
Meall an t-Sithe and Creag Rainich

[NH 142 764], [NH 081 755]–[NH 108 748]

S.P. Kelley

Introduction

The Moine rocks of the Meall an t-Sithe and Creag Rainich GCR site in Ross-shire represent the closest approach of the Sgurr Beag Thrust, a ductile D2 structure, to the later Moine Thrust Belt. The site affords an excellent opportunity to study the interaction of Scandian mylonitization and thrusting of the Moine Thrust Belt with earlier Caledonian structures and metamorphic fabrics associated with the Sgurr Beag Thrust.

In the Fannich Mountains, middle amphibolite-facies gneissose semipelites and pelites of the Glenfinnan Group lie structurally above lower amphibolite-facies psammitic and pelitic rocks of the Morar Group, separated by a major tectonic break, the Sgurr Beag Thrust. The area was originally mapped by J. Horne for the Geological Survey and described in the memoir for the Fannich Mountains (Sheet 92) (Peach *et al.*, 1913; Geological Survey of Scotland, 1913a). Horne selected Meall an t-Sithe as the type area for the gneissose, partly migmatitic semipelite and pelite which forms the bulk of the Glenfinnan Group rocks in this area. The early descriptions of the site (Peach *et al.*, 1913) emphasize the high metamorphic grade of the Meall an t-Sithe Pelite, although Winchester (1973) thought the grade was similar in the underlying Sgùrr Mòr Pelite of the Morar Group (see (Figure 7.3)). The importance of the Meall an t-Sithe–Creag Rainich area in terms of the relationship between the early and later Caledonian deformations was first recognized by Kelley and Powell (1985).

The area lies at the northern end of the F3 Fannich Synform, which post-dates the Sgurr Beag Thrust, and bedding and S2 cleavage orientations generally dip gently to the south. D3 deformation effects are restricted to minor folds, which fold the earlier penetrative S2 cleavage and D2 structures. Westwards, towards the Moine Thrust Belt, the D3 deformation features become more strongly developed, with F3 folds becoming tight and even locally isoclinal, and a penetrative, composite S2–S3 cleavage is present. Lewisianoid gneisses are interfolded with the Meall an t-Sithe Pelite Formation in the Fannich Mountains to the south-east (see Fannich GCR site report, this chapter), but are absent in the Meall an t-Sithe and Creag Rainich GCR site.

Description

The site encompasses two sections at either end of the broad, rocky, partly peat-covered, WSW-trending ridge between Meall an t-Sithe and Creag Rainich. The western section stretches from Abhainn Loch an Nid to Creag Rainich and Meall Dubh and includes the Moine Thrust. The eastern section is focused on Meall an t-Sithe, and lies some 6 km east of the Moine Thrust. The structurally highest unit is the coarsely foliated gneissose semipelite and pelite of the Meall an t-Sithe Pelite Formation, assigned to the Glenfinnan Group. This formation lies in a structural outlier or klippe, surrounded by the Sgurr Beag Thrust (Figure 7.6). It is preserved owing to a NE-trending normal fault that passes through part of Loch a' Bhraoin and throws the succession down to the north-west. The main synformal outlier of the Sgurr Beag Thrust and Glenfinnan Group rocks lies to the south and is described in the Fannich GCR site report (this chapter).

The gneissose semipelite of the Meall an t-Sithe Pelite Formation consists of biotite, muscovite, garnet, quartz and plagioclase feldspar with abundant coarse-grained plagioclase-quartz segregations that in part define the foliation. Claret-coloured garnets are locally very abundant. The unit is locally layered and migmatitic. It crops out on the ridge running from Meall Dubh [NH 103 747] to Meall an t-Sithe [NH 140 764] and underlies much of the peat-covered southern slopes of the ridge towards Loch a' Bhraoin. The gneissose semipelite contrasts strongly with the schistose pelites and fiaggy psammites of the Morar Group on the summit of Creag Rainich and on the lower slopes north of Meall an t-Sithe, towards the A832 road.

