

# Minor intrusions - St. Kilda: an illustrated account of the geology

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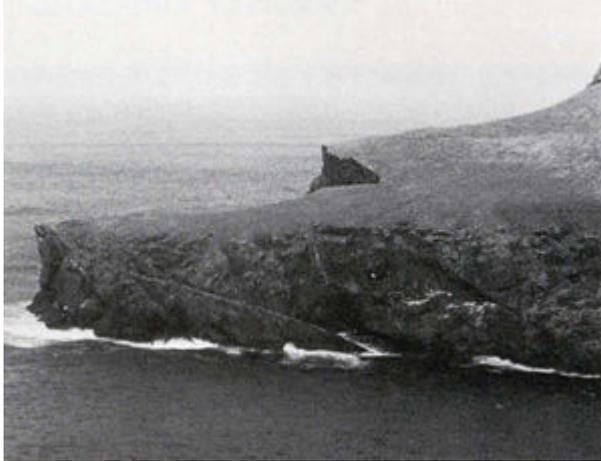


Figure 24A The arch at Gob na h-Airde, Glen Bay, which has formed by the preferential erosion of the point of intersection of a steeply inclined composite dyke (in the roof of the arch) and a shallow-dipping basaltic sheet

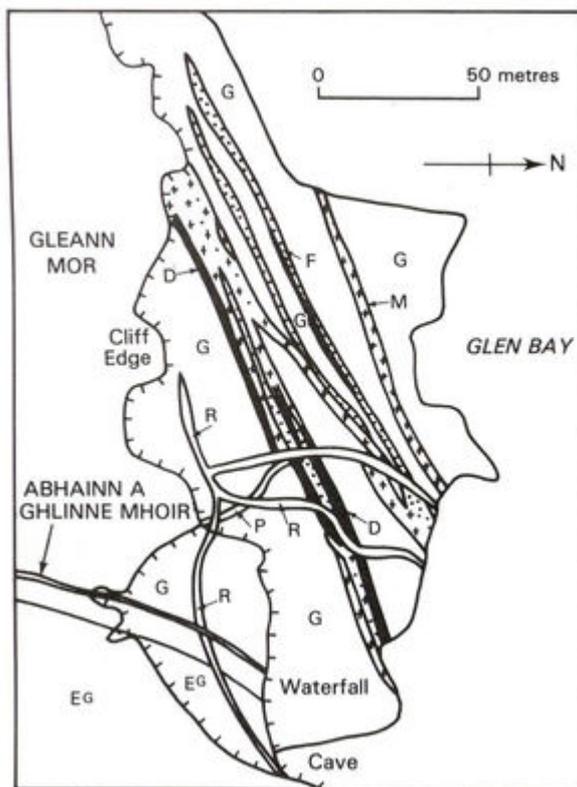


Figure 24B The dykes on Leacan an Eitheir, Glen Bay. E°, Glen Bay Gabbro; G, Glen Bay Granite; P, early banded porphyritic felsite;

D, dolerite (short line pattern); M, microdiorite (crosses); F, microgranite and felsite (circles); R, late rusty-weathering basalt or dolerite sheets. Felsite P is near-vertical, R has a shallow irregular dip SE, and the remaining dykes dip steeply SE

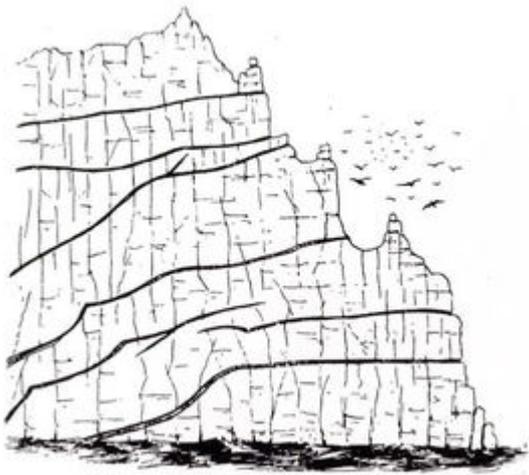


Figure 24C Inclined sheets cutting granite in the cliffs below Conachair (from Geikie, 1897)



Figure 25A Multiple inclined sheets dipping NE at 50°, cutting the Western Gabbro at An Fhaing, Dun. The upper and lower sheets are each 1 m thick



Figure 25B Composite dyke 2 m-wide cutting dolerites and microgranites of the Mullach Sgar Complex on Na h-Eagan. The dyke has a basaltic outer component with a centre of porphyritic pitchstone; the lobate nature of the contact between the two is well displayed



Figure 25C Dolerite sheets on Oiseval display a shallow dip eastwards

## Chapter 14 The minor intrusions

**Keywords: basalt-rhyolite range, regional structure**

A considerable number of inclined sheets and dykes are exposed on St Kilda which cut all the major plutonic intrusions. Differential erosion of these minor intrusions has resulted in some of the more spectacular scenic features of the islands including caves ([Figure 24A](#)), arches and numerous gullies and ledges which have become the nesting sites for thousands of sea birds.

