Loch Sgioport (Skipport), South Uist

[NF 812 384]

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Introduction

The Loch Sgioport GCR site (formerly termed 'Loch Skipport') shows several features and relationships that are critical to the overall interpretation of the Lewisian Gneiss Complex in South Uist. Firstly, it is one of the few areas west of the Outer Hebrides Fault Zone to contain relict granulite-facies pyroxene-bearing felsic gneisses. Secondly, metasedimentary rocks are present and their relationships to the Scourian-age migmatization and to the mafic dykes and sheets of the 'Younger Basic' Suite can be seen. Thirdly, although the overall Laxfordian deformational effects are low to moderate, local late-stage Laxfordian folding and remobilization of the gneisses are both well developed in the area.

The area of interest spans the southern slopes of Ben Tarbert, the Loch Sgioport road (B890), and the area immediately west of Loch Teanga (Figure 2.20). The dominant rocks are felsic gneisses, with subsidiary amphibolitic mafic units. In parts the gneisses are migmatitic, and contain numerous veins of leucogranite and veins and pods of pegmatitic granite. Belts of pelitic metasedimentary rocks occur immediately west of Loch Teanga and on the south-eastern slopes of Ben Tarbert. Amphibolite dykes of the 'Younger Basic' Suite are abundant, particularly on the north side of the road. Coward (1969) first mapped the area in detail and described its varied features (Coward *et al.,* 1969; Coward, 1973b). The overall geology is also summarized in Fettes *et al.* (1992).

Description

Within the GCR site area, south of the Loch Sgioport road and west of Loch Teanga, there are numerous low-relief rocky exposures and a scattering of small lochs. North of the road the ground rises towards Ben Tarbert, and here the exposure is generally good with progressive tiers of low crags. Glaciation has scoured most of the area and has left many clean rock slabs and rounded outcrops. Glacial striae and roche moutonnee bedforms show clearly that the ice flow moved eastwards across the site area, at least during the Late Devensian.

The area is dominated by white to grey, massive to blocky, thinly banded, biotite- and hornblende-bearing quartzofeldspathic gneisses, with thin bands and larger pods and lenses of mafic gneiss, up to 2–3m across. The banding in the felsic gneisses is commonly migmatitic, and veins and pods of quartz-feldspar pegmatite and pegmatitic granite are abundant in places. In rare instances these features are seen to be cross-cut by mafic dykes of the 'Younger Basic' Suite. The gneissose foliation is disposed around late-Laxfordian folds (see below) and its strike varies from north-west to north and north-east, with dips of 50°–80° to the west. Coward (1969) recorded relict clinopyroxene-orthopyroxene and clinopyroxene-garnet assemblages in some of the agmatitic 'Older Basic' bodies, particularly around Loch Teanga. He also noted the presence of orthopyroxene in parts of the adjacent felsic gneisses, although normally the orthopyroxene is retrograded to hornblende as a result of late-Laxfordian metamorphism (see below).

Lenticular bands and pods of metasedimentary rock, up to several metres across, occur in the area immediately north-west of Loch Teanga. These rocks are schistose pelites and semipelites with a characteristic yellow-brown weathered appearance (Figure 2.21)a. Typically, they contain the mineral assemblage quartz-plagioclase-biotite-garnet, but Coward *et al.* (1969) also recorded the presence of hornblende, anthophyllite and pyroxene. The schistosity is defined by the biotite and aligned quartz. Coward (1969) noted that both diopside and hypersthene are present and that the ratio of hornblende to pyroxene is highly variable. Coward *et al.* (1969, fig. 2) showed that a second belt of metasedimentary rocks can be traced north-eastwards from Loch Airigh na h-Achlais across the shoulder of Ben Tarbert (Figure 2.20).

On the slopes north of the road there is a series of metadolerite dykes belonging to the 'Younger Basic' Suite. These dykes range from a few centimetres to 1 m in width, and although locally boudinaged, some can be traced laterally for over 100 m. The dykes cut across the gneissose banding and foliation, generally at low angles (Figure 2.21)b, but locally with greater angular discordance. Hence the banding and foliation are predominantly of Scourian age. Some of the mafic dykes in this area, notably the thicker dykes or pods, retain pyroxene-bearing assemblages and show little evidence of an internal fabric. They contrast with the strongly deformed and partly agmatized mafic bodies of the 'Older Basic' Suite that have been subject to the main Scourian gneiss-forming events, examples of which are seen south of the road. Coward *et al.* (1969) reported a 'Younger Basic' dyke cutting a 'migmatized' metasedimentary unit north of the road at [NF 814 389], confirming that such metasedimentary units are Scourian (Archaean) in age.

