

Talisker

OS Grid Reference: NG318333

Highlights

The spectacular coastal cliffs here provide some of the best sections through the highest part of the Skye Main Lava Series (SMLS) which is notable for the variety of lava types within it. The exposures on Preshal More and Preshal Beg demonstrate a thick, ponded flow of low-alkali, high-calcium olivine tholeiite which was erupted after a long erosional interval, following the last flows of the SMLS. The site is the type locality for this distinctive tholeiite which is matched by only one other flow in Skye, although many of the north-west dykes are of similar composition.

Introduction

A coastal cliff section and three well-exposed inland areas have been selected to demonstrate the diversity and complexity of the plateau lava sequence of west-central Skye (Fig.2.6). Collectively, they provide evidence of a thick lava succession (>400 m) comprising flows of picrite, olivine-basalt, hawaiite, mugearite and olivine tholeiite compositions belonging to the Arnaval and Talisker groups (Williamson, 1979). The area was subject to major reassessment by Williamson (1979) following earlier studies by Harker (1904), Anderson and Dunham (1966) and Esson *et al.* (1975).

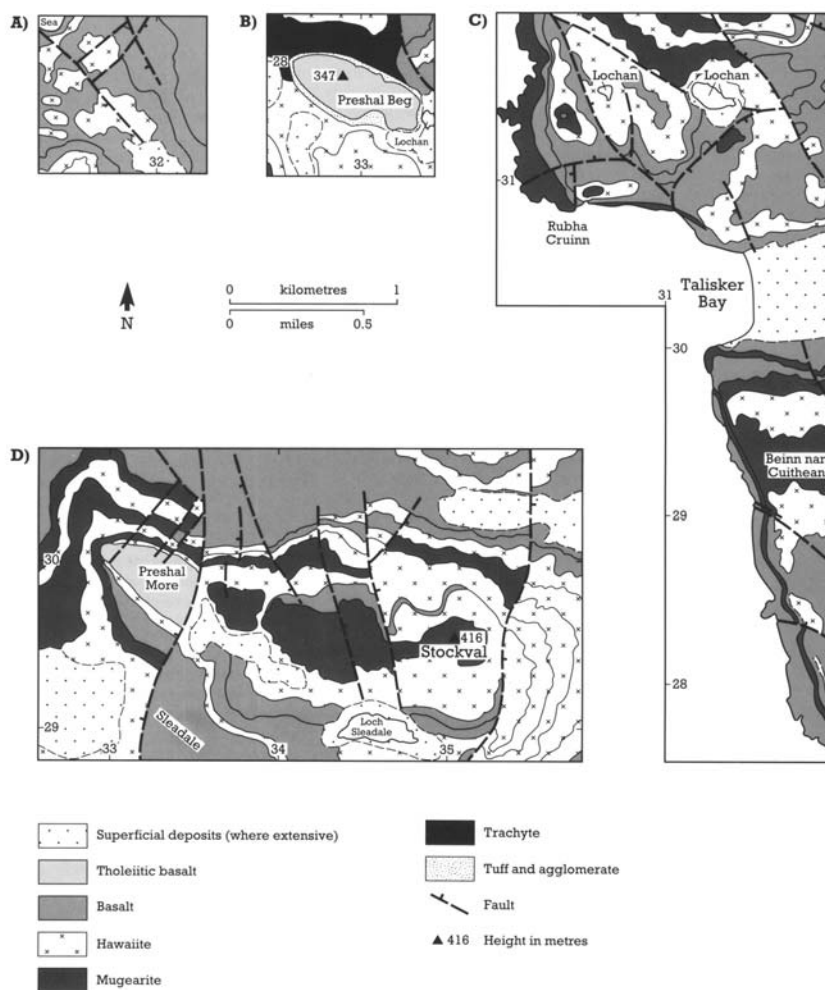


Figure 2.6: A Geological map of the Talisker site (after Williamson, 1979). Area south-west of Fiskavaig

Description

The Talisker Bay (NG 300 315–317 284), Stockval (NG 351 296) and Ard an t-Sabhail (NG 318 333) localities (Fig. 2.6) incorporate lavas belonging primarily to the Arnaval Group of Williamson (1979) which is probably equivalent to the youngest Osdale Group (Table 2.2; Anderson and Dunham, 1966) of northern Skye. The overall thickness of the Arnaval Group is probably in excess of 400 m, but nowhere is the whole sequence exposed and, in general terms, the following divisions are recognized (Williamson, 1979):

C	Rare, thin, massive olivine basalts and mugearites. Hawaiites and mugearites become progressively more common towards the top.	175–200 m
B	Porphyritic and non-porphyritic basalts with rare hawaiites and picritic basalts.	100 m
A	Highly amygdaloidal olivine basalts and picritic basalts with mugearite.	150 m

The cliff sections around Talisker Bay afford excellent exposures of picritic basalts, well-developed brown/grey/red boles, and abundant amygdales filled with zeolites. A thick mugearite flow near to the base of the succession at MacFarlane's Rocks (NG 301 314) to the south of Talisker Bay, displays characteristic flow-jointing which has been intricately overfolded and also forms antiforms and synforms in the upper part of the flow. Major dislocations to the east have faulted the succession, rendering correlation with other areas difficult. Inland, at the Stockval ridge locality south of Gleann Oraid (NG 320 305), the upper part of the succession is exposed comprising mainly hawaiite and mugearite flows.

