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# Ardnamurchan Point to Sanna

## Highlights

The site contains some of the clearest examples of net-veining, intrusion breccias and 'liquid-liquid' contacts between basic and acid rocks to be found in the BTVP. The Hypersthene Gabbro exhibits excellent layered structures which frequently simulate structures developed in clastic sediments.

## Introduction

The coastal strip from the Point of Ardnamurchan to Sanna Point, including Sgurr nam Meann, provides an excellent traverse across several of the intrusions of Centre 2 and demonstrates their truncation by the Great Eucrite of Centre 3. Many features of petrological interest are easily accessible; these include net-veining, igneous brecciation, igneous layering and the occurrence of pyroxene granulites.

The area has been thoroughly investigated and described by Richey and Thomas (1930); the granophyric Quartz Dolerite of Sgurr nam Meann in particular has received considerable mention by these authors and by Wells (1954b), and was selected for special study in this area by Skelhorn and Elwell (1966).

## Description

A traverse from Ardnamurchan Point to Sanna crosses the following intrusions (Figure 4.7):

1. Hypersthene Gabbro of Ardnamurchan Point
2. Granophyric Quartz Dolerite of Sgurr nam Meann
3. Quartz Gabbro of Loch Carrach
4. Eucrite of Beinn nan Ord
5. Fluxion Gabbro of Portuairk
6. Great Eucrite of Centre 3

The full sequence is seen between Ardnamurchan Point and the southernmost shores of Sanna Bay where the Great Eucrite is reached. Beyond the outcrop of the latter intrusion, from Sanna to Sanna Point, the Hypersthene Gabbro and grano-phyric Quartz Dolerite of Sgurr nam Meann (Butchins, 1973) are again exposed, but the Quartz Gabbro of Loch Carrach and Eucrite of Beinn nan Ord are absent, having been truncated by the Great Eucrite. The salient petrographic features and contact relations of all these intrusions, except for the Fluxion Gabbro, are given in the descriptions for Beinn na Seilg-Beinn nan Ord or the Centre 3 areas and are not repeated in this account, where attention is drawn to features not found elsewhere or better displayed in this area.

The Hypersthene Gabbro to the west of the lighthouse has a quartz doleritic outer marginal facies and passes eastwards into a coarser, rather silicic quartz gabbro facies. The intrusion is cut by cone-sheets belonging to the outer set of Centre 2 (Richey and Thomas, 1930). On Eilean Carrach, the layering in the gabbro dips to the east at 30° and extensive tabular masses of pyroxene granulite occur parallel to the layers.

The area between the lighthouse pier [NM 423 675] and Eilean Carrach contains superb exposures of the granophyric Quartz Dolerite of Sgurr nam Meann. In this area, porphyritic dolerite roofs a complex intrusion of aphyric dolerite and granophyre. From place to place, the granophyre varies from being volumetrically dominant to subordinate; small-scale anastomosing veins which cut both dolerites can be traced to sheet-like acid masses which contain a varied assemblage of basic rock types as inclusions (Figure 4.8). The inclusions frequently exhibit fine-grained, crenulated, chilled edges against the enclosing granophyre. Further to the north, the Quartz Dolerite contains several large, raft-like masses of Hypersthene Gabbro and steeply dipping contacts between the Dolerite and Hypersthene Gabbro are exposed south of

Eilean Carrach. Eastwards, the granophyric Quartz Dolerite of Sgurr nam Meann is bordered by a narrow outcrop of the Quartz Gabbro of Loch Caorach, which in turn adjoins an augite-rich variety of the Eucrite of Beinn nan Ord containing felsic veins bearing fine-grained basic xenoliths. The contact relationships of these intrusions have not been convincingly demonstrated.