Farther north on the shoulder of Ben Tarbert, at [NF 813 393], an ultramafic pod approximately 150 m in diameter forms a prominent upstanding craggy outcrop. The rock has a characteristic brownish-yellow weathered appearance, but is dark green to black on fresh surfaces. In places the rock shows evidence of patchy alteration to tremolite and actinolite. The degree of recrystallization generally increases towards the margins although the actual contact with the host gneisses is not seen. In thin section the rock consists dominantly of orthopyroxenes and clinopyroxenes with subsidiary amphibole, and hence is a pyroxenite. To the west of this pod there are a number of fairly thick (3–4m) dykes of the 'Younger Basic' Suite. They have granular textures in hand specimen, and in thin section they exhibit clinopyroxene-garnet-plagioclase-quartz assemblages. Locally, the dykes show evidence of increasing Laxfordian strain relative to those seen to the south. Some of the thinner dykes are tightly folded and the development of deformational fabrics is accompanied by retrogression of garnet rims to plagioclase.

Coward *et al.* (1969) noted that the metasedimentary units could be used as lithological markers to trace out the regional trend of the gneissose foliation. The foliation is basically of Scourian age, but has been enhanced by moderate Laxfordian $D2_L$ deformation and weak $D3_L$ deformation. Coward (1973b) noted that the F2 fold axes and L2 lineations are generally indistinguishable from the equivalent D3 structures. In the Loch Teanga area these linear elements plunge at 30°–40° to the south-west. However, the foliation traces define a series of folds with subvertical axial planes trending roughly east–west. Related minor folds range from open to tight with generally disharmonic profiles. Coward (1973b) ascribed these folds to the regional Laxfordian $D4_L$ event. He also noted that there is a progressive eastward development in the intensity of $D4_L$ deformation, which reaches its acme in the eastern part of the Loch Sgioport area. He also noted that as the F4 folding became more intense there is a concomitant increase in the degree of remobilization and recrystallization of the Scourian gneisses. This recrystallization was syn- to post-tectonic, such that it overprinted the new $D4_L$ fabrics. This phenomenon reaches its greatest development in an area north of Hecla, about 4 km to the SSE of the GCR site area. Here, Coward (1973b) noted that 'almost the whole gneiss has been transformed into a granitic mass, the gneissic banding is destroyed and the basic rocks remain only as hornblende-and biotite-rich schlieren'.

Interpretation

Coward *et al.* (1969) described the metasedimentary units in North and South Uist. They recognized two types, which they termed metasediments *sensu stricto* (*ss)* and *sensu lato* (*sl).* The former are more readily distinguishable from the quartzofeldspathic gneisses and include the brownish-weathering schistose garnetiferous biotite semipelites and pelites seen near Loch Teanga. The 'metasediments *s/'* include quartzose and quartzofeldspathic lithologies, which are less easily distinguished from the host felsic gneisses, which were derived from tonalite and granodiorite intrusions. Coward *et al.* (1969) further noted that many of the metasedimentary units are associated with banded mafic units (the 'Older Basic' Suite of Fettes *et al.,* 1992). Indeed, concentrations of associated mafic–metasedimentary units appear to define linear belts, traceable for several kilometres, even though the individual units are normally lenticular and only a few tens of metres wide.

The relationships at Loch Sgioport, particularly the undeformed 'Younger Basic' dykes cutting already foliated and migmatized metasedimentary rocks and the host felsic and mafic gneisses, allowed Coward *et al.* (1969) to argue that the metasedimentary rocks had been subjected to the Scourian gneiss-forming events. They further postulated that the 'metasediments *s/'* grade into the quartzofeldspathic gneisses and that the felsic gneiss complex is effectively a migmatized supracrustal sequence. The currently observed metasedimentary units thus represented unmigmatized

more-exotic relics. Such circumstances seem unlikely, as normally semipelitic rocks are preferentially migmatized and quartzites or mafic lithologies tend to be preserved as relics. The interpretation of Coward *et al.* (1969) was overturned by Moorbath *et al.* (1975) who, on the basis of Pb-Pb and Rb-Sr isotopic systematics, showed that the protoliths of the felsic gneisses were upper-mantle-derived igneous rocks emplaced *c.* 100–200 Ma before the main Scourian events, that is at *c.* 2900 Ma. This conclusion together with correlations with analogous rocks in Greenland suggests that the metasedimentary and spatially associated banded mafic units are distinctly older than the bulk of the felsic gneisses (see Fettes and Mendum, 1987, for discussion). Hence they represent preserved xenolithic rafts or screens within the igneous protoliths.