In the eastern part of the structural outlier, the peak metamorphic D2 structures associated with the Sgurr Beag Thrust are preserved. These include: L2 stretching lineations in both the gneissose semipelites and pelites and underlying psammites that plunge towards 160°; a suite of discordant pegmatitic granites that cross-cut the D2/Sgurr Beag Thrust fabrics and post-date peak metamorphism; and quartz c-axis preferred orientations associated with the Sgurr Beag Thrust that are little modified by later deformation (Kelley and Powell, 1985). Farther west, the L2 lineations swing gradually towards 110° and 090°, to accord with stretching lineations developed within the later Moine Thrust mylonites. The undeformed pegmatites found in the east become progressively rotated into parallelism with the composite fabric, and the Sgurr Beag Thrust fabrics in both psammites and pelites become deformed by S–C-type fabrics on all scales, implying a top-to-the-WNW sense of movement. Finally, exposures of the Meall a' Chrasgaidh Psammite close to the Moine Thrust exhibit some brittle deformation features, including cataclastic zones and thin pseudotachylyte veins. At its most westerly exposure in the site area, on Meall Dubh [NH 103 747], the Sgurr Beag Thrust lies only 2 km east of the brittle Moine Thrust and only 400 m structurally above it.

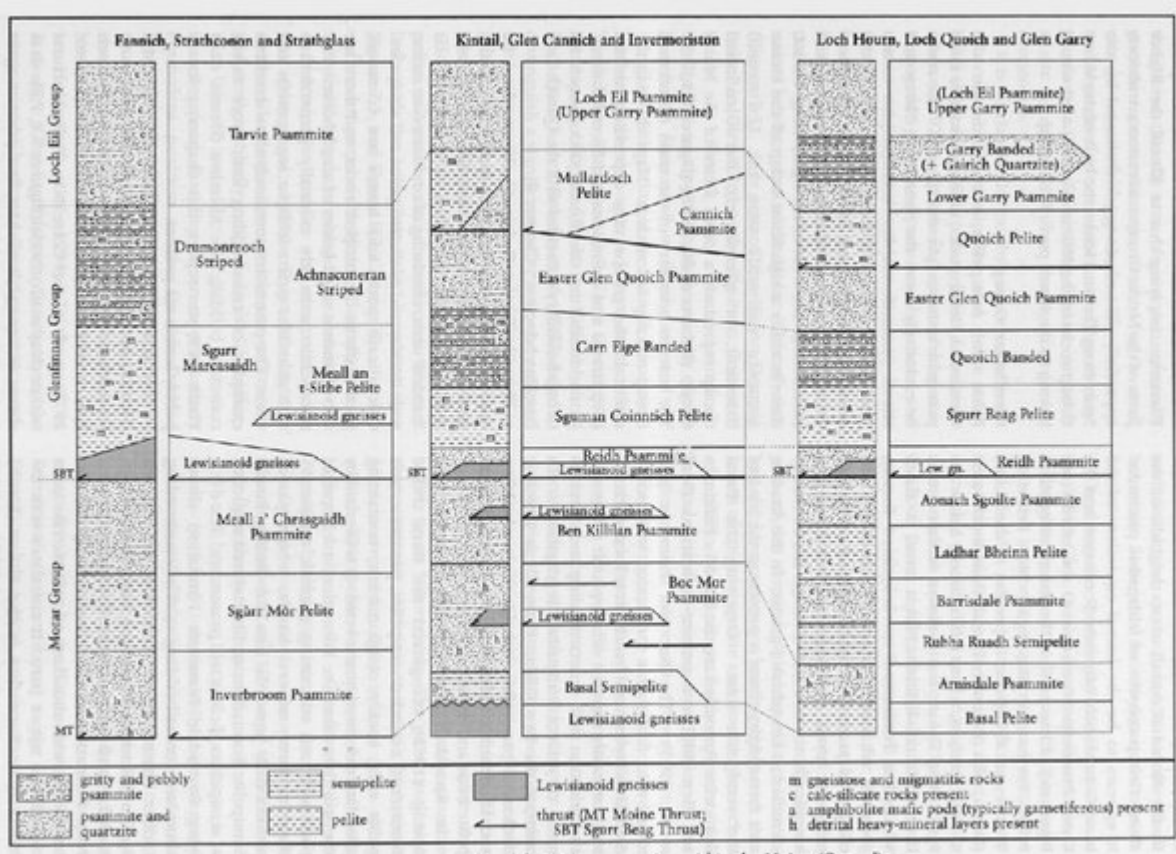
Interpretation

The close proximity of the Sgurr Beag Thrust to the Moine Thrust Belt in the Meall an t-Sithe and Creag Rainich area demonstrates the relative ages of the Moine mylonites and the D2 movements on the Sgurr Beag Thrust. D2 movements along the Sgurr Beag Thrust in the area are generally considered to have occurred mainly during the Grampian Event (Early Ordovician), although farther south Knoydartian (Neoproterozoic) movement has been documented (Tanner and Evans, 