At Dun Ard an t-Sabhail, a composite lava flow overlies a sequence of alkali-olivine basalts. The lava is more basic than those at Roineval and at Druim na Criche (Harker, 1904; Kennedy, 1931b) but is similar in that the flow consists of a porphyritic member overlying a non-porphyritic member of a broadly similar rock type. The upper member carries between 14% and 27% volume plagioclase phenocrysts which are more numerous at the base and which appear to belong to two separate generations (Boyd, 1974). Labradorite predominates but rounded, resorbed andesine is also found. Williamson (1979) also recorded the presence of orthopyroxene phenocrysts (or xenocrysts) in the upper unit, thereby distinguishing this flow from the other composite flows of Roineval and Druim na Criche. Hercynite spinel microphenocrysts mantled by titaniferous magnetite are also present, these and the orthopyroxene may be relicts of a phase of high-pressure crystallization prior to eruption.

The twin hills of Preshal More (Fig. 2.7) and Preshal Beg consist mainly of a 100 m thick flow of olivine tholeiite belonging to the Talisker Group (Williamson, 1979). The two outliers exhibit spectacular columnar jointing. At Preshal More, a series of fine-grained, water-lain tuffs underlie the tholeiite flow along the north-eastern margins of its outcrop. In contrast, to the west the tuffs are absent and the flow rests directly upon a series of hawaiites, mugearites and basalts of the Arnaval Group. On Preshal Beg the tholeiite rests upon a coarse agglomerate associated with minor tuff horizons. The agglomerate overlies leucocratic, clinopyroxene-phyric trachytes or trachyandesites in the north, but at the southern margins of its outcrop it lies directly upon fine-grained hawaiite. The tholeiite has an unusual chemistry within the Skye lava succession and is only matched by a flow high in the Osdale Group (Table 2.2) near Edinbane (Esson *et al.*, 1975). It is an olivine tholeiite which is unusually depleted in alkalis and rich in calcium with a distinctive trace-element chemistry (Fig. 1.2; Esson *et al.*, 1975; Williamson, 1979). The thick flow is interpreted as a ponded lava lying on top of the Arnaval lavas (Esson *et al.*, 1975); ponding occurred either owing to a downstream obstruction, or when a thick flow outwith the area flooded back into the valley (cf. Fionchra, on Rum).

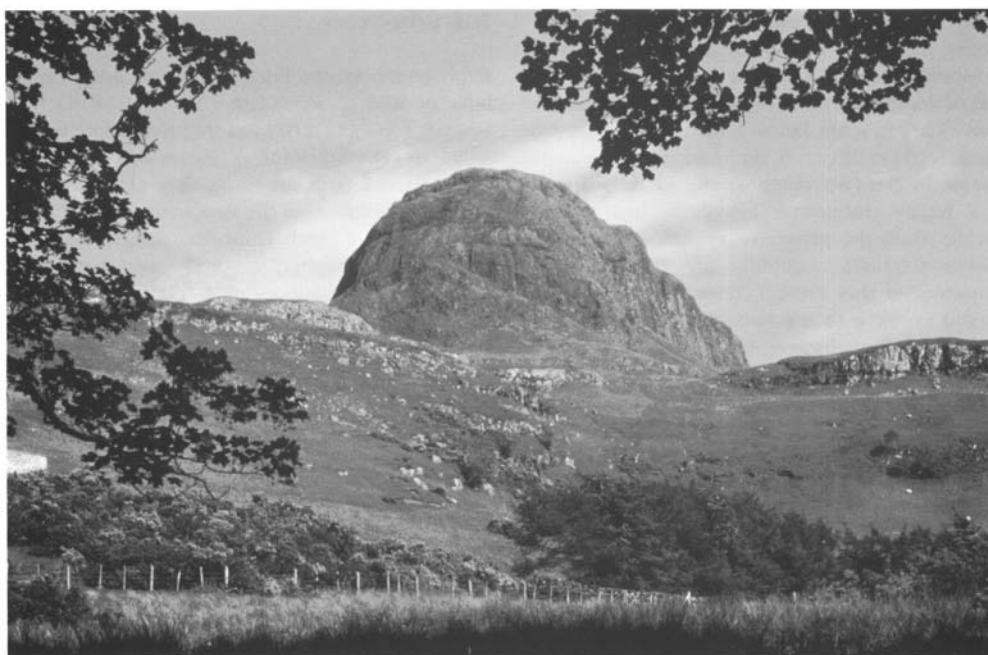


Figure 2.7: Late tholeiite lava forming Preshal More and infilling a former valley eroded in flows of the Skye Main Lava Series that form pale-coloured scarps below and to the right. Talisker site, Skye. (Photo: A.P. McKirdy.)

