Druimindarroch

[NM 684 838]–[NM 690 844]

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Introduction

The Druimindarroch GCR site provides a representative section through the psammites and subsidiary semipelites of the Lower Morar Psammite Formation. Sedimentary structures, mainly cross-bedding and convolute bedding, are locally well seen. In addition, good examples of minor fold structures are displayed. The semipelites in the north-east part of the site contain well-developed microcline feldspar porphyroblasts whose relationship to the minor structures and related cleavages was studied by Smith and Harris (1972).

The Morar District was initially mapped by J.E. Richey for the Geological Survey in the mid-1930s. Richey and Kennedy (1939) divided the rocks into two main units, the 'Moine' and 'Sub-Moine Series'. They proposed that the underlying 'Sub-Moine' rocks had experienced a more-complex structural history and higher metamorphic grades than the overlying 'Moine' rocks. The largely right-way-up 'Moine' sequence mantles the large-scale periclinal Morar Antiform (Figure 8.4). Richey and Kennedy also noted the sedimentary features in the 'Moine' rocks on the western flank of the Morar Antiform. On its eastern flank metamorphic grade is higher and locally migmatites are developed in the semipelitic and pelitic lithologies. Later work in the area has shown that the psammites and semipelites of the 'Sub-Moine Series' form the basal units of the flanking succession of 'Moine' rocks (MacGregor, 1948; Lambert, 1958; Powell, 1964). These basal pelites, semipelites and siliceous psammites, and underlying Lewisianoid gneisses were tightly interfolded and thrust westwards, prior to the formation of the Morar Antiform. Although Richey and Kennedy's Moine-Sub-Moine hypothesis is now rejected, the 'Moine' stratigraphy is still largely correct (Figure 8.3).

Powell (1974) carried out a detailed analysis of the regional structure in the Morar–Knoydart district and recognized four separate deformation phases. His terminology is used in this account.

Description

The rocky peninsula of Rubh' Aird Mhòir by Druimindarroch consists mainly of SE-dipping, flaggy to blocky, feldspathic and micaceous psammites of the Lower Morar Psammite Formation. The psammites are well exposed on a clean-washed rock platform adjacent to Loch Nan Uamh and on rocky crags immediately inland. The Druimindarroch GCR site lies immediately west of the hinge region of the large-scale Morar Antiform and hence bedding dips are low to moderate, with open folding of probable F3 age (Figure 8.17).

The psammites range from laminated to medium-bedded and are interbedded with subsidiary dark-grey, finely cleaved, semipelite units. Cross-bedding is seen locally and some of the units show grading from siliceous bases to micaceous tops. North of the stone pier, ovoid white microcline porphyroblasts up to 5 mm across are locally abundant in the semipelite units (Smith and Harris, 1972) (Figure 8.18).

A NNE-trending fault separates more-deformed siliceous psammite and semipelite on Rubh' Aird Ghamhsgail from the upper part of the Lower Morar Psammite that is exposed in the Druimindarroch area (Figure 8.17). This boundary was originally interpreted by Richey and Kennedy (1939) as the Moine-Sub-Moine boundary, but is now recognized as the tectonic junction between the highly deformed lower part of the Lower Morar Psammite and underlying Basal Pelite, and the overlying less-deformed Morar Group succession. Lewisianoid inliers occur farther north in the deformed lower sequence.

Powell (1974) recognized four separate deformation phases in the Morar-Knoydart district. Broadly, D1 folds and shear-zones duplicate the stratigraphy and the underlying Lewisianoid gneisses. The upright Morar Antiform, which

