Bearraich

OS Grid Reference: NM417274

Highlights

The site contains an excellent succession of basalt flows at the base of the Mull lavas, with good development of columnar jointing, pegmatitic veins and segregations, and associated lignite beds. The lavas are seen to envelop "MacCulloch's Tree'.

Introduction

The south-western part of the Ardmeanach Peninsula at the entrance to Loch Scridain shows a representative and relatively well-exposed, continuous section through the lower lavas of the Plateau Group (Bailey *et al*., 1924) of Mull and Morvern (Fig. 5.1) The majority of the lavas are alkaline to transitional olivine basalts belonging to the Mull Plateau Group (see Table 5.2 for lava correlations, etc.), but the flows at the base of the succession form part of the Staffa Magma Type (cf. Thompson *et al*., 1986). The basal flow envelops "MacCulloch's Tree'.

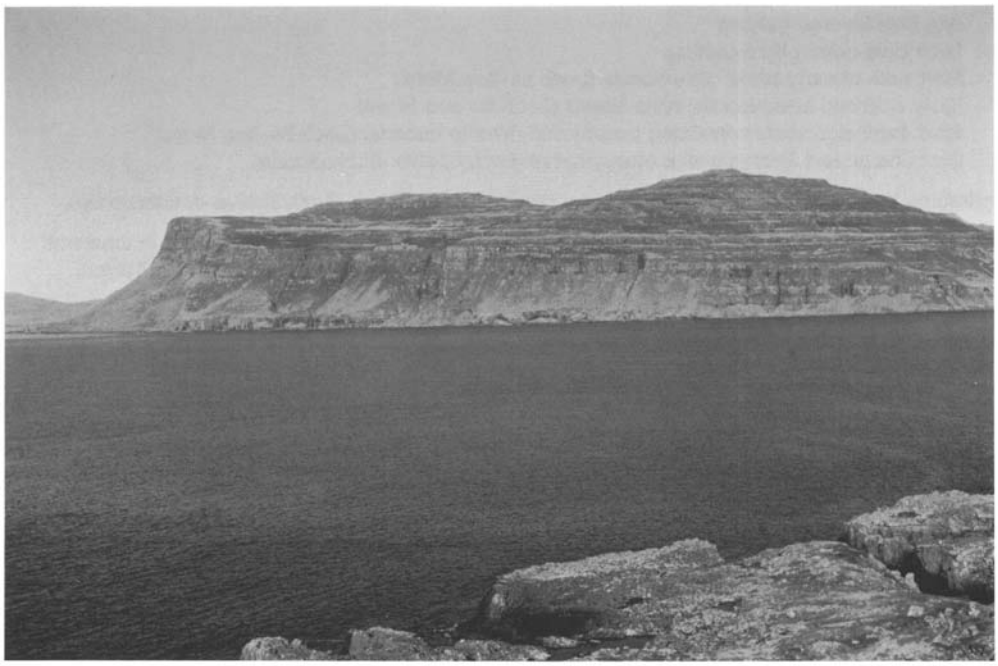

Figure 5.1: The flat-lying succession of basalt lavas of the Wilderness area, western Mull, give rise to the trap-type topography. Bearraich site, Mull. (Photo: C.H. Emeleus.)

The most comprehensive investigation, to date, on the lavas of Mull was published in the classic Mull Memoir by Bailey *et al*. (1924); it remains the only account with comprehensive field data. The geochemistry of the lavas was subsequently reassessed byTilley and Muir (1962) and Beckinsale *et al*. (1978) proposed a new subdivision on the basis of preliminary trace-element and isotope data. Further detailed geochemical investigations byMorrison (1979), Morrison *et al*. (1985) and Thompson *et al*. (1986) suggest that the lavas were significantly contaminated by crustal partial melts during their passage to the surface (see also Introduction to this chapter). The distribution of zeolite minerals within the lavas of Mull, including Ardmeanach, has been studied byWalker (1971).

Description

From Tavool House (NM 437 273; Fig. 5.4) to the Wilderness (NM 405 295), the coastal cliffs provide continual exposure through lava flows which demonstrate spectacular examples of two-tier columnar jointing and complex, auto-intrusive admixtures of massive columnar and

scoriaceous basalt. The majority of flows are fine-grained, aphyric basalts which have a very compact appearance. These are the Staffa Magma Type lavas of Thompson *et al*. (1986) which show transitional, tholeiitic–alkaline, olivine-basalt affinities; they were considered to be pyroxene-rich variants of the mildly alkaline Plateau basalts (Tilley and Muir, 1962). Many of the flows higher in the succession are olivine basalts belong to the Mull Plateau Group (Table 5.2), while others are basaltic hawaiites (Beckinsale *et al*., 1978).