Coward (1973b) described pyroxene-bearing felsic gneisses and metasedimentary units from the Loch Sgioport area. This is the only part of the Outer Hebrides, outwith eastern Barra, where such high-grade felsic gneisses are found. Their granulite-facies mineralogy and the crosscutting nature of the 'Younger Basic' mafic dykes all indicate low degrees of Laxfordian reworking. Coward (1969) argued from textural evidence that pyroxene recrystallized (or remained stable) in the gneisses during and immediately after the regional Laxfordian $D2_L$ event but became almost completely retrograded in the felsic gneisses during the $D4_L$ event. Drawing parallels with the geological history inferred from Leinis in Barra (see Leinis GCR site report, this chapter), it seems probable that the gneisses were subject to granulite-facies metamorphism during the main Scourian tectonometamorphic events. Their resulting relatively anhydrous nature allowed recrysta fli7ation of the pyroxene during the early Laxfordian. In contrast, the granulite-facies mineralogies found widely in the mafic dykes and larger pods of the 'Younger Basic' Suite are deemed to be a product of crystallization of relatively anhydrous basic magma in already hot country rocks at mid-crustal levels.

Coward *et al.* (1970) ascribed the main Laxfordian reworking to the second and third deformational events. Although the former $D2_L$ event was more penetrative, the latter $D3_L$ event produced a series of regional-scale folds, whose steep axial planes trend north-west. These F3 folds have cuspate profiles with broad anti-formal crests and narrow pinched-in synforms. In parts of the Outer Hebrides, areas of low Laxfordian strain commonly correspond to the broad antiformal F3 hinge zones, but the Loch Sgioport area does not follow this pattern. Here, $D3_L$ effects are slight and overall Laxfordian reworking is low but this does not appear to be reflected in the earlier Laxfordian $D2_L$ stuctures, which are moderately to strongly developed, nor in the $D3_L$ structural features (Coward, 1973b). It is probable that the Scourian granulite-facies metamorphism was patchy and confined to the eastern and southern parts of the southern islands (Moorbath *et al.,* 1975). Thus, the pyroxene-bearing gneisses of Loch Sgioport are probably not relics of a widespread granulite-facies terrain preserved in a zone of low reworking. Rather, the granulite-facies gneisses themselves may have been instrumental in determining the nature of the reworking, focusing strain into the adjacent more-hydrous amphibolite-facies gneisses (Coward, 1973b). Strangely, as noted above, the greatest development of $D4_L$ deformation in the Uists is in the Loch Sgioport area. It is unclear why this is the case, and equally puzzling why high degrees of gneiss remobilization occurred during $D4_L$ in what were previously relatively anhydrous rocks. Even if the $D4_L$ strain had allowed a high degree of fluid access, the preservation of the orthopyroxene is still surprising. Coward (1973b) noted the anomaly but was unable to explain it.