dominates the overall structural pattern in this district, was assigned to D2. At Druimindarroch, D1 structures are represented by tight minor F1 folds preserved in hinge zones of F2 folds, for instance in thinly bedded psammites and semipelites at [NM 690 842]. A related penetrative cleavage (S1) is developed here. Both D1 and D2 structures have associated cleavages or schistosities; S1 invariably lies sub-parallel to bedding, and S2 also lies close to bedding except in F2 hinges. In the semipelitic units S2 is manifest as a pervasive crenulation cleavage, but normally forms only a weak fabric in the psammites. F2 folds are commonly tight and verge to the south-east, with S2 normally axial planar. At Druimindarroch, steeply dipping and locally inverted minor folded zones separate the predominant, gently SE-dipping, right-way-up parts of the Moine sequence. Both tight minor folds (F2) and more-upright open structures (F3) are present, with the latter structures largely responsible for the rolling nature of the bedding. F2 and F3 fold axes are generally coaxial and plunge gently to the south-west, co-linear with the locally strong quartz rodding lineation (mainly L2). East of the Morar Antiform both major and minor F3 folds occur (Powell, 1974), but only minor open to tight F3 folds occur to the west. Locally they have an associated crenulation cleavage (S3). Upright F4 folds form small- and large-scale open folds, typically manifest as swings in the regional strike of the bedding and traces of the earlier axial planes. Semipelites locally show a weak SSE-trending subvertical S4 crenulation cleavage.

Smith and Harris (1972) showed that micro-dine porphyroblasts are generally flattened in S2 and have been partially replaced by quartz, epidote and white mica. These relict 'microcline augen' lie in a matrix of quartz, muscovite and biotite, with the micas showing a strong preferred orientation defining S2. In the field the porphyroblasts occur both as flattened and aligned forms and unmodified non-aligned crystals (Figure 8.18). These latter porphyroblasts retain their initial form and consist mainly of single crystals of microcline. Smith and Harris (1972) argued that these feldspars crystallized subsequent to D2 deformation under lower amphibolite-facies conditions, and that they overgrow the S2 fabric. Some of the porphyroblasts were reported to contain a central zone of strongly orientated fine inclusions and a marginal zone of coarser inclusions, suggesting either two phases of growth or that porphyroblast growth continued after D2 deformation had ceased. The later D4 deformation has resulted in some rotation of the 'microcline augen', the generation of microfolds of the S2 mica fabric, and locally formation of a rudimentary crenulation cleavage.

Two 1 m-thick sheets of grey-green microdiorite, locally appinitic with coarse hornblende, intrude the Moine succession near the southwest end of the peninsula. These intrusions belong to the Silurian-age, late Caledonian Microdiorite Sub-suite and have been metamorphosed, here under greenschist-facies conditions. In a small bay [NM 687 842] west of the pier, a camptonite dyke cuts an additional thin microdiorite sheet. Several camptonite dykes are present on the peninsula. They range from 0.5 m to 3.5 m thick and form part of the regional, E–W-trending, Permo–Carboniferous alkali-basalt camptonite-monchiquite swarm. They are cut in turn by several brown-weathering Palaeocene basalt dykes of the Skye swarm that form very marked features on the coastal section. These dykes range up to 13 m thick and in this area consistently trend 350° (Figure 8.17).

Interpretation

The Druimindarroch site lies immediately west of the hinge region of the regional Morar Antiform. The psammitic Moine sequence is locally tightly folded here, but overall the beds dip gently to moderately to the south-east. The psammites, which form the upper part of the Lower Morar Psammite Formation, show sedimentary features indicative of their shallow-water origin.

