

Kilchrist

OS Grid Reference: NG600215

Highlights

At Kilchrist excellent examples of ignimbrites, tuffs and rhyolite flows are interbedded with agglomerates. Granite and gabbro fragments in the agglomerates demonstrate that a period of plutonic activity pre-dated the Eastern Red Hills centre. The lava flows and volcanoclastic rocks are preserved in a downfaulted block bounded by a ring-dyke of hybrid (mixed-magma) rocks and the Beinn na Caillich Granite.

Introduction

The site encompasses the internationally famous Kilchrist Vent which lies within the eastern part of the Eastern Red Hills centre and thus also includes part of the last major phase of igneous activity on Skye. The vent contains a highly varied association of agglomerates, ignimbrites, acidic rocks, hybrids and gabbros. The site also contains part of the large Inner, or Beinn na Caillich, Granite of the Eastern Red Hills centre (Fig.2.19).

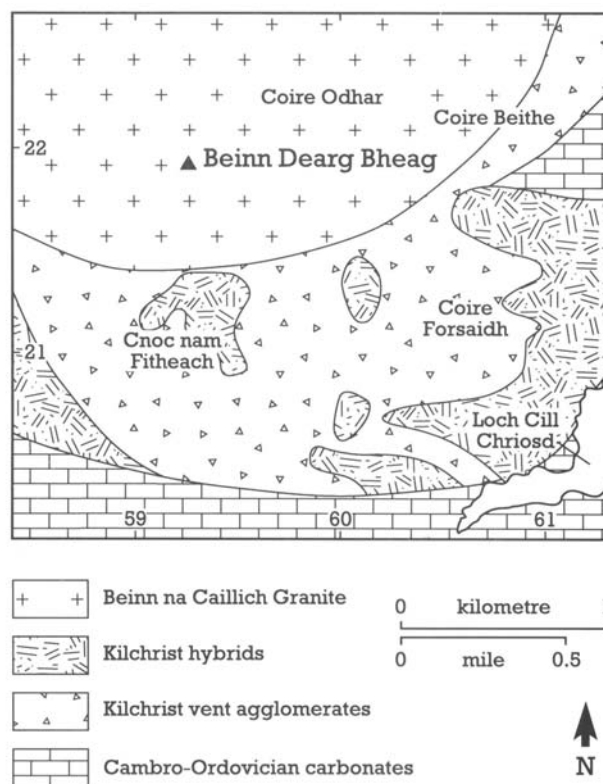


Figure 2.19: Geological map of the Kilchrist site (after Gass and Thorpe, 1976, figure 6)

The Eastern Red Hills centre was, until recently, comparatively neglected. The results of the earlier investigations and some work in the immediate post-war years have been summarized by Stewart (1965). At about the same time, aspects of the Kilchrist Vent were investigated by Ray (1960, 1962, 1964, 1966 and 1972). An intensive study of the centre has since been carried out by B.R. Bell (1982, 1983, 1984a, 1984b and 1985) and these investigations are summarized in Bell and Harris (1986).

Description

The volcanoclastic rocks and hybrids in the area between the middle slopes of Beinn Dearg Bheag (NG 593 219) and Loch Kilchrist are the principal features of interest in this site (Fig.

2.19). These rocks occupy the area defined in the earlier literature as the Kilchrist Vent but subsequently shown by Bell (1982) to be a downfaulted bedded volcanoclastic sequence later intruded by hybrids, rather than a chaotic vent infill. Predominant coarse agglomerates contain blocks and smaller clasts of Torridonian sandstones and shales, Cambrian carbonates and quartzites, Jurassic limestones, sandstones and siltstones and a variety of igneous rocks of probable Palaeocene age such as basalt, rhyolite, ignimbrite, granite, pitchstone and gabbro. Evidence for bedding comes from rare lateritic horizons, thin basic tuffs with lapilli, acid tuffs with wispy rhyolitic fragments, and thin rhyolites which probably represent flows (better evidence for rhyolite flows comes from exposures east of Beinn Dearg Mhor; Bell, 1985). In addition, in stream sections east of Cnoc nam Fitheach (NG 593 211), extremely well-developed ignimbrites with beautifully formed *fiamme* texture crop out. Ray (1960) initially recorded the ignimbrites and considered them to be intrusive but they have since been shown by Bell (1985) to be extrusive. The common occurrence of bedding argues against these rocks representing a chaotic vent infilling.

