
Glaisgeo–Farr Point

[NC 713 635]–[NC 727 640]

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Introduction

The peninsula of Farr Point and its adjacent rocky bays and geos provide an impressive across-strike section through the Clerkhill Intrusion and the migmatitic psammities and semipelites of the Bettyhill Banded Formation including the Farr Pelite Member (Figure 6.29). The Clerkhill Intrusion is a deformed and metamorphosed, appinitic, ultramafic to mafic and felsic body that is unique to Sutherland. In parts it shows spectacular development of potash-feldspar porphyroblasts, commonly aligned to give an augen texture. The bulk of its component lithologies are foliated, but they are cross-cut by numerous undeformed small granitic intrusions. Recent U-Pb zircon dating has shown that the intrusion is Silurian in age (PD. Kinny and R.A. Strachan, pers. comm., 2006). The site provides an in-depth view of the complex structural and metamorphic nature of the Moine rocks of the Naver Nappe.

As in the other Bettyhill sites B.N. Peach initially mapped the Farr area for the Geological Survey in 1891–1892. He recognized the nature of the Moine metasedimentary rocks, the granitic intrusions and the hornblende-rich parts of the succession. Several drawings and sketches, some of which show the intense folding of the Moine rocks in the cliff sections and detail of the migmatitic textures, enhance his field slips. However, others portray sheep, cattle and female members of the local crofting population. Somewhat later, in the 1930s, studies by Y.C. Cheng focused more intently on the different rock-types. Cheng (1942) recognized the coarsely hornblendic nature of the Clerkhill Intrusion and termed it the 'Hornblendic complex with appinitic types'. Moorhouse (1979) also mapped the body, and Moorhouse *et al.* (1988) termed it the 'Clerkhill Appinite Suite', reflecting the presence of coarse hornblende-pyroxene rocks. Although the texture and mineralogy of the constituent rocks have similarities to the Appinite Suite in its type area (Wright and Bowes, 1979; Platten in Stephenson *et al.*, 1999), the Clerkhill Intrusion is strongly deformed and has been subject to amphibolite-facies metamorphism and considerable metasomatism (Cheng, 1942).

Migmatitic Moine semipelites and psammities are exposed on the south-western side of the Clerkhill Intrusion, and mixed psammitic and semipelitic lithologies occur widely on its northeast side towards Farr Point. A foliated migmatitic and gneissose biotite-rich pelite is exposed on Farr Point and inland along the spine of the Ard Farr peninsula. Cheng (1943) designated this unit the 'Ard Farr pelitic gneiss' and it was one of the main lithologies studied in his pioneering work on the geochemical effects resulting from migmatization and metasomatism. In this account it is termed the 'Farr Pelite Member' of the Bettyhill Banded Formation.

Description

The GCR site area encompasses the indented, steeply cliffed coastline and small bays that stretch from Glaisgeo in the west, around Farr Point to Borge Castle (ruin) and Borroged in the east. Inland lies the peaty and rocky promontory that culminates in the hill of Ard Farr at 110 m above OD. The grain of the country is defined by the steep north-easterly dip of the lithological units and dominant foliation, and the trend of the granitic, dioritic and mafic intrusions. Faults are marked by linear features, which at the coast have been selectively eroded to form the larger geodh features. Access to the CGR site area is from the hamlet of Farr to the south or by boat. A small part of the site is separate and lies some 200 m south-west of Swordly Loch around [NC 7285 6275] (Figure 6.29).

The Clerkhill Intrusion comprises a variable sequence of metamorphic lithologies ranging from ultramafic through to mafic and felsic 'appinites', commonly with prominent feldspar augen. The dominant lithologies are foliated diorites, granodiorites and appinitic amphibolites. The augen lithologies comprise several zones crammed with prominent pink, 'dent de cheval', perthitic potash-feldspar porphyroblasts. They are beautifully exposed at several localities, for example between the high- and low-tide marks at Glaisgeo [NC 7131 6340] (Figure 6.30). The feldspar augen are up to several

centimetres across and are generally aligned within the NW-striking foliation. Along the western boundary of the intrusion are highly attenuated, migmatitic, quartz-rich gneissose Moine psammities that show marginal 'interfingering' (or possibly tight infolding) with fine-grained, strongly foliated, hornblende-rich lithologies. In contrast, the eastern contact of the Clerkhill Intrusion against gneissose Moine psammities and semipelites is sharp, where it is seen in the coastal section by Creag Ruadh at [NC 7148 6371]. However, minor lenticular ultramafic 'pods' are present in the adjacent semipelites.