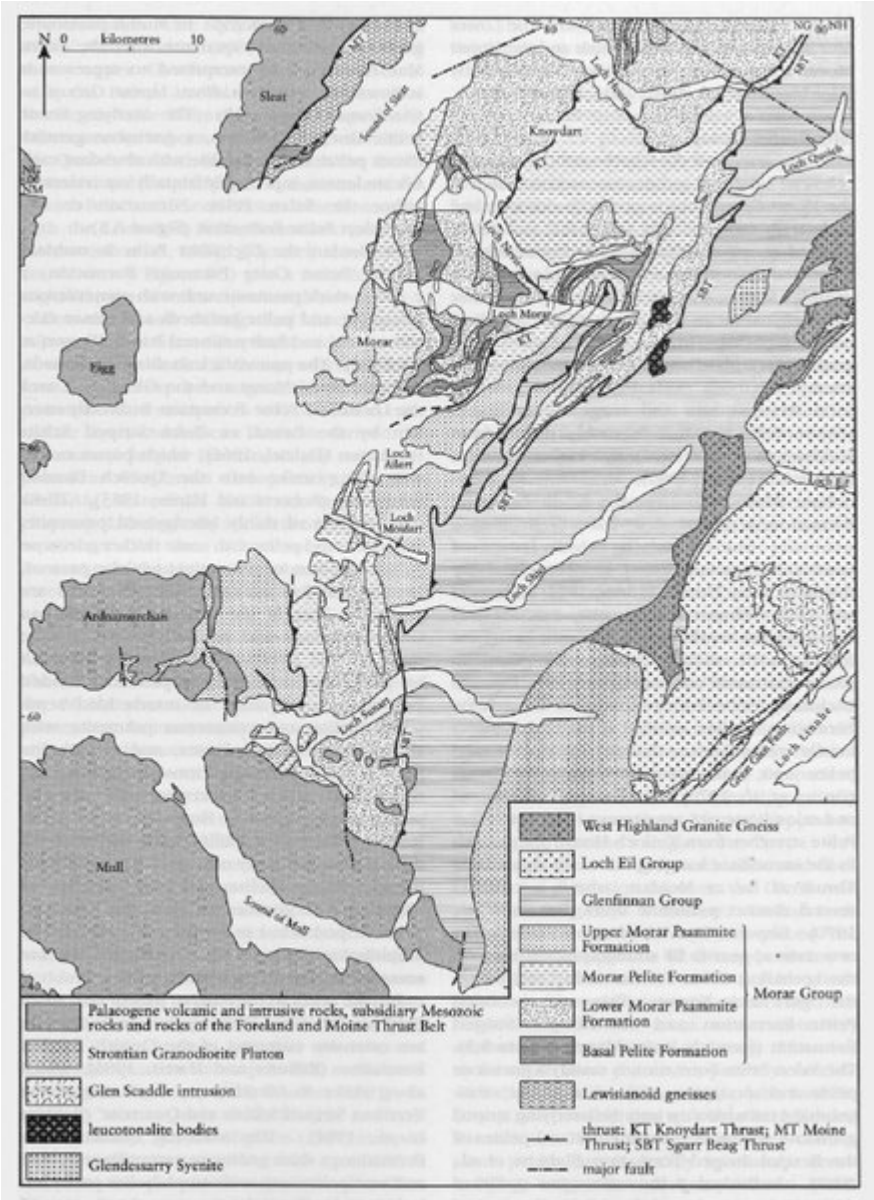
The microcline porphyroblasts found in some of the semipelite units formed both before the development of the main S2 cleavage, and after D2 deformation but prior to the D3 deformation (Smith and Harris, 1972).