Five distinct masses of hybridized rock within the vent area together form a discontinuous ring-dyke known as the Kilchrist Hybrid Ring Dyke (Bell and Harris, 1986). The margins of this intrusion are steep against the Cambro-Ordovician and Jurassic country rock, but relatively flat lying against the vent deposits. The hybrids are leucocratic to mesocratic and are medium grained, containing irregularly shaped crystals of quartz rimmed by clusters of amphibole and/or pyroxene, together with rounded white crystals of alkali feldspar. In addition, xenoliths of fine-grained basic material with irregular, diffuse margins also occur. An unusual feature of these hybrids is the presence of thin, flow-banded margins against the fragmental rocks. A good example of this feature occurs in the Allt Coire Forsaid, where small xenoliths of volcanoclastic material are also enclosed within the marginal hybrid.

The steep-sided Beinn na Caillich granite intrusion occupies the northern part of the site. The rock is a granophyre or microgranite and contains amphibole and biotite as the main ferromagnesian phases. A fine-grained felsitic or spherulitic marginal facies, rarely more than a few metres wide, is developed at some localities, most notably in the gorge of the Allt Slapin in the extreme western tip of the site (NG 584 218). Here, fresh samples contain the iron-rich minerals ferrohedenbergite and fayalite which have been frequently replaced by hydrous alteration products. In this excellent section a succession of near-vertical basaltic and rhyolitic tuffaceous breccias strikes parallel to the granite margin and passes downstream into brecciated Jurassic sediments, which also dip steeply off the granite hereabouts. The volcanoclastic rocks are part of a narrow zone which separates the Beinn na Caillich, or Inner, Granite from Jurassic sediments and Palaeocene lavas to the west and north-west (Bell, 1985, fig. 2). Emplacement of the Inner Granite has caused severe deformation of the adjoining country rocks.

Interpretation

In the literature prior to 1980, the volcanoclastic rocks of this site were interpreted as being vent infill deposits intruded by hybrid rocks. It was termed the Kilchrist Vent (cf. J.D. Bell, 1976). B.R. Bell's detailed reinvestigation has clearly demonstrated that the fragmental rocks are not a chaotic vent infill and there is much evidence for bedded volcanoclastics, highly compacted ignimbrites and rhyolite flows (Bell, 1982). The hybrid status accorded by Harker (1904) to the highly variable intrusive rocks has been confirmed by the later studies and Bell (for example, in Bell and Harris, 1986) noted that the mixed magma nature of the rocks is very apparent in their heterogeneous field appearance. He suggested (Bell, 1982) that the Kilchrist hybrids could be produced by mixing variable proportions of basic and acid magmas similar to those which gave rise to the composite basic and acid sills of the Broadford area.

The form of the Kilchrist hybrid intrusions is important in the interpretation of the volcanoclastic rocks. The hybrids have steep outer margins against Cambro-Ordovician sediments but intrude the volcanoclastic rocks at low angles as sheet-like masses. Bell has interpreted the hybrids as a ring-dyke, the Kilchrist Hybrid Ring Dyke (Bell and Harris, 1986), and considered that the volcanoclastic rocks form a central, downfaulted block preserved within this structure. Thus, the coarse-bedded volcanoclastic deposits, together with intercalated lava flows, may once have been more extensive, as is suggested by their occurrence on the western and north-western sides of the Beinn na Caillich (or Inner) Granite. Clearly, from the evidence within this site and

that provided elsewhere around Beinn na Caillich, the emplacement of the Inner Granite involved, or was at least associated with, complex tectonic events which have not as yet been fully explained.

