
Sgonnan Mòr-Dubh Loch Beag–Upper Glen Oykel

[NC 295 145]–[NC 298 132], [NC 316 155]–[NC 320 160], [NC 308 180]–[NC 312 185]

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Introduction

The three separate areas that make up the Sgonnan Mòr-Dubh Loch Beag–Upper Glen Oykel GCR site provide exposures of the Ben More Thrust and its associated structures (Figure 5.28). This site report should be read in conjunction with that on the adjacent Ben More Assynt–Conival–Na Tuadhan site and the 'Introduction to the Ben More Thrust'. The folds in the hangingwall of the thrust at this site (and at Na Tuadhan) have been important in defining the temporal relationship between individual major thrusts and the Loch Ailsh Pluton, and thus in determining the relative and absolute timing of thrust displacements. Elliott and Johnson (1980) correlated these so-called 'Sgonnan Mòr structures' as a single deformation episode, so that intrusion events could be linked to thrusting. However, the use of such structural correlations can be erroneous and hence yield unreliable results (see also Foinaven GCR site report, this chapter). Butler (1997) related these folds to the propagation of the Ben More Thrust, possibly nucleating on Precambrian normal faults that offset the Lewisian-Torridonian unconformity.

Description

In south-central Assynt, the Ben More Thrust crosses upper Glen Oykel, and structures associated with the thrust are exposed on either side of the glen. In its type area, just to the west of Ben More Assynt, the thrust sheet emplaces Lewisian and Torridonian rocks together with their cover of Cambrian quartzites over younger parts of the Cambrian quartzite sequence, which are intruded by pre-thrusting peralkaline rhyolite ('grorudite') sills. This thrust relationship is also clearly demonstrated in the stream section of the Allt an Dubh Loch Mhoir ([NC 311 182], 'A on (Figure 5.28)) in Upper Glen Oykel. Here the footwall lies in Durness Group carbonate rocks, which lie above a continuous, gently NE-dipping section of Pipe Rock, Fucoïd Beds and Salterella Grit. Above the thrust lies about 1 m of quartzites, followed by some 30 m of Torridonian rocks, overlain in turn by Lewisian gneisses. The quartzites are presumed to be the lowest part of the Cambrian succession so that the hangingwall is an inverted stratigraphical sequence (cf. Milne, 1978). Uncertainty exists with this interpretation because of the intense deformation associated with the thrust, which has obscured sedimentary structures in the hangingwall strata. The footwall strata are metamorphosed, presumably not only by sills of vogesite (hornblende-rich lamprophyre), but also by the nearby Loch Borralan Pluton, so that the Durness carbonate rocks are now marbles. The thrust plane dips parallel to bedding in the footwall and to the mylonitic foliation in the overlying quartzites. It is marked by 10 cm of carbonate-rich gouge and brecciated marble. The quartzite mylonites contain an intense ESE-plunging mineral lineation. The mylonitic deformation, brecciation and presumably, all the displacement on the Ben More Thrust, post-date the igneous activity and metamorphism at this locality.

Folding and cleavage development in the hangingwall of the Ben More Thrust are well illustrated by outcrops around Bealach Choinnich [NC 296 146] on the west side of Glen Oykel (Figure 5.31). Here, a tight, W-facing fold, termed the 'Sgonnan Mòr Syncline' (Johnson, 1965), is cored by Torridonian sandstones and conglomerates (Butler, 1997). Its axial surface lies sub-parallel to the Ben More Thrust. The distinctive basal conglomerate unit of the Torridonian is missing from the inverted, upper limb on the northern slope of Sgonnan Mòr, suggesting a faulted contact. A similar faulted contact between Lewisian and Torridonian may be inferred on the normal limb of the syncline as exposed on the south side of Bealach Choinnich (Figure 5.31). Here the contact dips more steeply than bedding in the right-way-up Torridonian. The bedding is discordant and the facies is not conglomeratic. This inferred fault surface may be traced around the synclinal fold closure, implying that it originally had a southward downthrow (Butler, 1997).

Near the Allt Dubh Loch Beag, on the east side of Glen Oykel, the hinge zone of the Sgonnan Mòr. Syncline is well exposed, partly in the stream section, partly in nearby roches moutonnees. On its western limb are flat-lying Torridon Group basal conglomerates containing cobble-sized detritus; this limb is not strongly sheared. In contrast, the eastern

limb is steep to overturned, with a narrow shear-zone.