Conclusions

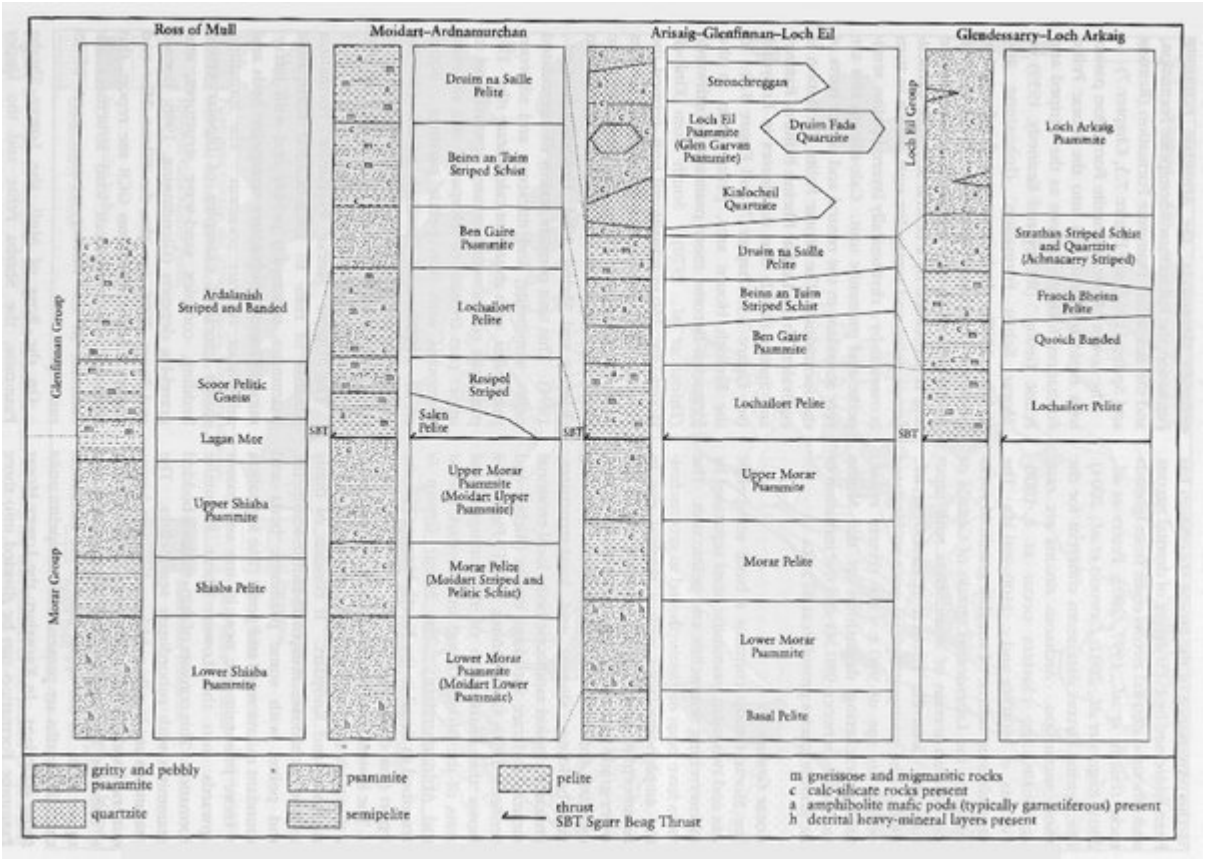
The Druimindarroch area contains a well-exposed rocky coastal section that shows the Neoproterozoic Moine psammites of the Lower Morar Psammite Formation, a prominent unit in the lower part of the Morar Group. These are mainly psammitcs but include subsidiary semipelites. At the site sedimentary grading and cross-bedding are still readily recognizable, yet the rocks show two main phases of open to tight minor folding and related cleavages. In the semipelites metamorphic porphyroblasts of microcline feldspar are present in places. These Moine rocks lie just to the west of the

complex hinge zone of the Morar Antiform, a regional structure that controls the outcrop pattern in the Morar district. On the peninsula Silurian microdiorite sheets, Permo–Carboniferous camptonite dykes, and Palaeogene basalt and dolerite dykes intrude the Moine metasedimentary rocks. The Druimindarroch site remains an excellent area to study the effects of the various deformation phases that are present in this part of the Moine succession and their relationship to the lower amphibolite-facies metamorphism.

