The Airde of Shin

[NC 519 146]–[NC 528 134]

N.J. Soper

Introduction

The peninsula on the north-east shore of Loch Shin, known as 'The Airde', exposes a strip of felsic and amphibolitic mafic gneisses, metalimestones (marble) and schistose calc-silicate rocks, almost 1 km wide, flanked to the north-east and south-west by Moine psammites of the Altnaharra Psammite Formation (Morar Group). The gneissose rocks form part of the arcuate outcrop of mainly Lewisianoid rocks that can be traced southwards from Loch Shin and westwards through the Allt Doir' a' Chatha section to Glen Cassley (Figure 6.38)a. This regional swing in strike forms part of what is known as the Assynt 'bulge'; the regional doming of the Moine rocks that overlie the Assynt Culmination that lies to the west (see Chapter 5). The finely layered nature of the gneissose lithologies, their association with calcareous rocks of clear sedimentary origin and structural concordance with the enclosing Moine psammites, led H.H. Read (in Read *et al.,* 1926) to interpret these rocks as part of the Moine sequence. He suggested a volcanic origin for the amphibolitic rocks, regarding them as Durcha-type Moines', the type locality for which lies along strike to the south (see Allt Doir' a' Chatha GCR site report, this chapter). Subsequently, a geochemical study by Winchester and Lambert (1970) showed the amphibolitic and calcareous rocks at The Airde of Shin (Shinness) to be compositionally akin to similar lithologies in the Lewisian Gneiss Complex, but unlike Moine calc-silicates. They interpreted the whole strip from Loch Shin to Glen Cassley as a highly attenuated Lewisianoid inlier.

Description

The Airde of Shin is a low-relief mainly grassy promontory in Loch Shin with sporadic lochside outcrop and a few inland occurrences, notably at the Shinness Quarry [NC 525 137]. The Lewisianoid rocks of the inlier strike ESE and dip at moderate angles to the NNE. They are disposed symmetrically about a central strip of marble and calc-silicate schist. The best-exposed section is in the northern half of the inlier, on the western shore of The Airde between [NC 521 139] and [NC 519 146] (Figure 6.38)b. At the southern end of the section is a small peninsula composed of white, coarsely crystalline calcite marble in pods up to 1 m thick, interlayered with calc-silicate schist and flanked above and below by pelitic and semipelitic schist with minor calc-silicate layers (Figure 6.39). The marble can be traced about 500 m to the ESE as far as the Shinness Quarry. The calc-silicate rocks consist dominantly of tremolite, diopside, calcite, quartz and sphene (Read *et al.,* 1926, pp. 138–40).

To the north amphibolitic mafic gneisses are interleaved with pale biotitic quartzofeldspathic gneisses. Locally recumbent minor folds deform the gneissose layering, generally showing 'Z' symmetry. Fold axes plunge moderately northwards, congruent with a penetrative mineral lineation. There are several slightly discordant dyke-like bodies of amphibolite, strongly veined by aplitic material, that probably represent pre-Caledonian dolerite intrusions within the Lewisianoid gneisses. There are also a few actinolite-rich pods, which are interpreted as boudinaged ultramafic intrusions.

At [NC 520 144] a narrow belt of very platy quartz-muscovite schist marks the boundary between the Lewisianoid gneisses and the Moine psammites to the north. The schist appears to be derived from the psammitic lithologies by shearing, recrystallization and hydration of feldspar. The overlying psammites are coarse grained, arkosic and locally pebbly with feldspar clasts up to 1 cm across. They are probably right-way-up; although no sedimentary structures have been recorded close to the gneiss contact, upward-younging cross-bedding is seen 1 km to the north at [NC 521 154].

The southern part of the inlier is effectively a mirror image of the northern part; the marble and calc-silicate lithologies are succeeded to the south by amphibolitic mafic and felsic gneisses, platy quartz-muscovite schist and Moine psam-mites with minor folds of 'S'-profile. Psammites crop out on the south coast of The Airde where they exhibit highly strained but recognizably inverted cross-beds.

Interpretation

The contrast in fabric between the gneissose rocks and bedded Moine psammites, and the presence of two types of intrusion within the gneisses that are not seen in the adjacent Moines, leave little doubt that a basement-cover relationship is preserved at The Airde. The Lewisianoid affinity of the gneisses and associated calcareous rocks has been confirmed by the geochemical studies of Winchester and Lambert (1970).

At the time of Winchester and Lambert's re-instatement of the Shinness Lewisianoid Inlier, the concept of 'Lewisian slices' in the Moines was prevalent. Peacock (1975) interpreted the platy muscovite schists that he had recognized at the margins of the inlier as 'slide rocks' formed during interleaving of the Moine and Lewisian strata. He was not alone at the time in failing to address the general problem posed by the need to infer a thrust-sense displacement below the inlier and one of lag-sense (younger on older) above.

