
20 Loch Avich

[NM 957 174]–[NM 952 155]

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20.1 Introduction

This GCR site lies at the north-eastern end of Loch Avich, west of Loch Awe. It contains the type locality for the Loch Avich Lavas Formation and shows a complete section through the underlying gritty metasandstones and metamudstones of the Loch Avich Grit Formation. The uppermost part of the Tayvallich Volcanic Formation, which underlies the Loch Avich Grit Formation, is also present in the northern part of the site. The Loch Avich Grit and the Loch Avich Lavas are the youngest observed Dalradian rocks in the core of the Loch Awe Syncline and form the lower part of the Southern Highland Group. Hence the lavas are of great significance in the tectono-magmatic evolution of the Dalradian basin(s).

The Loch Avich Grit Formation has long been recognized and was first described by Hill (1905) and Bailey (1913). The outcrop of the Loch Avich Lavas Formation was originally classed as ‘epidiorite’ (Hill, 1905) and lavas (Bailey, 1913) and was not distinguished from the older Tayvallich Volcanic Formation. It has only relatively recently been recognized and described as a separate formation lying above the Loch Avich Grit Formation (Borradaile, 1972a). This discovery was especially important as the lavas represent the only known extrusive volcanic rocks in the Southern Highland Group. Several samples from the Loch Avich Lavas Formation were analysed geochemically and compared with lavas from the Tayvallich Volcanic Formation by Borradaile (1973) as part of his investigation of the structure and stratigraphy of the northern Loch Awe district. The Loch Avich lavas were the subject of recent research by Pickett *et al.* (2006) into the origin of the volcanoclastic Green Beds, with which they have been correlated stratigraphically, and were also included in the regional geochemical synthesis of Dalradian volcanism by Fettes *et al.* (2011).

20.2 Description

Around Loch Avich, the Tayvallich Volcanic Formation and the overlying Loch Avich Grit Formation lie within the core of the Kilchrenan Syncline (Figure 2.45), which is part of the major F1 Loch Awe Syncline. A complete section through the Loch Avich Grit Formation is preserved in the Allt Mór burn, north-west of the hill of An Cnap, where its observed thickness has been calculated as 650 m (Borradaile, 1973). Elsewhere in the Loch Awe area it attains a thickness of 1100 m. The formation typically comprises chloritic and feldspathic gritty metasandstones, which show graded bedding, together with green and green-grey metamudstones (Borradaile, 1973). The metasandstones are laterally discontinuous on a large scale and exhibit evidence of channelling. They contain angular grains of K-feldspar, some plagioclase, quartz, detrital epidote and opaque minerals in a chloritic matrix. Black slaty metamudstones, black calcareous metamudstones and detrital volcanic material occur as lenses within the metasandstones. Good exposures of typical lithologies can be observed near the burn junction at [NM 954 165], north of An Cnap. Slightly calcareous black metamudstones occur at the top of the formation and can be observed by the roadside at the east end of Loch Avich in the southern part of the GCR site [NM 951 155]. These rocks display NW-dipping bedding as well as slaty and crenulation cleavages.

The overlying Loch Avich Lavas Formation is represented only by a small outcrop preserved in the core of the Kilchrenan Syncline, on the hill of An Cnap, north of Loch Avich, at [NM 954 158] (Figure 2.45). The formation consists of an observed thickness of 300–500 m of greenschist-facies pillow lavas with no significant sedimentary intercalations (Borradaile, 1973). Recent geochemical studies have indicated that the Loch Avich lavas are tholeiitic and have basaltic andesite to andesitic compositions (Pickett *et al.*, 2006; Fettes *et al.*, 2011). The south-western end of the lava outcrop terminates within the synclinal fold closure, where the lavas directly succeed black calcareous metamudstones at the top of the Loch Avich Grit Formation.

The following description of the lavas is based on field observations made by Pickett (1997) and Hyslop and Pickett (1999). Well-preserved pillow lavas are present in the central part of the outcrop, whereas more homogeneous lavas are exposed along the south-eastern margin. The pillows are 1–1.5 m wide and are separated by 5 cm-thick epidotic rims of formerly glassy pillow rinds. The asymmetrical pillow shapes indicate that they are the right way up (Figure 2.46). The pillow cores are generally porphyritic, whilst the margins are fine grained and display flow structures. Mineralized and chloritized vesicles are common. Several pillows display concentric rims of vesicles, which have been infilled by quartz in places, producing a 'gritty' appearance. The lavas are generally fine grained and are altered to a pale buff to light greenish grey colour. Many display a foliation, especially away from the central part of the outcrop. Small pockets of green slaty metamudstone are intercalated with the pillows locally.

The structure of the area is dominated by the Kilchrenan Syncline whose axial trace trends north-east–south-west through the southern part of the GCR site, across the hill of An Cnap (Borradaile, 1973). The north-west limb of the syncline, on which most of the site lies, is overturned, with bedding dipping at c. 40–75° to the north-west. On this limb, the south-west-striking S1 slaty cleavage dips at c. 40–50° to the north-west.