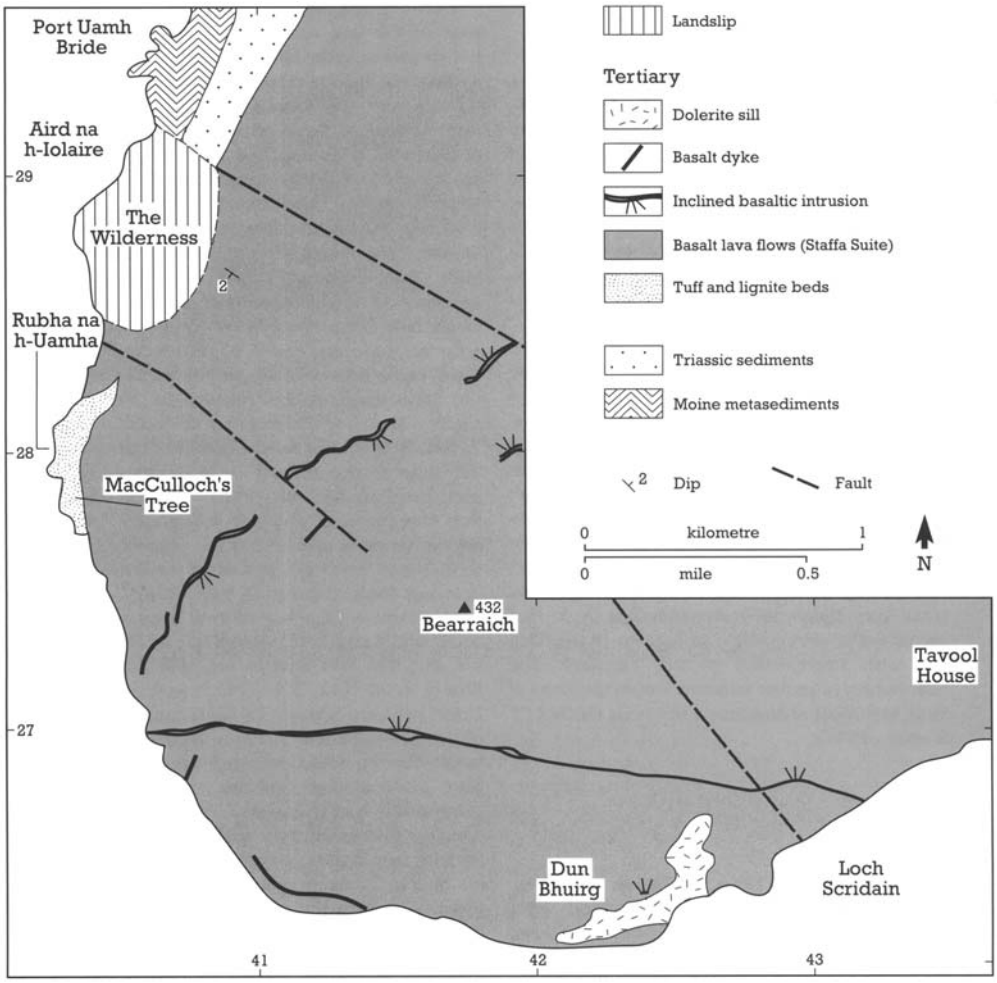

Figure 5.4: Geological map of the Bearraich site (adapted from the British Geological Survey 'One Inch' map, Sheet 43, Iona)

Thin tuff and lignite beds occur towards the base of the lava succession which are contemporaneous with the fluvio-lacustrine sediments at Ardtun. At this horizon, John MacCulloch discovered the well-known large tree fossils, the most famous of these being 'MacCulloch's Tree' at Rubha na h-Uamha (NM 402 278), (Fig. 5.5), an upright coniferous trunk some 12 m high engulfed by lava (MacCulloch, 1819).

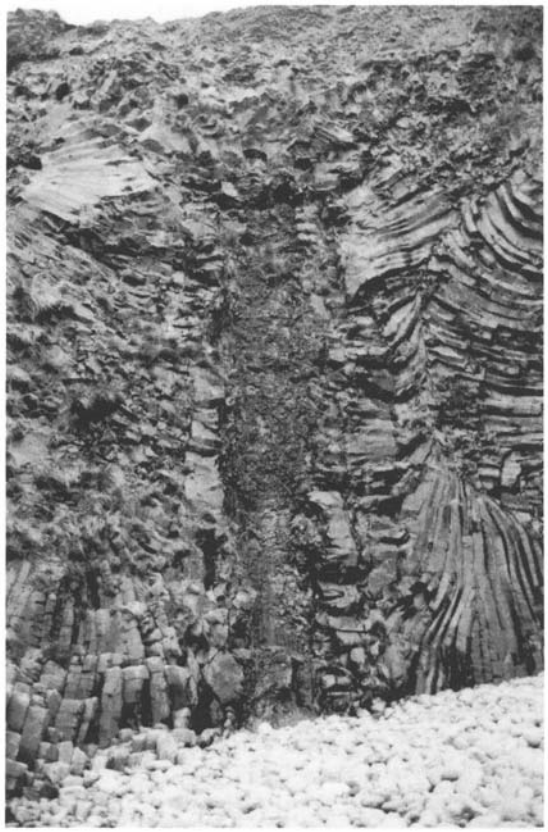

Figure 5.5: 'MacCulloch's Tree' on Rubha na h-Uamha (NM 402 278), an upright coniferous trunk 12 m high engulfed by lava of StafTa Magma Type. Bearraich site, Mull. (Photo: C.J. MacFadyen.)