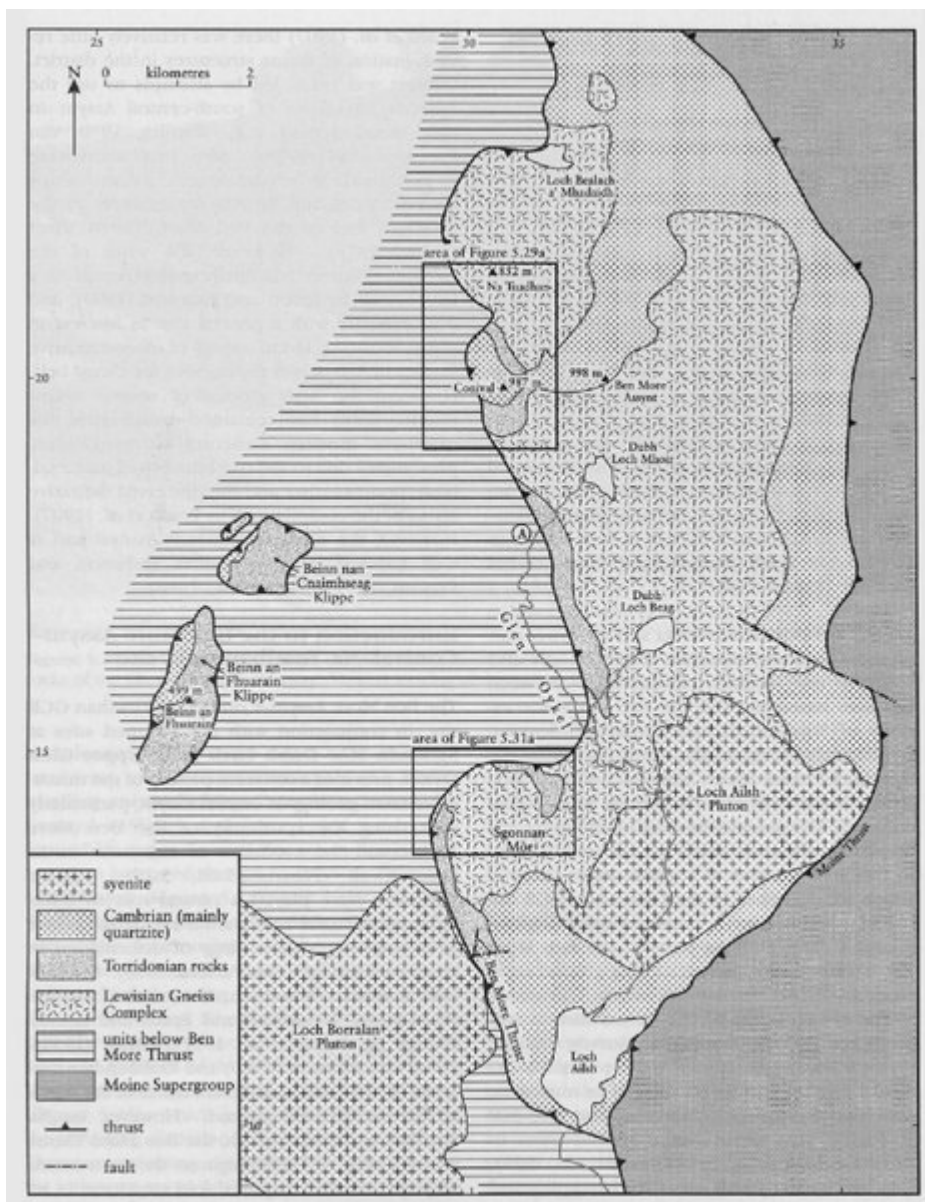
Interpretation

The relationships between folds, thrusts and igneous intrusions within the Ben More Thrust Sheet are controversial and have been discussed by Elliott and Johnson (1980) and Goodenough *et al.* (2006). Although exposure around Loch Ailsh Pluton is notably poor, the syenite pluton is foliated and contains numerous shear-zones. In addition, it is cross-cut by peralkaline rhyolite dykes that are displaced and deformed by thrust movements elsewhere in Assynt (Goodenough *et al.*, 2004). Milne (1978) argued for a continuous thrust that juxtaposed Lewisian on Torridonian strata through central Assynt that he traced into the nearby Loch Ailsh Pluton. However, at the Allt an Dubh Loch Mhoir, the contact between Lewisian and Torridonian rocks in the hangingwall to the Ben More Thrust is readily interpreted as an overturned unconformity. Thus, an alternative interpretation of the Torridonian–Lewisian relationships at Allt Dubh Loch Beag, as at Bealach Choinnich, is that the omission of the basal conglomerate could be due to Precambrian faulting (Butler, 1997). Such faults are described from Conival in the Ben More Assynt–Conival–Na Tuadhan GCR site report (this chapter). Extensional faulting of Torridonian and Lewisian rocks prior to the deposition of the Cambrian strata and the erosional event represented by the sub-Cambrian unconformity was discussed by Soper and England (1995). They suggested an episode of Vendian rifting in north-west Scotland, synchronous with deposition of the younger components of the Dalradian Supergroup farther to the south. The recognition of these early faults is important in the evaluation of pre-Caledonian palaeogeography across northern Scotland and through the North Atlantic region.