Conclusions

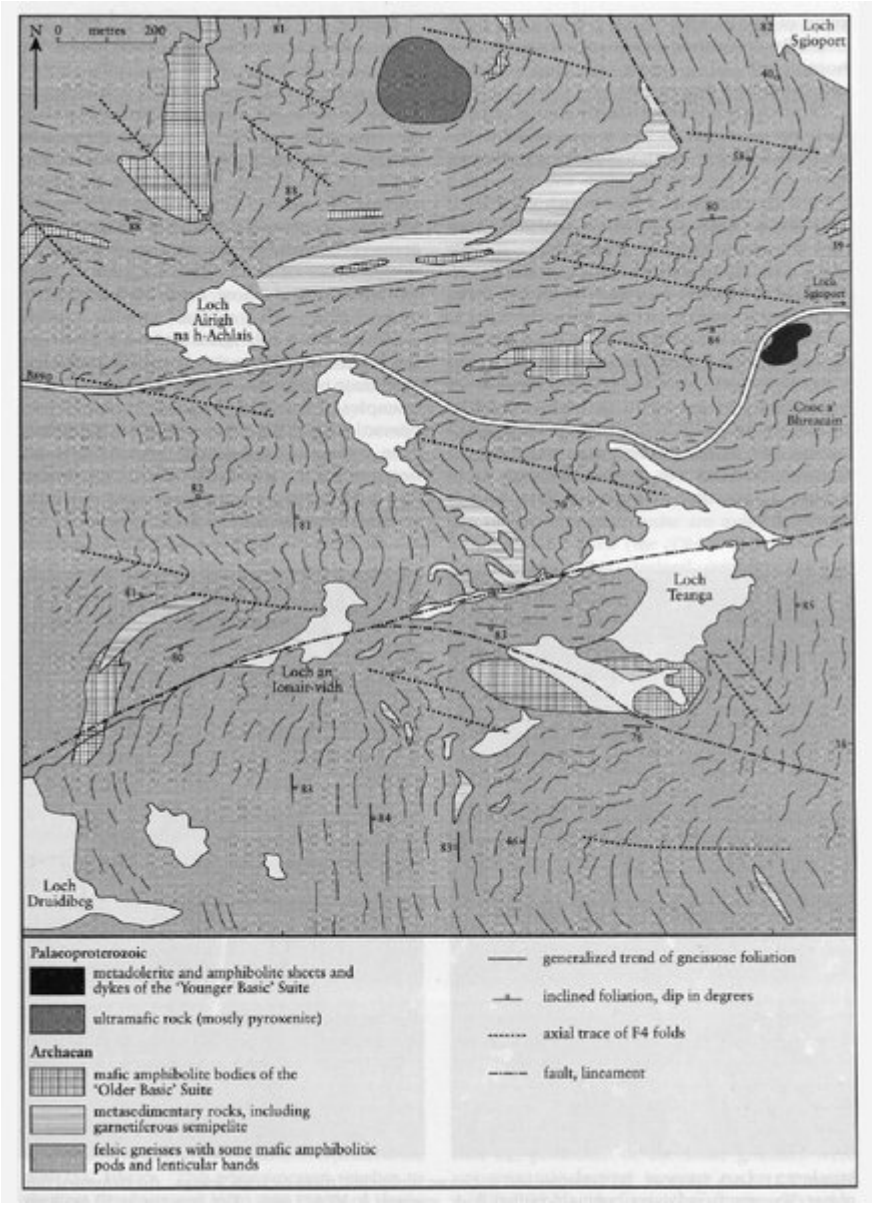
The Loch Sgioport GCR site contains a variety of Lewisian gneiss lithologies and Archaean and Proterozoic features unique to the Outer Hebrides. Pyroxene-bearing felsic gneisses with relict granulite-facies mineralogies occur in association with metasedimentary units and mafic amphibolite bodies of the 'Older Basic' Suite. These Archaean elements are cross-cut by mafic dykes of the 'Younger Basic' Suite. The Scourian (Archaean) gneisses are commonly migmatitic and in places contain abundant quartz-feldspar pegmatite and leucogranite veins and pods. The main Laxfordian reworking events have not greatly affected this part of South Uist and many key Scourian and early-Laxfordian relationships can still be discerned. Similar features are well seen in eastern Barra (see Leinis GCR site report, this chapter) but the Loch Sgioport occurrences are the only Hebridean examples that lie to the west of the Outer Hebrides Fault Zone.

The metasedimentary and 'Older Basic' mafic rocks both contain pyroxene-bearing assemblages in the Loch Sgioport area. Relict orthopyroxene is also present locally in the quartzofeldspathic gneisses. It is believed that these