To the east of the Eucrite of Beinn nan Ord there occurs a mass of laminated gabbro known as the Fluxion Gabbro of Portuairk (Richey and Thomas, 1930). The intrusion is not homogeneous and its variable features were attributed by Richey and Thomas to the modification of basic magma by silicic melt prior to, intrusion, probably when the basic rock was in a solid or semi-solid state. It is characterized by feldspar lamination or fluxion texture, which serves to distinguish it from the Beinn nan Ord Eucrite; no clear contacts between these two have been reported. The Fluxion Gabbro is cut by the later Great Eucrite of Centre 3, but again the contact is not readily interpretable because of the lack of contact alteration and the presence of a flow-banding structure in the outer zones of the Great Eucrite.

The Great Eucrite forms the shores of Sanna Bay, from Portuairk to the north of the Sanna River, and is seen in intrusive contact against the Hypersthene Gabbro to the north. At Sanna Point perfect mineralogical layering dipping to the south at angles of between 10° and 20° towards the Aodainn centre is present in the Hypersthene Gabbro. Occasional anorthosite, peridotite and iron-oxide-rich bands are found and igneous lamination, especially of plagioclase, is locally marked. Rhythmic banding and density stratification are also present in places. From the north of the Sanna River around Sanna Point and for 2.5 km to the east, sill-like bodies of granophyre containing inclusions of aphyric and porphyritic dolerite cut the Hypersthene Gabbro. Butchins (1973) considered those near Sanna Point to be apophyses from the granophyric Quartz Dolerite of Sgurr nam Meann.

## Interpretation

Although the features seen in the section from Ardnamurchan Point to Sanna duplicate to some extent those seen in parts of Beinn na Seilg–Beinn nan Ord, many are much better displayed. Exposures of the granophyric Quartz Dolerite of Sgurr nam Meann (Centre 2) provide clear evidence as to its form and contact relationships with the Great Eucrite (Centre 3) and the excellent shore exposures south-east of Eilean Carrach clearly demonstrate the 'mixed magma' character of the granophyric Quartz Dolerite (Skeihorn and Elwell, 1966; Vogel, 1982). This is arguably the best exposure of net-veining, intrusion breccias and chilling of basic magma against acid magma to be found in the BTVP. On Eilean Carrach and elsewhere in the Hypersthene Gabbro, mafic pyroxene-granulite xenoliths are comparable with inclusions found in the mafic plutonic rocks of Skye, Rum and at other localities. Previously considered to be of sedimentary origin (Wells, 1951), an igneous origin for the xenoliths was suggested by Brown (1954) in accordance with the interpretations of similar rocks elsewhere (for example, Rum, Askival–Hallival). As a consequence of the very varied, well exposed geology, this section is of great significance within the Ardnamurchan complex and is used extensively for educational purposes (for example, see Gribble *et al.*, 1976), despite the fact that some of the contact relationships remain poorly understood.