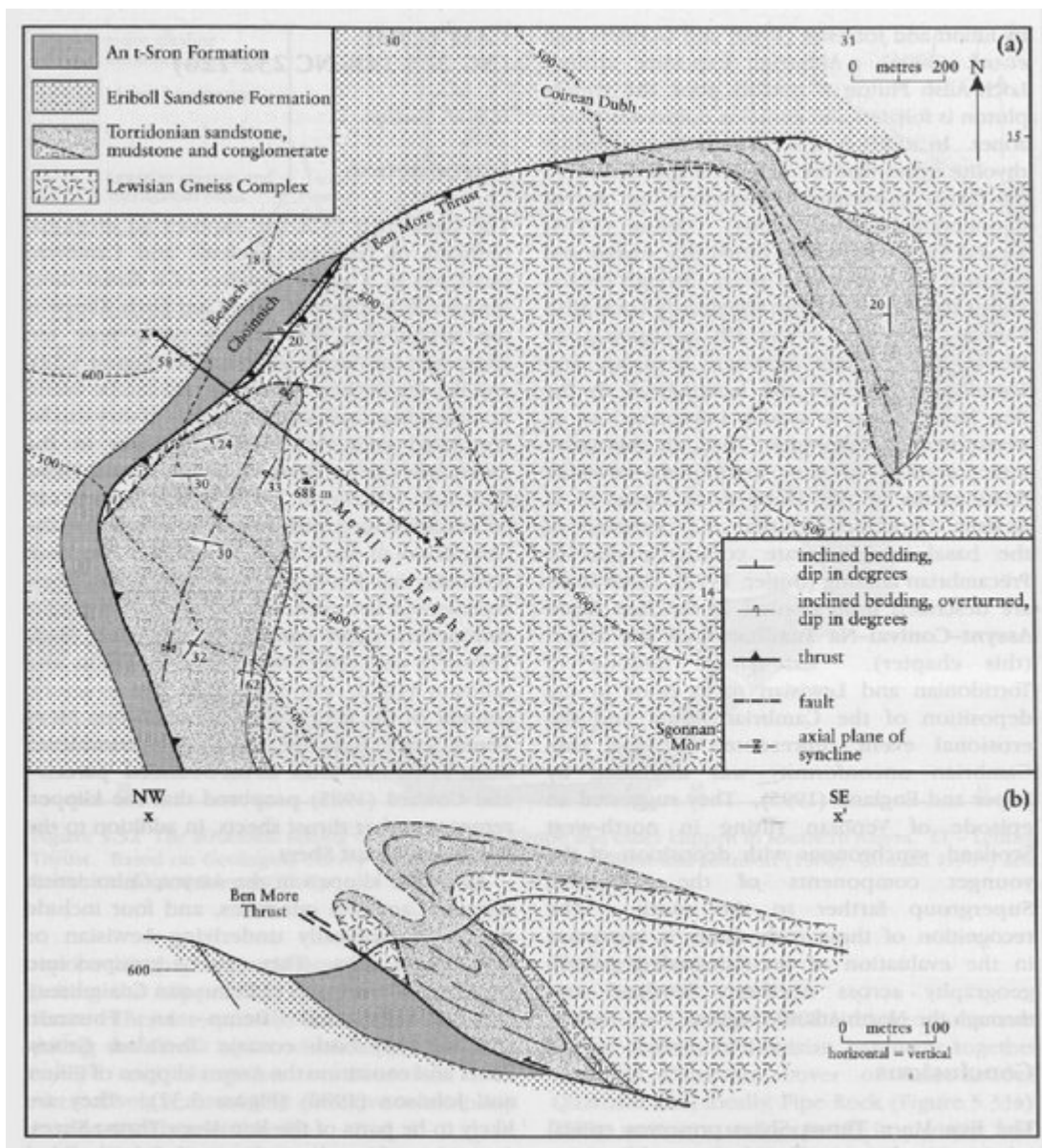
Conclusions

The Ben More Thrust Sheet preserves critical relationships between Torridonian and Lewisian units that can best be explained in terms of Caledonian deformation acting upon preexisting Precambrian extensional faults, probably formed during a period of Vendian rifting. Although the Loch Ailsh Pluton, which was intruded at c. 439 Ma, cross-cuts these early faults, it demonstrably pre-dates Caledonian folding and thrusting. These relationships, linked to radiometric age determinations, provide an important constraint on the timing of deformation within the Moine Thrust Belt.

[References](#)



(Figure 5.28) Map of the Ben More Thrust Sheet in the Assynt District of the Moine Thrust Belt. A = Allt an Dubh Loch Mhoir. The locations of Figures 5.29a and 5.31a are indicated. After British Geological Survey (2007).



(Figure 5.31) (a) Map of the Ben More Thrust Sheet at Bealach Choinnich, Sgonnan Mòr—Dubh Loch Beag—Upper Glen Oykel GCR site (see Figure 5.28 for location). Topographical contours in metres. Two inliers of Torridonian strata are shown; the one south of the bealach was remapped by the author, whereas the map of the inlier near Coirean Dubh is modified after Milne (1978). (b) Sketch cross-section through the southern inlier (x—x' on (a)). The geometry of the sub-Cambrian unconformity (upper inferred boundary) is placed using adjacent outcrops farther to the south-east and at Bealach Choinnich. After Butler (1997).