An exposure south-west of Swordly Loch provides critical evidence for the emplacement age of the Clerkhill Intrusion relative to the tectonothermal history of the Naver Nappe. Here, stringers and veins of 'appinitic' amphibolite with feldspar augen belonging to the Clerkhill Intrusion cut the early stromatic migmatitic banding (S₁) in the surrounding psammities and semipelites of the Bettyhill Banded Formation. In addition, a foliated K-feldspar-bearing amphibolite sheet of the Clerkhill Intrusion is folded along with the migmatitic psammities and semipelites into tight upright (F₃) folds. These structures clearly fold an earlier penetrative foliation in both the Clerkhill Intrusion and in the Moine metasedimentary rocks that is interpreted as a combined S₁ + S₂ fabric. Farther south-east by Loch Salachaidh at [NC 7331 6212] the main foliation is cross-cut by a foliated granite body whose deformation is ascribed to late D₃.

Interpretation

Geochemical studies by Moorhouse (1979) suggest that the rocks of the Clerkhill Intrusion show similarities with the Appinite Suite rocks of Argyll (Wright and Bowes, 1979; Platten in Stephenson *et al.*, 1999) and the Ach'uaire Hybrid intrusions of central and south Sutherland (Read, 1931). Both sets of intrusions show enrichment in K, Sr, Ba, Ni, Cr and light REE. Recent zircon age dating also suggests that the diorites and granodiorites were intruded during the Silurian (PD. Kinny and R.A. Strachan, pers. comm., 2006) and may link to the Strath Halladale Granite Complex farther east (Kocks *et al.*, 2006). However, the foliated and metamorphosed nature of the Clerkhill rocks suggests that they pre-date the Late Silurian Appinite Suite (*sensu stricto*), and hence are considerably older. The field relationships noted above suggest that the Clerkhill Intrusion was emplaced after the imposition of the early (D₁) gneissose fabric in the Moine rocks but before tight folding related to the D₃ deformation events, which are probably linked to the Grampian and Scandian orogenic events respectively (Kinny *et al.*, 1999). The pervasive foliation in the Clerkhill rocks has been correlated with the main S₂ schistosity/foliation in the adjacent Moine rocks, thus implying a pre- or syn-D₂ emplacement of the intrusion (Moorhouse *et al.*, 1988), but the recent U-Pb age dating suggests that this correlation is incorrect. F₃ folds and D₃ deformation of the diorites and granodiorites appear to post-date the main fabrics within the Clerkhill Intrusion. In the Glaisgeo area there is no obvious change in F₂ or F₃ minor fold vergence across the augen gneisses of the Clerkhill Intrusion, suggesting that it does not occupy a major F₂ or F₃ fold hinge.

The Clerkhill Intrusion is a differentiated granodioritic, dioritic and metadoleritic body, smaller examples of which are found throughout the Naver Nappe. The age of the ultramafic pods is more equivocal.

The Moine metasedimentary rocks (Bettyhill Banded Formation) of the Naver Nappe have been subject to considerable whole-rock and trace-element geochemical studies. Moorhouse and Moorhouse (1983) suggested that geochemically they showed more affinity with the Morar Group rocks farther south rather than the Glenfinnan Group rocks. Similar conclusions were reached for the psammities and semipelites in the structurally higher Swordly Nappe to the east. Hence, they concluded that it was unlikely that the Naver or Swordly thrusts correlated with the Sgurr Beag Thrust to the south. However, the migmatitic nature of these rocks testifies to the influx of fluid phases at various times in their tectonometamorphic history (Burns, 1994; Watt *et al.*, 1996) so that correlations based on the geochemistry should be treated with caution.