The varied assemblage of clasts in the fragmental rocks is of considerable interest, not least since it provides evidence for early Tertiary igneous rocks which pre-date the bedded volcanoclastics, hybrid intrusions and the Inner and Outer granites. These have been listed (see above) but attention is directed especially to the presence of blocks of granite which indicate, once again, that there may have been a distinctly early phase of plutonic acid intrusions in Skye (cf. Bell, 1976 and the evidence from Allt Geodh a' Ghamhna).

Conclusions

The site provides clear evidence that, during the Palaeocene, the Eastern Red Hills were an area of fairly extensive bedded volcanoclastic accumulations with interbedded acid and basic lava flows and excellent examples of ignimbrites. The clast content of the volcanic breccias shows that coarse-grained plutonic rocks (both gabbros and granites) were present, possibly representing a phase of central complex development on Skye which was obliterated by the emplacement of the presently exposed centres. These early volcanoclastic rocks are preserved as a downfaulted block within the Kilchrist Hybrid Ring Dyke; they may represent vent-infill material but their present margins are determined by the ring-dyke intrusion. It is therefore possible that they once formed part of an early, much more widespread cover of acid and basic lavas and volcanoclastic deposits.

The hybrid rocks provide yet another example of coexistence and mixing of acid and basic magmas found throughout the period of Tertiary magmatism on Skye. They augment the evidence from the marscoite suite of Marsco and elsewhere (Marsco and Mheall a' Mhaoil) and from the composite sills (Rubha' an Eireannaich). The intrusive behaviour of these mixed magmas is convincingly demonstrated in this site.

The Beinn na Caillich, or Inner Granite is the youngest major intrusion in the site and also in the Eastern Red Hills centre. It is in sharp, chilled contact with the country rocks but does not appear to have produced very marked thermal effects on them. However, the very steeply dipping sequence of volcanoclastic rocks and Jurassic sediments, found at the granite contact in the extreme west of the site, provides convincing evidence that emplacement of this granite caused considerable tectonic disturbance of the adjoining country rocks.

Reference list

- Bell, J.D. (1976) The Tertiary intrusive complex on the Isle of Skye. *Proceedings of the Geologists' Association*, **87**, 247–71.
- Bell, B.R. (1982) The evolution of the Eastern Red Hills Tertiary igneous centre, Skye, Scotland. Unpublished PhD. Thesis, University of London.
- Bell, B.R. (1983) Significance of ferrodioritic liquids in magma mixing processes. *Nature*, **306**, 323–7.
- Bell, B.R. (1984a) The basic lavas of the Eastern Red Hills district, Isle of Skye. *Scottish Journal of Geology*, **20**, 73–86.
- Bell, B.R. (1984b) The geochemistry of Lower Tertiary basic dykes in the Eastern Red Hills district, Isle of Skye, and their significance for the proposed magmatic evolution of the Skye Centre. *Mineralogical Magazine*, **48**, 365–72.
- Bell, B.R. (1985) The pyroclastic rocks and rhyolitic lavas of the Eastern Red Hills district, Isle of Skye. *Scottish Journal of Geology*, **21**, 57–70.
- 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.
- Harker, A. (1904) *The Tertiary Igneous Rocks of Skye*. Memoir of the Geological Survey of Great Britain, HMSO, Edinburgh.
- Ray, P.S. (1960) Ignimbrite in the Kilchrist vent, Skye. *Geological Magazine*, **97**, 229–38.
- Ray, P.S. (1962) A note on some acid breccias in the Kilchrist vent, Skye. *Geological Magazine*, **99**, 420–6.
- Ray, P.S. (1964) On the association of an indurated basic tuff and a felsite intrusion in the

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- Kilchrist vent, Skye. *Geological Magazine*, **101**, 289–301.
- Ray, P.S. (1966) An association of rhyolite and ignimbrite in the Kilchrist vent, Skye. *Geological Magazine*, **103**, 8–18.
- Stewart, F.H. (1965) Tertiary igneous activity. In *The Geology of Scotland*. (ed. G.Y. Craig), 1st edn, Oliver and Boyd, Edinburgh, pp. 417–65.