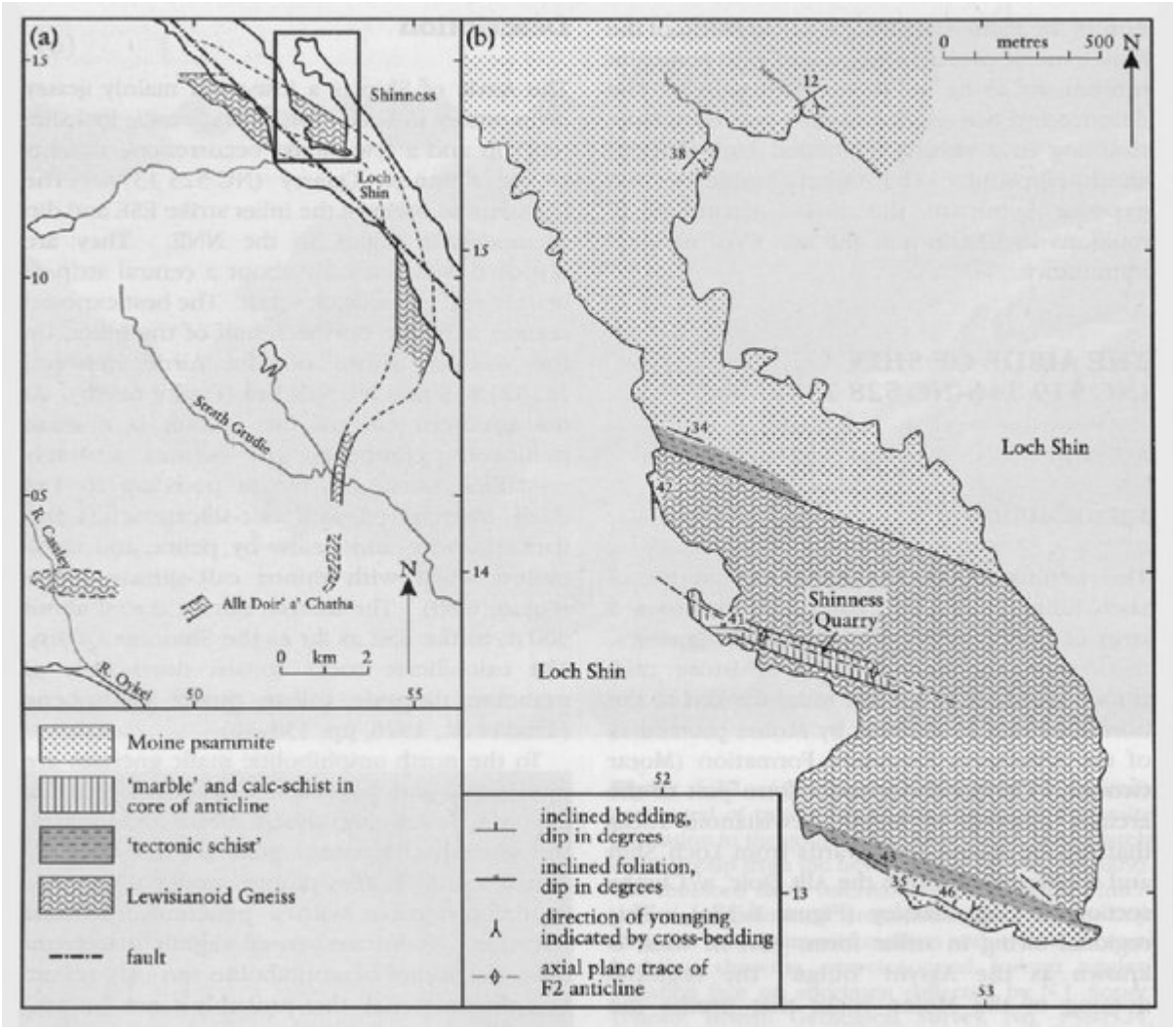
This problem was resolved through a structural study made by Strachan and Holdsworth (1988) in the context of an investigation of regional basement-cover relationships in the Sutherland Moines. On the basis of the reversal in minor fold geometry on either side of the marble outcrop and the reversal in younging direction in the adjacent Moine rocks noted above, they inferred the presence of an isoclinal D2 (Caledonian) anticline closing sideways to the south-east, whose axial surface coincides with the marble outcrop. However, this interpretation does not entirely explain the zone of intense shear strain of presumed D1 age at the Moine-Lewisianoid contact.

A further unresolved problem is the age of the basement rocks. Eclogitic pods within grey gneisses from the eastern Glenelg Lewisian Inlier have yielded Grenville Sm-Nd garnet-cpx-whole-rock ages (Sanders *et al.,* 1984). Hence other Lewisianoid inliers within the Moines may have undergone Grenville reworking prior to Moine deposition, and the location of a putative Grenville front within the Northern Highlands is still an outstanding problem in Scottish geology. However, the presence of recognizable dyke-like intrusions within the Shinness gneisses, even after Caledonian deformation, militates against Grenville reworking and suggests that the Lewisianoid gneisses were formed during the Scourian event (*c.* 2.5–2.9 Ga) and not substantially modified until the Caledonian Orogeny.