20.3 Interpretation

The Loch Avich Grit Formation was interpreted by Borradaile (1973) as a sequence of turbiditic deposits that, together with the overlying Loch Avich Lavas Formation, was generated in a subsiding deep marine basin during rifting of a continental margin during late-Dalradian times (Anderton, 1985). The Loch Avich lavas are interpreted as representing the final phase of a period of extensive volcanism (that also generated the Tayvallich Volcanic Formation; see the *West Tayvallich Peninsula* GCR site report), which accompanied the lithospheric stretching and rifting. They constitute the youngest expression of volcanism in the Dalradian and are generally regarded as a source of the volcanoclastic detritus in the green beds that occur at a comparable stratigraphical level throughout much of the Southern Highland Group outcrop (Pickett *et al.*, 2006).

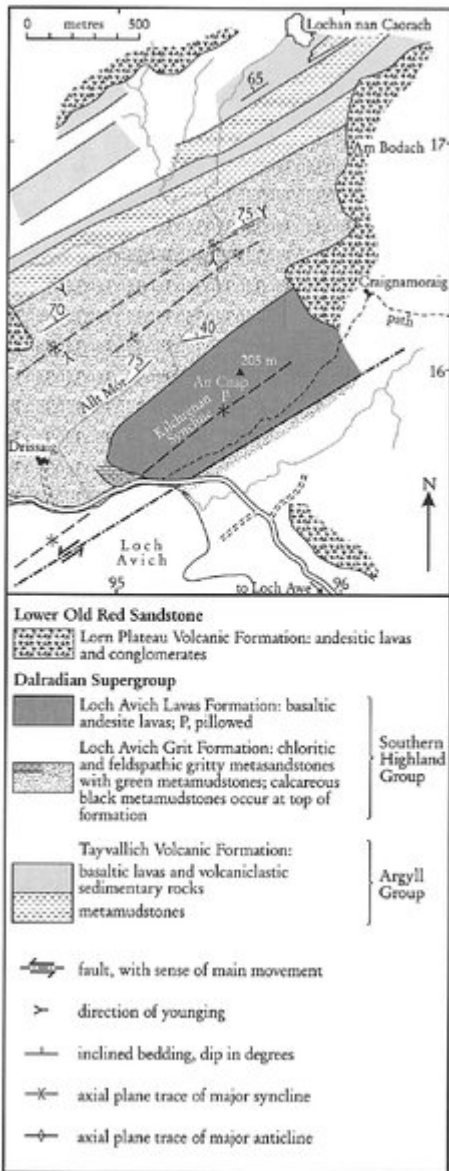
Borradaile (1973) suggested that the Loch Avich lavas were fed by some of the sills that occur below the lavas of the Tayvallich Volcanic Formation, although there is no direct field evidence to corroborate this. He interpreted the Loch Avich lavas as being comagmatic with the Tayvallich volcanic rocks and its sill-feeders, the Loch Avich lavas representing a new phase of submarine volcanism. However, the geochemistry of the Loch Avich lavas does exhibit some subtle differences from that of the underlying Tayvallich volcanic rocks (Hyslop and Pickett, 1999; Pickett *et al.*, 2006). Both show evidence of mixing of enriched and depleted components of their mid-ocean-ridge type mantle source and the Loch Avich Lavas in particular show signs of crustal contamination (Fettes *et al.*, 2011).

20.4 Conclusions

The Loch Avich GCR site is the type locality for the Loch Avich Lavas Formation, the only known extrusive volcanic rocks in the Southern Highland Group and the highest in the Dalradian succession. The complete section extends from the top of the Tayvallich Volcanic Formation, through the Loch Avich Grit Formation to the base of the Loch Avich Lavas Formation.

The Loch Avich Grit Formation exhibits a range of metasedimentary rocks, which are valuable for the interpretation of the depositional environments in latest Neoproterozoic time. The Loch Avich Lavas Formation is well exposed and displays good pillow forms with many relict igneous features. These lavas are the subject of current geochemical studies associated with research into the origin of the widespread volcanoclastic Green Beds with which they have been correlated stratigraphically. The section is critical for studies of Dalradian stratigraphy and in reconstructing the depositional environment and tectono-magmatic setting of the uppermost part of the Dalradian Supergroup.

[References](#)



(Figure 2.45) Map of the area north-east of Loch Avich that includes the outcrop of the Loch Avich Lavas Formation (after Borradaile, 1977).



(Figure 2.46) Basaltic andesite pillow lavas at An Cnap, Loch Avich, viewed to the south-east [NM 9544 1586]. Hammer shaft is 35 cm long. (Photo: E.K. Hyslop, BGS No. P 726591.)