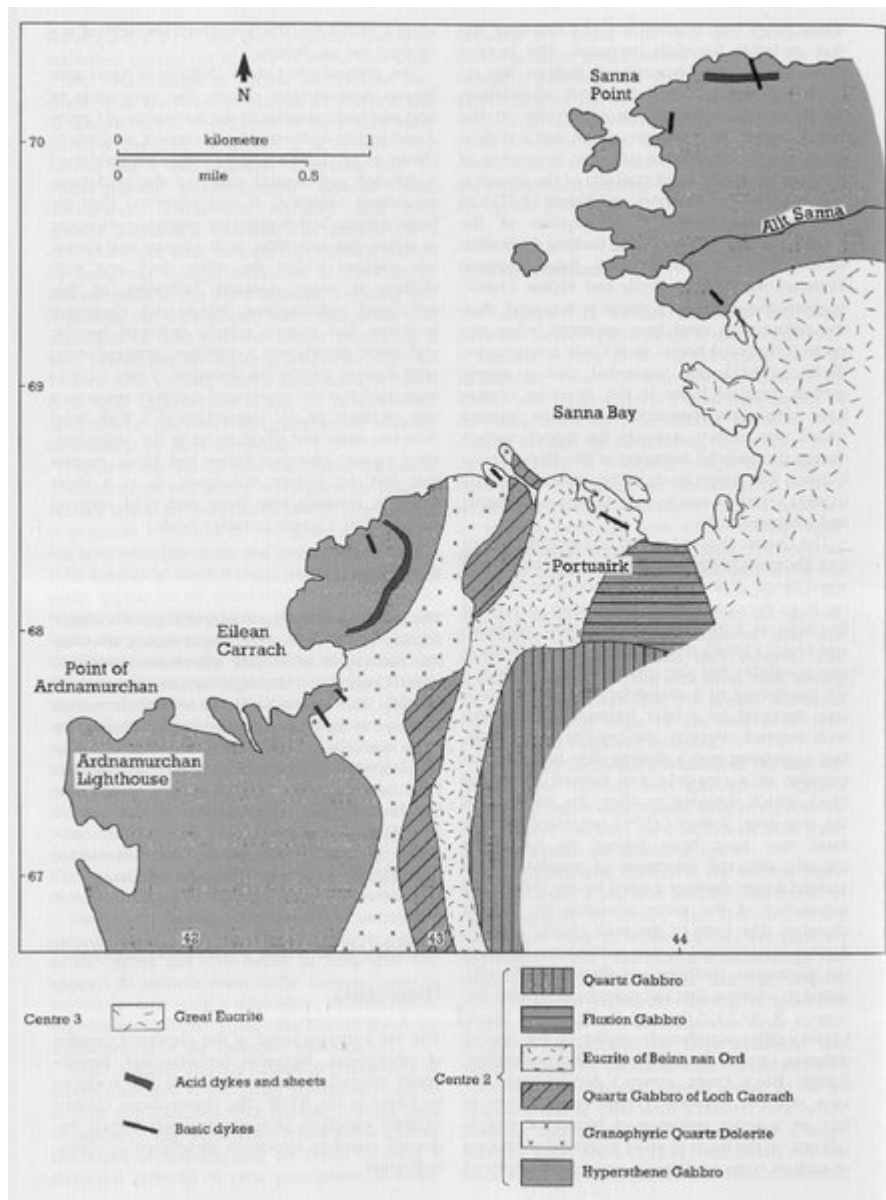
The excellent examples of layering found east of Sanna Bay contain many structures which simulate those developed in clastic sediments. Although extensive reappraisal of the origins of igneous layering have taken place recently (for example, Parsons, 1987), the layering in the Hypersthene Gabbro provides evidence which supports the contention that the structure results from gravity-controlled accumulation of crystals, probably aided by convection currents (Skelhorn and Elwell, 1966; in agreement with Wells, 1954a) and that the gabbro may form part of a large layered intrusion.

## Conclusions

The outstanding feature of the Ardnamurchan Point to Sanna section is the exceptionally fine exposure of net-veining and intrusion breccia near Eilean Carrach (Figure 4.8); this shows clearly that basic and acid magmas coexisted, that basic magma was chilled against acid magma and that both magmas mixed to give a variety of intermediate (hybrid) rocks. This type of relationship is common throughout the BTVP, but the examples exposed here are certainly the most accessible and arguably the best exposed in the Province. The igneous layering in the Hypersthene Gabbro is closely comparable with layering found in gabbros and ultrabasic rocks in Skye and Rum, and lends support to the suggestion

that this gabbro is part of a layered intrusion. The manner in which the Hypersthene Gabbro structures are truncated by the Great Eucrite provides evidence for the relatively late emplacement of Centre 3.

## References



(Figure 4.7) Geological map of the Ardnamurchan Point—Sanna site (after Gribble et al, 1976).



*(Figure 4.8) Granitic net-veining and an intrusion breccia of gabbro and dolerite fragments. Centre 2 ring-dykes, near the lighthouse, western tip of Ardnamurchan. (Photo: C.H. Emeleus.)*