2003). Near Creag Rainich, the Sgurr Beag Thrust and Moine Thrust are exposed less than 2 km apart. The increasing deformation that has resulted in formation of the Moine Thrust Belt mylonites has progressively rotated the earlier L2 linear and S2 planar fabrics into parallelism. The peak metamorphic amphibolite-facies textures associated with the Sgurr Beag Thrust have been deformed under greenschist-facies conditions, with the earlier coarse-grained fabrics recrystallized into finer-grained mylonites. Hence, movements on the Sgurr Beag Thrust had ceased and the rocks had been uplifted and cooled substantially prior to the formation of the Moine mylonites. This is in contrast to earlier syntheses of the Moine Thrust Belt, which correlated mylonite formation with the peak of metamorphism in the Moine rocks farther east (Johnson, 1957, 1960; Barber, 1965). In the adjoining Fannich area to the south-east of the site (see Fannich GCR site report, this chapter), the Sgurr Beag Thrust is folded in a large F3 synform, but it appears that the mylonitic fabrics also overprint these D3 structures. Although it is not possible to determine the length of time between formation of the Fannich Synform and formation of the Moine mylonites, there is some continuity of minor F3 folds and microtextures from the synform into the mylonites (Kelley and Powell, 1985). This may indicate a possible progressive link between F3 and the Scandian-age mylonitization. However, if the Fannich Synform links to the F3 Monar Synform farther to the south-east there seems to be an age disparity, as c. 450 Ma pegmatites are related to the minor F3 folds at Monar (van Breemen *et al.*, 1974). In contrast, the K-Ar mica ages from the Fannich and Creag Rainich areas imply that mylonitization of the Moine Thrust Belt occurred later at around 440–430 Ma (Kelley, 1988; Freeman *et al.*, 1998).

