Glas Bheinn–Glebe Hill

OS Grid Reference: NM479644

Highlights

Several massive, arcuate, cross-cutting intrusions belonging to Ardnamurchan Centres 1, 2 and 3 intruded and metamorphosed pre-Tertiary country rocks and Tertiary plateau basalts. Centre 2 gabbros contain distinctive sapphirebearing xenoliths derived by alteration of contemporaneous soil (bole) and weathered basalt; calcareous Jurassic sediments at the margins of the gabbros have been altered to high-temperature calc-silicate hornfelses which contain the rare mineral kilchoanite (type locality). The age relationships between Centre 2 cone-sheets and the major intrusions are well-illustrated here.

Introduction

The original survey of Ardnamurchan by Richey and Thomas (1930) identified three independent but overlapping centres of igneous activity and showed them to consist of volcanic vents, various types of arcuate intrusion and cone-sheet swarms. Within the relatively small area of the Glas Bheinn–Glebe Hill site *(c.* 3 km2), various intrusions belonging to all three centres are represented, with a clear demonstration of their relative ages. The site also contains exposures of the contact between the intrusions and the country rocks which include Moine schists, Lower Lias sediments, Tertiary lavas and minor intrusions other than cone-sheets, a small remnant mass of agglomerate and highly metamorphosed xenoliths in the outer gabbros of Centre 2 (Figure 4.5). Agrell (1965) studied the thermally metamorphosed calcareous Lias sediments and identified a wide range of minerals, including kilchoanite ($Ca_3Si_2O_7$) mentioned above.

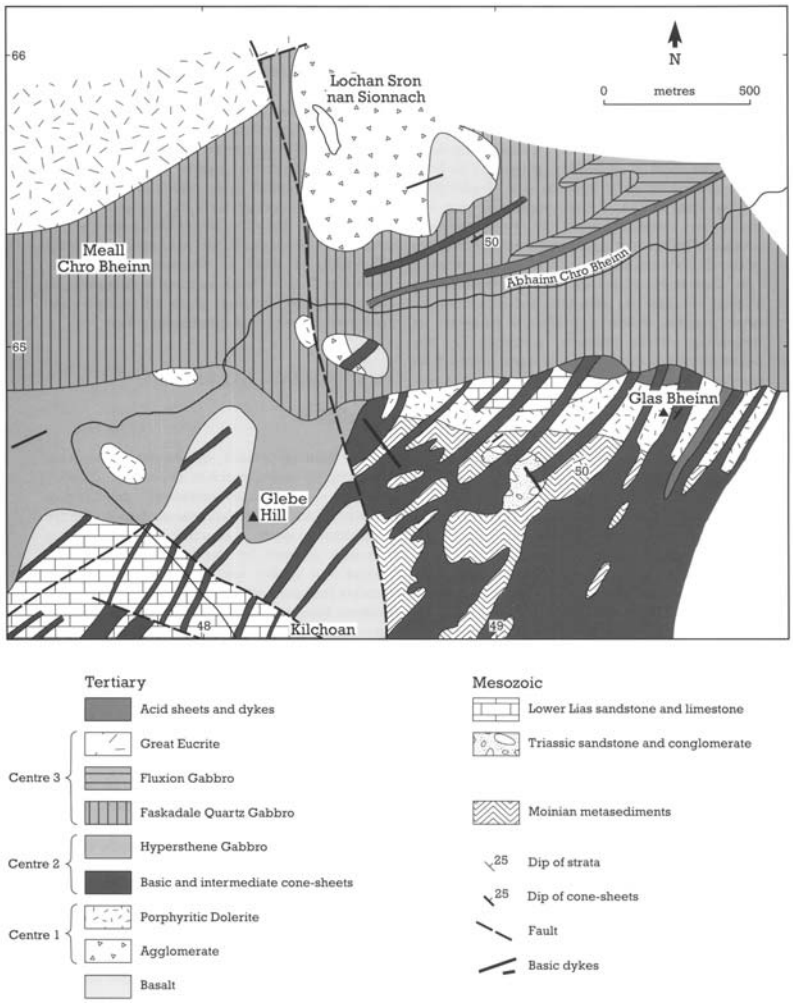

Figure 4.5: Geological map of the Glas Bheinn-Glebe Hill site (after Gribble et al., 1976)

Description

On Glas Bheinn (NM 493 648), a large, E–W-trending, dyke-like intrusion of plagiophyric dolerite (attributed to Centre 1) is poorly exposed. The intrusion appears to have near-vertical and often chilled, aphyric contacts with Moine psammites and Lias shaly sandstones. It is dissected by a swarm of non-porphyritic and (later) feldspar-phyric cone-sheets belonging to the outer set of Centre 2 and a later porphyritic sheet which is inclined towards the Centre 3 focus (Richey and Thomas, 1930). The main intrusion is a quartz dolerite or gabbro-bearing zoned labradorite phenocrysts in a matrix of acicular labradorite, augite and brown basaltic glass. Schistose xenoliths are commonplace and gabbroic xenoliths, of probable cognate origin, occur about 300 m west of the Glas Bheinn summit (NM 497 647). Near to the summit, the dolerite is intruded by a small mass of felsite or granophyre which, together with the cone-sheets and country rock, is almost entirely recrystallized owing to the thermal effects of the nearby Faskadale Quartz Gabbro of Centre 3.

The Faskadale Quartz Gabbro is poorly exposed within the site on the southern side of the Abhainn Chro Bheinn, and the form and intrusive relationships have been largely inferred rather than observed here. Cone-sheets do not cut this intrusion. Although typically a medium-grained quartz gabbro, the Faskadale intrusion varies from olivine eucrite to a basic granophyre especially towards the roof (Richey and Thomas, 1930; Gribble *et al*., 1976). The occurrence of internal contacts between coarse- and fine-grained members implies that the mass probably has a composite form.