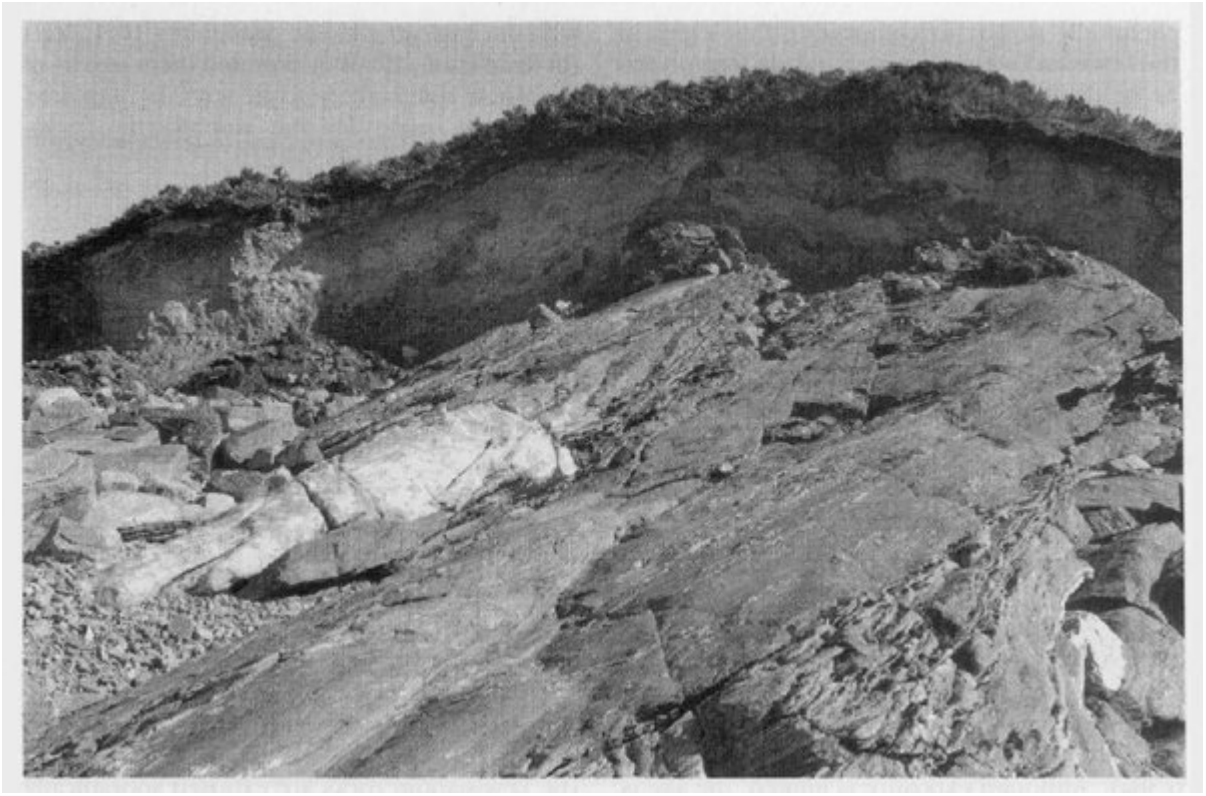
Conclusions

Excellent, though limited, outcrops on the western shore of The Airde of Shin reveal a Lewisianoid basement inlier sandwiched by Moine psammites of the Morar Group. The basement lithologies consist of mafic and felsic gneisses, and metasedimentary rocks, including marble and calc-silicate rocks. Exposure is sufficient to enable the tectonic relationship between basement and cover to be determined: the older rocks occupy the core of a recumbent anticline that is assigned to the second phase (D2) of regional deformation and is thought to be of Caledonian age. Intense shearing, resulting in the production of a platy muscovite-rich psammite ('tectonic schist'), has obliterated any features along the putative basement-cover unconformity. The basement rocks are chemically similar to comparable lithologies in the Lewisian Gneiss Complex and are interpreted as originally Scourian in age. The site is of national importance in encapsulating the problems associated with Lewisianoid inliers in the Moine succession and contains the largest occurrence of metacarbonate rocks in the Sutherland and Ross-shire Lewisianoid gneisses.

References



(Figure 6.38) (a) Location map of the Loch Shin area showing the strip of Lewisianoid rocks that extends from Loch Shin to the River Cassley. (b) The Airde of Shin Lewisianoid Inlier. Based on Winchester and Lambert (1970) and Strachan and Holdsworth (1988).



(Figure 6.39) Boudins of white-weathering calcite marble in calc-silicate schist in Lewisianoid gneisses in the hinge zone of a D2 anticline. Western shore of The Airde of Shin at [NC 521 139]. (Photo: Susan Hall.)