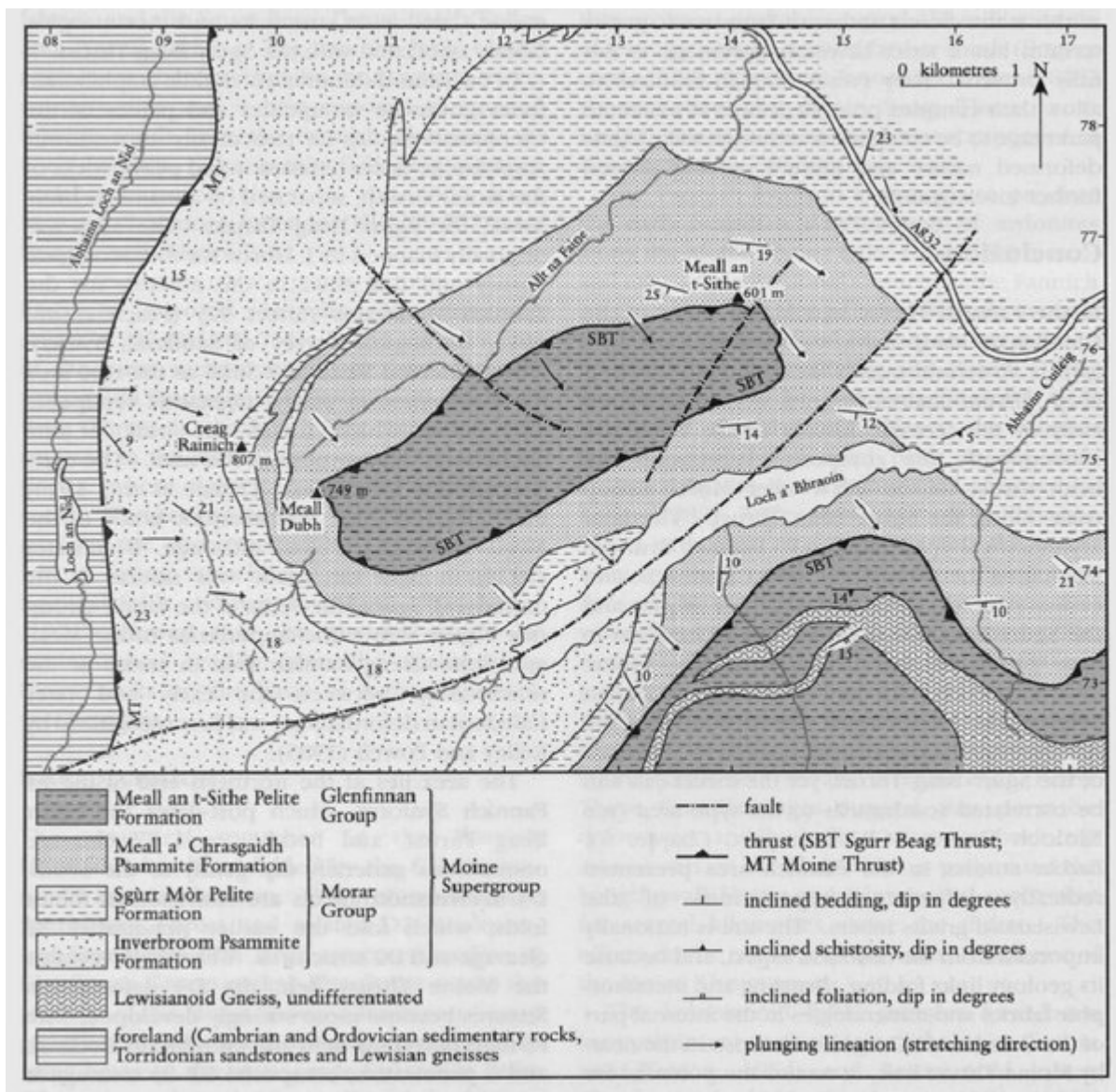
Conclusions

The Meall an t-Sithe and Creag Rainich GCR site is unique within the Northern Highlands in that it illustrates the relationship between probable Grampian (Early Ordovician age) D2 thrusting, peak metamorphism, later D3 folding, and the main period of Scandian mylonitization associated with the Moine Thrust Belt. As such it is of national importance as it enables the orogenic history of the more-internal, once deeper-level parts of the Caledonian mountain belt to be related to that of the external Moine Thrust Belt. The Sgurr Beag Thrust, a composite D2 + D3 structure in the type area to the south (see Kinloch bourn and Lochailort GCR site reports, Chapter 8), is here folded by the asymmetrical large-scale F3 Fannich Synform along gently S-plunging axes. Quartz-feldspar pegmatites that discordantly cross-cut the Sgurr Beag Thrust and its related fabrics are progressively deformed and re-orientated as the mylonite zone of the Moine Thrust Belt is approached. The site allows for further detailed studies to be made of the relationship between the Ordovician-age Grampian D2 and D3 deformation events and the later mid-Silurian-age Scandian thrusting and deformation events.

[References](#)



(Figure 7.3) Tectonostratigraphy of the Moine succession within the Moine (Central) area.



(Figure 7.6) Geological map of the Meall an t-Sithe and Creag Rainich area. Based on Geological Survey of Scotland (1913a) (Sheet 92) and Kelley and Powell (1985).