Glebe Hill (NM 480 647) is formed from baked and partially granulitized amygdaloidal basaltic lavas which are cut by thin, basic cone-sheets, a few minor felsites and the Hypersthene Gabbro. Most of the basalts are aphyric, containing olivine pseudomorphs and the amygdale

assemblages have been altered to chlorite and plagioclase. The lavas are probably related to the relatively unaltered mildly alkaline, olivine-basalt lavas around Ben Hiant. At Glebe Hill, the lavas form a roof to the Hypersthene Gabbro intrusion, the contact varying between being virtually horizontal and steeply inclined. The Hypersthene Gabbro is generally a fine-grained, pyroxene-rich rock but, around Glebe Hill, coarse pegmatitic quartz gabbro and allivalitic–troctolitic varieties are prevalent. Xenoliths, which are frequently observed in the gabbro, contain equigranular plagioclase and dark-green hercynitic spinel accompanied by interstitial, colourless and blue corundum (including sapphire) and magnetite with exsolved ilmenite lamellae. These were derived from aluminous sediments, possibly bole horizons in the lavas.

The contact between the Hypersthene Gabbro and the Faskadale Quartz Gabbro trends east–west to the north of Glebe Hill. Partial exposure of this contact occurs in the bed of the Abhainn Chro Bheinn a few metres north of where the stream turns westwards before passing under the Kilchoan–Sanna road. The Hypersthene Gabbro is shattered, deeply weathered and veined by granophyre. The Quartz Gabbro is chilled towards the contact and locally a thin screen of amygdaloidal basalt intervenes. Elsewhere, the position of the contact can be accurately inferred although it is rarely exposed. On following the contact eastwards towards Glas Bheinn, the Hypershene Gabbro, Faskadale Quartz Gabbro and the Glas Bheinn Porphyritic Dolerite, with its numerous cone-sheets, can all be seen in close proximity to one another.

Around Lochan Sron nan Sionnach (NM 484 656), the slopes of Meall an Tarmachain expose a mass of basalt lava and agglomerate roofing the Faskadale Quartz Gabbro and the Great Eucrite. These are cut by sparse cone-sheets inclined towards the focus of Centre 3 and consist mostly of basaltic, felsitic and country rock fragments in a tuffaceous matrix. The lavas and agglomerates are highly thermally metamorphosed and closely resemble a similar rock assemblage which forms part of the Meall nan Con screen (see below). The Centre 3 cone-sheets find geomorphological expression as a series of low, often inconspicuous, terrace features in the Quartz Gabbro and the volcanic rocks dip at about 50° towards the focus of this centre near Glendrain. They are largely plagiophyric basalts and dolerites with rarer non-porphyritic examples. West of Lochan Sron nan Sionnach, the weathering contrast between the Quartz Gabbro and the Great Eucrite is demonstrated; the actual contact appears to be complex, with narrow intervening zones of fine-grained gabbro occurring at intervals. There is also evidence for the alteration and crushing of the Quartz Gabbro by the emplacement of the Great Eucrite.

Interpretation

The exposures at Glas Bheinn–Glebe Hill provide an excellent opportunity to demonstrate how the evolution of the Ardnamurchan complex has been elucidated using the intricate field relationships of the various intrusions. Within this relatively small site (*c.* 3 km), representative ring-dyke intrusions belonging to all three centres are in close association, enabling the major phases of development of the complex to be studied. The contacts of the porphyritic dolerite on Glas Bheinn with the surrounding intrusions and cross-cutting cone-sheets shows that, relatively, it must be the earliest. This intrusion is assigned to the first centre of plutonic igneous activity on Ardnamurchan and cuts older Centre 1 agglomerates which appear to belong to the extensive Northern Vents (Richey and Thomas, 1930). The dolerite is similar to the porphyritic dolerite of Ben Hiant and an olivine-bearing variety also occurs to the north of Camphouse.

The Faskadale Quartz Gabbro mass extends in a broad arc from Faskadale (NM 501 708) southwards and westwards to Beinn na Seilg and may well continue further west under a roof of Centre 2 rocks to reemerge south of Sanna Bay as the Ben Bhuidhe intrusion (Gribble *et al.*, 1976). This mass is the outermost ring intrusion of Centre 3; cone-sheets belonging to Centre 2 are absent and it cuts the earlier Hypersthene Gabbro and Glas Bheinn porphyritic dolerite. Likewise, the Great Eucrite is a younger intrusion of Centre 3, as demonstrated by field relationships described above. The Hypersthene Gabbro, discussed in detail for Beinn na Seilg–Beinn nan Ord (see below), is the earliest ring intrusion of Centre 2 cutting the porphyritic dolerite of Glas Bheinn and truncating the Faskadale intrusion. High emplacement temperatures for the ring-dyke intrusions are clearly demonstrated by the sanidinite-facies

mineral assemblages developed in adjoining country rocks.

Conclusions

The contact relationships between major ring intrusions and the associated cone-sheet swarms within the site, belonging to each of the three centres of Tertiary plutonic activity on Ardnamurchan, can be used to study the evolution of the complex. The early Glas Bheinn porphyritic dolerite of Centre 1 is cut by the Hypersthene Gabbro of Centre 2, which is in turn truncated by the Centre 3 Faskadale Quartz Gabbro and Great Eucrite masses. The high-temperature intrusions have given rise to distinctive thermal metamorphic mineral assemblages in altered, weathered basalt lavas and sandy limestones.

Reference list

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