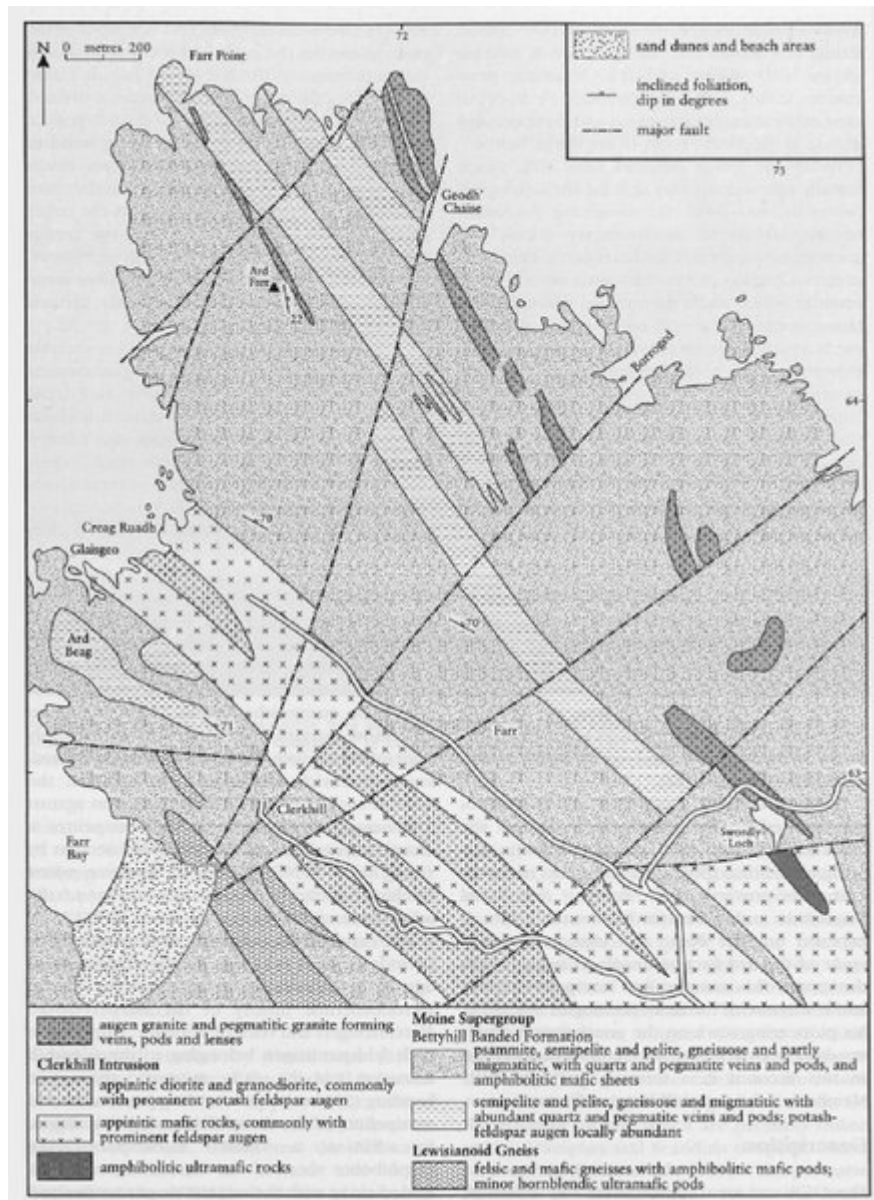
Conclusions

The Glaisgeo–Farr Point GCR site is of national importance as it provides good cross-sections across a large, deformed and metamorphosed, appinitic, felsic to mafic and ultramafic body, termed the 'Clerkhill Intrusion'. Lithologically it ranges from a granodiorite to a diorite and a dolerite, with subsidiary amphibole-rich ultramafic pods. Recent U-Pb zircon age dating supports correlation of the body with the classic Late Silurian appinites of the Appin area and the Ach'uaire Hybrid cluster of Sutherland, although its foliated and metamorphosed nature imply that it may be older. Potash-feldspar-rich

augen are abundant and hornblende-granite gneiss sheets and various other hornblende-rich lithologies can be studied in outstanding coastal exposures at Glaisgeo and inland. The deformation fabrics and minor structures in the rocks of the Clerkhill Intrusion, and in the surrounding gneissose Moine psammites and semipelites, indicate that the Clerkhill Intrusion was emplaced into the Moine succession during the latter stages of the Scandian Event in a similar manner to the Strath Halladale Granite Complex and foliated granitic intrusion of Strath Naver.

The Glaisgeo–Farr Point coastal section is also nationally important in providing excellent exposures of the Moine metasedimentary rocks on either side of the Clerkhill Intrusion. These form part of the Bettyhill Banded Formation and lie in the central part of the Naver Nappe. The site area has been the subject of several geochemical studies on the effects of metamorphism, metasomatism and migmatization on the range of rock types present and remains suitable for further work.

References



(Figure 6.29) Map of the Glaisgeo–Farr Point GCR site. Based on Cheng (1943) and British Geological Survey 1:50 000 Sheet 115W, Strathy Point (1996).



(Figure 6.30) Foliated augened diorite with deformed amphibolitic mafic stringers and lamellae. Foreshore at Glaisgeo [NC 7142 6362]. The compass is 18 cm long. (Photo: J.R. Mendum, BGS No. P577534, reproduced with the permission of the Director, British Geological Survey, © NERC.)