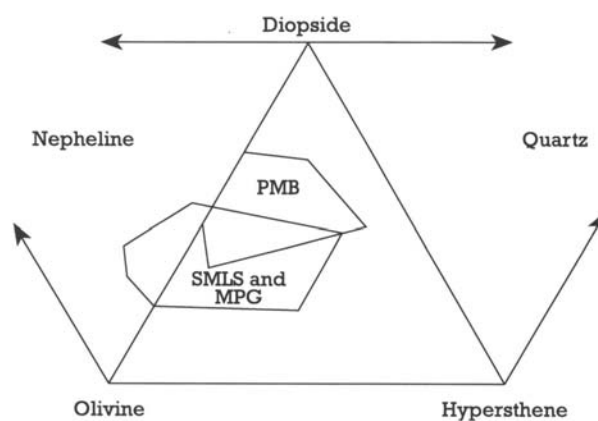


Figure 1.2: Diagram showing fields of the Preshal More Basalts (PMB), and the Skye Main Lava Series (SMLS) and Mull Plateau Group (MPG) when projected into normative nepheline-diopside-olivine-hypersthene-quartz (after Thompson, 1982, figure 2)

Interpretation

The site is largely occupied by the varied lavas of the Arnaval (Osdale) Group at the top of the SMLS. As with the lavas of the Storr (see above), these are transitional in geochemical character, but have a more varied composition (picrites, olivine basalts, hawaiites, mugearites and trachytes). Striking evidence for a major compositional change in the basaltic magma comes from the thick lava flow which forms Preshal More and Preshal Beg. This flow occupies a valley eroded in the upper flows of the transitional lavas of the Arnaval Group. The valley appears to have been partly floored by agglomerates and bedded water-lain tuffs, and it is most probable that the abnormally thick flow which overlies these deposits was ponded within the steep-sided valley. Thus, it is clear that the Preshal More–Preshal Beg flow was erupted after a significant erosional interval, a situation comparable with that of some basaltic andesites and icelandites on Rum (see Fionchra below). The analogy may be taken further since, as on Rum, there is major change in the lava composition; in this instance to a highly distinctive, low-alkali, high-calcium olivine tholeiite generally depleted in incompatible elements. Although the effusive representatives of this Preshal More magma type are limited

on Skye to the two hills of this site, and one earlier flow, basic rocks of similar composition occur widely as intrusions and are particularly abundant in the Skye dyke swarm (Mattey *et al.*, 1977); the magma type is important in the British Tertiary Volcanic Province in general (Thompson, 1982) and has many similarities to mid-ocean ridge basalts (cf. Bell and Harris, 1986).

Conclusions

This is an important site for demonstrating both the structural and compositional complexity of the subaerially erupted lavas of the upper part of the SMLS. It also contains a particularly clear record of an abrupt change in lava composition from earlier flows after a major erosional interval. The site contains the type locality for the distinctive Preshal More type of olivine basalt, which is known to have a widespread occurrence within the BTVP and which is comparable in many respects with mid-ocean ridge basalts.

Reference list

- Anderson, F.W. and Dunham, K.C. (1966) *The Geology of Northern Skye*. Memoir of the Geological Survey of Great Britain, HMSO, Edinburgh.
- Bell, B.R. and Harris, J.W. (1986) *An Excursion Guide to the Geology of the Isle of Skye*. Geological Society of Glasgow, 317 pp.
- Boyd, W.W. (1974) A geochemical investigation of composite bodies involving intermediate members of the alkali–basalt–trachyte suite. Unpublished Ph.D. Thesis, University of Edinburgh.
- Esson, J., Dunham, A.C. and Thompson, R.N. (1975) Low alkali, high calcium olivine tholeiite lavas from the Isle of Skye, Scotland. *Journal of Petrology*, **16**, 488–97.
- Harker, A. (1904) *The Tertiary Igneous Rocks of Skye*. Memoir of the Geological Survey of Great Britain, HMSO, Edinburgh.
- Kennedy, W.Q. (1931b) On composite lava flows. *Geological Magazine*, **68**, 166–81.
- Mattey, D.P., Gibson, I.L., Marriner, G.F. et al. (1977) The diagnostic geochemistry, relative abundance, and spatial distribution of high calcium, low-alkali olivine tholeiite dykes in the Lower Tertiary regional swarm of the Isle of Skye, N.W. Scotland. *Mineralogical Magazine*, **41**, 273–85.
- Thompson, R.N. (1982) Magmatism of the British Tertiary Volcanic Province. *Scottish Journal of Geology*, **18**, 49–107.
- Williamson, I.T. (1979) The petrology and structure of the Tertiary volcanic rocks of west-central Skye, N.W. Scotland. Unpublished Ph.D. Thesis, University of Durham.