplacement of the plug basalt.

Locality 6. Basalt plug

The contact between basalt and sediments dips steeply inwards at about 80 degrees. Near the contact, the normally blue-black colour of the basalt changes to dark green due to the development of chlorite in the groundmass and in amygda les; the plagioclase is albitic in composition.

Apart from this contact zone, throughout the remainder of the plug the blue-black basalt is consistently fine-grained, composed of microphenocrysts of olivine and plagioclase (labradorite) in a groundmass of plagioclase, augite and iron ore. According to MacGregor's classification (1928) this basalt is transitional between Jedburgh and Dalmeny types.

Other features of interest

In the high-level gully which crosses the central part of the Rock there are good examples of glacial striae, first described as long ago as 1855. In addition, the western face of the gully exhibits very small-scale roches moutonnees: looking one way along the face the basalt appears quite rough, whereas looking the other way the same surface appears smooth.

The summit of Dumbarton Rock is a good vantage point for viewing the following: the course of the River Clyde from the restricted channel near Bowling down the widening estuary: the valley of the River Leven and the Cowal hills to the west: Ben Lomond to the north, and Dumbuck volcanic vent and the lavas of the Kilpatrick Hills to the east.

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