Above the basal columnar flows of Staffa Magma Type basalt lies the main succession of Mull Plateau Group basalts. This is a thick sequence of medium- to coarse-grained olivine basalt lava flows, some of which contain glomeroporphyritic aggregates of olivine and plagioclase, but others are feldspar-phyric. Chemically, the lavas have mildly alkaline to transitional alkaline–tholeiitic olivine-basalt affinities. Between 25 and 30 flows can be identified from the base of the suite to the summit of Bearraich (432 m), each generally less than 15 m thick and forming the characteristic stepped topography of the region. Of particular note is the presence of red, scoriaceous flow tops, indicating subaerial extrusion and contemporaneous weathering.

Pegmatite segregation veins of augite, feldspar and analcite are observed in a few of the lavas of the site. The lava flow in the cliffs below Dun Bhuirg (NM 422 262) 2 km west of Tavool House on Loch Scridain contains a good example of this phenomenon. The lava, an ophitic, olivine basalt bearing violet-coloured augite and abundant fresh olivine (Plateau Magma Type) is traversed by numerous small veins of analcite and contains cavities filled by zeolites associated with analcite (see Walker, 1971 for zeolite distribution in Mull). Coarse-textured veins of euhedral pyroxene and strongly zoned plagioclase in a matrix of analcite and feldspar also occur. The alkaline nature of their matrix is shown by the presence of aegirine augite, both in the zoned margins of titanaugite crystals and forming individual crystals; segregation of this alkaline residual material could generate rocks of phonolitic, nepheline, syenite composition (cf. the Shiant Isles).

Subsidiary interests of the site include fragments of Mesozoic and basal Tertiary sediments in the small landslip at Aird na h-Iolaire (NM 403 288). Minor Tertiary intrusions include sills of the xenolithic Scridain Suite (Bailey *et al.*, 1924) and pitchstone dykes.

Interpretation

The site provides a virtually uninterrupted section through the base of the Plateau lava succession on Mull, recording the onset of Palaeocene igneous activity. The occurrence of red-weathered tops to lava flows, lignite beds and the nearby Ardtun leaf beds attest to a

subaerial, warm temperate environment of lava effusion. Thick red boles above the weathered flow tops in the vicinity of the site (for example, on Aird Kilfinichen, NM 494 278) may indicate possible lava extrusion in bodies of shallow water, although conclusive evidence is lacking. Walker (1971), in a study of the regional distribution of zeolites in the Ardmeanach lavas, has shown them to have suffered burial sufficient to place them in the laumonite and mesolite zones. The systematic distribution of zeolite zones reflects the depth of burial of the lavas and, on Mull, these zones are discordant to the stratification of the flows. Walker (1971; see also Craig, 1983, Fig. 13.5) compared the Mull zonation with the more complete picture obtained from flows in Iceland, and estimated that the Mull lava succession was originally over 2200 m in thickness.

The lowermost lavas exposed on this site, including the flow enveloping "MacCulloch's Tree', belong to the Staffa Magma Type of Bailey *et al*. (1924) and Thompson *et al*. (1986) (= Group 2, Beckinsale *et al*., 1978). These strikingly columnar flows have provided some of the evidence used by Morrison *et al*. (1985) and Thompson *et al*. (1986) to postulate contamination by crustal partial melts – see Introduction to this chapter. At the present time, the areal distribution of these flows appears to be largely restricted to the base of the lavas either side of the entrance to Loch Scridain and to Staffa; however, there is a lack of modern stratigraphic information about the distribution of these and the other types of lavas recognized on Mull and Morvern, and their spatial distribution remains one of the outstanding problems of Tertiary igneous geology in the Hebrides, requiring a combination of modern geochemical work and careful field investigations.

'MacCulloch's Tree' is one of a number seen enveloped in the lavas within the site. It was assigned to the genus *Cupressinoxylon* by Gardner (1887). The conditions of eruption leading to preservation of this and the other trees have not been discussed in detail, but the enveloping lava must have behaved in a very fluid manner; had a typical, fragmenting flow-front advanced across the area, it is difficult to envisage that the trees remained upright. Further evidence about the environment at the start of lava eruption comes from Ardtun.

Conclusions

The site contains an important, continuous section through the lower part of the Mull lava succession. Geochemical investigation of the lowest flows shows that these were contaminated by crustal material on their path to the surface and this knowledge has been used to construct models of likely magmatic plumbing systems beneath the Mull lavas. The lowermost lavas are tholeiitic–transitional basalts, the main body of the overlying thick succession consists of alkali to transitional basalts. They were erupted subaerially and the lowermost flow engulfed growing trees.

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