The presence of minor intrusions in the St Kilda igneous complex was first noted by Macculloch (1819) who described the 'syenite' (Conachair Granite) as being 'traversed near the bay by two long

and nearly horizontal basaltic veins at no great distance from each other, the fragment of a third being also seen near the village'. Ross (1884) also noted the 'veins of compact basalt' cutting the granite of Oiseval in addition to the 'several trap dykes, of many feet in thickness, penetrating the granite (of Glen Bay) at right angles to the line of ... a great junction of greenstone with the granite', and also dykes on the north shore of Village Bay. He reported that microscopically the basalt dykes comprise minute prisms of plagioclase feldspar, mainly granular augite and mostly serpentinised olivine. Geikie (1897) figured some of the inclined sheets cutting the Conachair Granite ([Figure 24C](#)) and reported that although numerous dykes traverse both the gabbros and granites, they are more abundant in the gabbros. He believed that a large number of these intrusions pre-dated the granite although correctly noting that an actual example of a basic dyke truncated by the Conachair Granite could not be seen. The sheets and dykes were examined and extensively sampled by Cockburn whose collection and notes are housed in the Royal Scottish Museum, Edinburgh. Cockburn (1935) described the age relationships of these bodies and recognised 3 groups: first, a restricted group of thin pre-Glen Bay Granite dykes which cut the Western Gabbro (pp. 2-3 of this report); secondly, a group of dykes and sheets which cut all the major intrusions except the Conachair Granite; and thirdly, a post-Conachair Granite group of sheets and dykes. Cockburn recognised that a considerable variety of rock types were emplaced during these intrusive episodes. The earliest intrusions are olivine-free basalt with some variolitic types whereas the second group varies widely from basalt through andesite to spherulitic and nonspherulitic microgranites, granophyres and felsites. The latest intrusions were predominantly basaltic although some granitic intrusions were emplaced late in the history of the complex.

The overall structure of the sheets is best appreciated by considering the St Kilda islands in turn. On the western coasts of Dun and Hirta the predominant strike of dykes and sheets is NW or NNW, the sheets being inclined NE at angles between 30° and 60°. In Glen Bay and along the northern cliffs on Mullach Mor, Conachair and Oiseval the dykes and sheets strike NE, the sheets dipping SE at about 60° in the west and at much shallower angles in the Conachair Granite. Some sheets depart significantly from the dominant trend as, for example, the 2 m-thick sheet exposed at the top of the cliffs south of Ruaival which strikes north-west and dips south-west. Most sheets have been intruded along dilational fractures with little additional disturbance to the country rock, although there are some shear zones of crumbly-weathering gabbro on the west coast that are adjacent and parallel to the dolerite sheets, and it is probable that some compressional shearing movements preceded the sheet intrusion in these regions.

On Soay the late sheets generally show a south-easterly dip and, indeed, the gently sloping top of the island appears to follow the surface of an eroded sheet. Late sheets on Boreray and the Stacs dip at low angles to the south and south-west ([Figure 9A](#)), and an erosion surface developed along one of these intrusions has given rise to the smooth, grassy slopes of southern Boreray. The swing in dip direction from mainly north-east on Dun, east on Hirta and south-east on Soay to mainly southerly on Boreray suggests a convergence of sheet attitude to the east of Hirta, in the manner of the classic cone sheet intrusions of the Inner Hebrides.

Many of the dykes in the complex have a north-easterly trend, a feature clearly shown by the older dykes of Glen Bay ([Figure 24B](#)). A similar trend is displayed by basic dykes which cut late sheets on Boreray.

A close association of basaltic and granitic magmas is displayed by several composite intrusions, and one in Glen Bay is exposed in the roof of the arch at Gob na h-Airde ([Figure 24A](#)). Others occur on the western side of Glen Bay, in Abhainn Gleshgill (a precipitous gully south-west of Mullach Sgar), above An Torc on Na h-Eagan ([Figure 25B](#)), and on Mol Ghiasgar below Conachair. A composite sheet occurs on the eastern cliffs of Soay, and another apparently occurs on Levenish (Cockburn slides L2-9). The dyke pictured in ([Figure 25B](#)) was regarded by Cockburn as a multiple rather than

a composite intrusion, as fragments of the 50 cm-wide basic margin were enclosed within the partially devitrified porphyritic pitchstone central part. The internal margins of the basic components are lobate which suggests that the basalt was still hot and mobile when it was intruded by the granitic magma.

## **References**

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