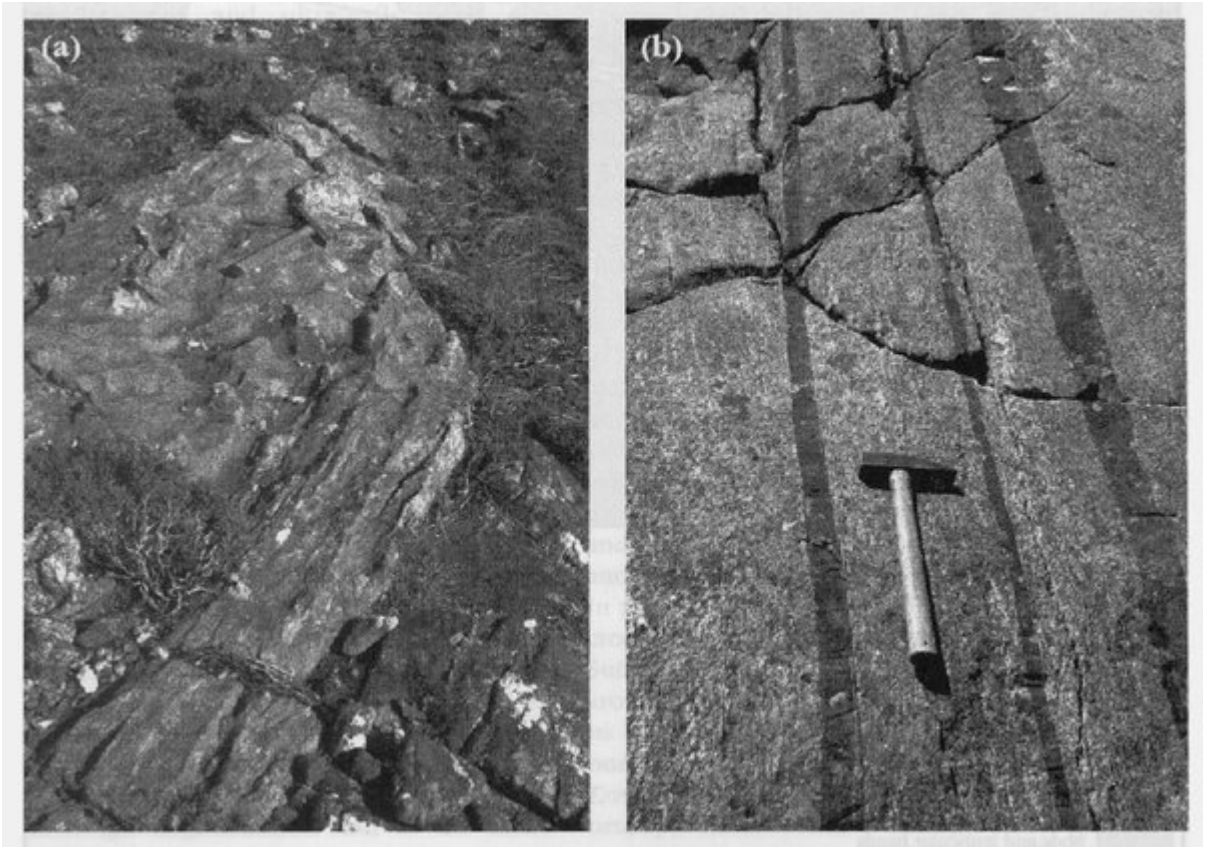
assemblages are Scourian, recording a local area of granulite-facies metamorphism. The consequent relatively anhydrous rocks resisted the subsequent main Laxfordian reworking phases and even allowed the pyroxene to locally recrystallize during early-Laxfordian times. However, during the late-Laxfordian, the intensity of deformation was greater in this region than elsewhere in the Uists, with the accompanying remobilization of the gneisses retrograding most of the pyroxene-bearing assemblages. Although some areas of the Outer Hebrides with low degrees of Laxfordian reworking are coincident with the antiformal hinge zones of large- or medium-scale Laxfordian F3 folds (cf. western Benbecula and Ardivachar Point, South Uist), the Loch Sgioport area does not appear to lie in such a structural position. The medium-scale folds of the gneissose banding in this area have E–W-trending axial planes and relate to the Laxfordian $D4_L$ deformation episode.

The Loch Sgioport GCR site is particularly important in that it provides evidence of the relationships between the various Lewisian lithologies. It also shows the controlling effects of the early high-grade rocks on the subsequent Laxfordian deformational and metamorphic pattern. Hence, it is a key area in deciphering the early history of the Outer Hebrides. As such the site is nationally important and its ready accessibility makes it useful for teaching purposes. It is also suitable for further work, particularly on the metamorphic mineralogy of the various different elements of the Lewisian Gneiss Complex.

References



(Figure 2.20) Simplified geological map of Loch Sgioport (Skipport), South Uist. After Coward (1969).



(Figure 2.21) Loch Sgioport. (a) Schistose and gneissose semipelitic rocks by Loch Teanga. (b) Deformed thin planar 'Younger Basic' dykes cutting Scourian felsic gneisses at [NF 812 389]. The hammer is 37 cm long. (Photos: J.R. Mendum.)