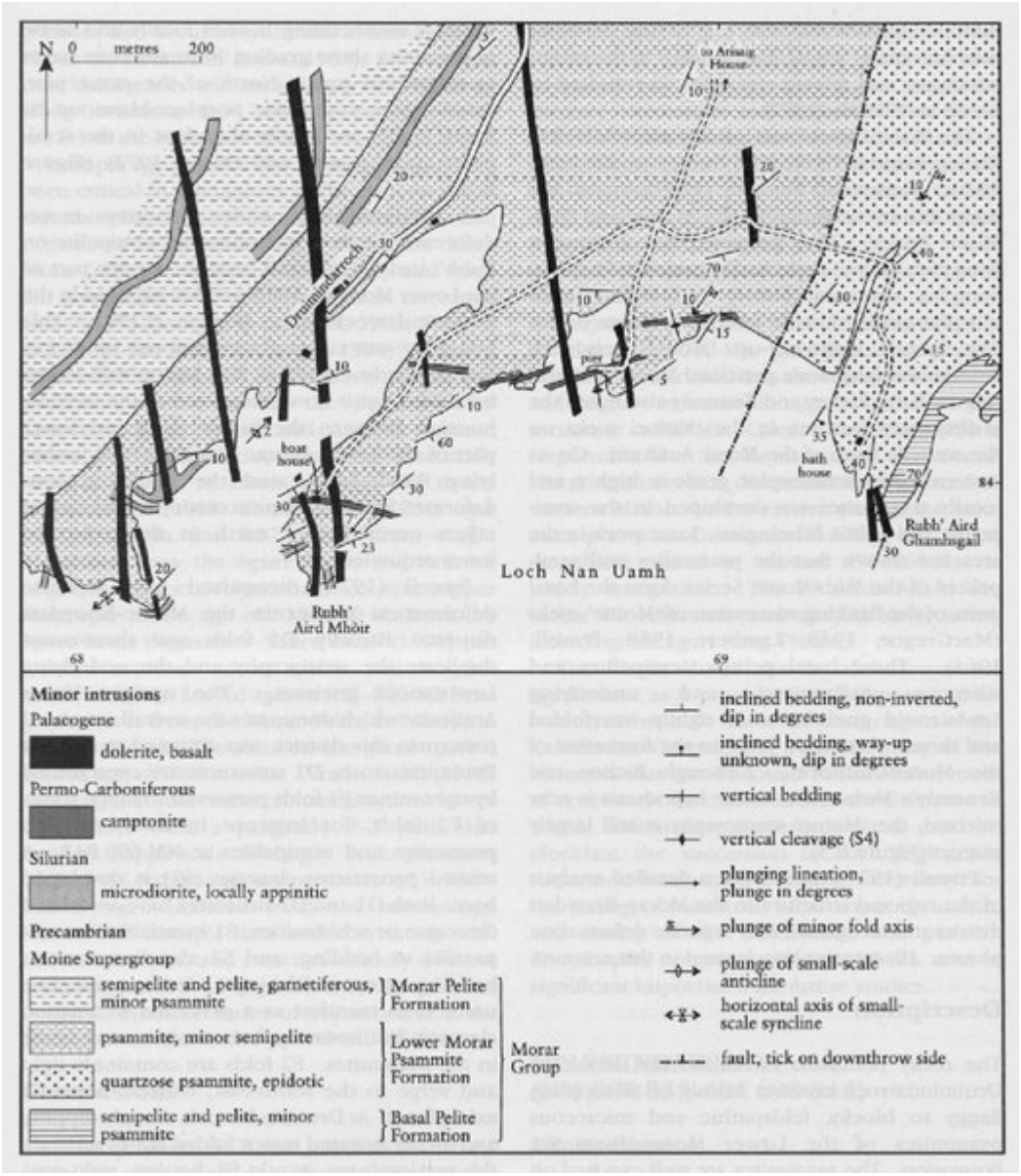
References



(Figure 8.4) Map of Knoydart, Morar and Ardnamurchan showing the distribution of formations of the Morar Group.



(Figure 8.3) Tectonostratigraphy of the Moine succession within the Moine (South) area, showing the main formations.



(Figure 8.17) Map of Druimindarroch GCR site and surrounding area (from BGS field maps).

(Figure 8.18) F2 fold in psammites and semipelites of the Lower Morar Psammite Formation. The psammites are locally cross-bedded. Microcline porphyroblasts are abundant in the semipelite. North side of pier [NM 6884 8420]. The compass is 18 cm long. (Photo: J.R. Mendum, British Geological Survey, reproduced with the permission of the Director, British Geological Survey, © NERC.)