

## LOCH ACHTRIOCHTAN

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### Introduction

This GCR site exhibits two contrasting topographic expressions of the ring fracture that encircles the down-faulted inner block of the Glencoe cauldron subsidence (Figure 9.17), together with good exposures of the metasedimentary rocks that underlie the volcanic rocks. Exposures within the site also reveal marginal tilting of rocks of the inner block immediately adjacent to the ring fracture, demonstrating that the subsidence was accompanied by drag.

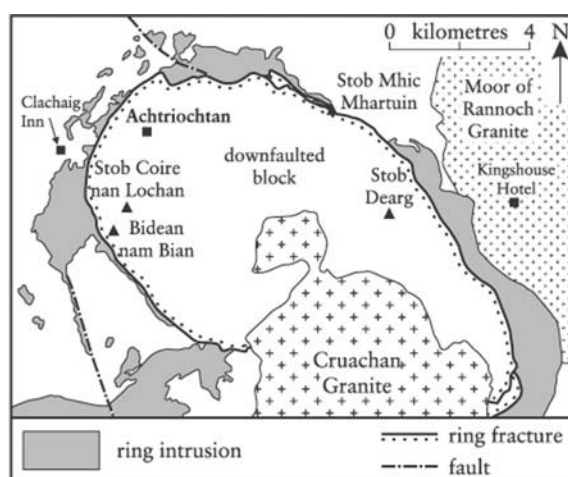
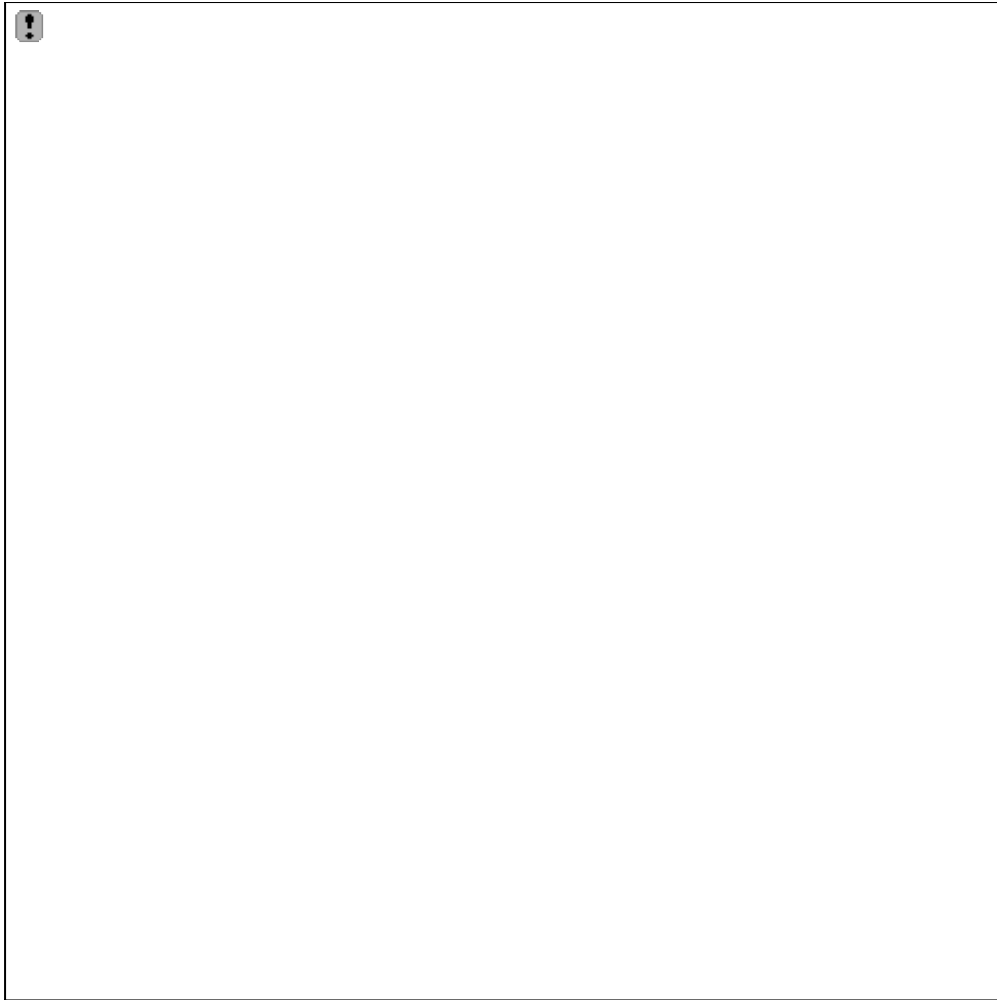


Figure 9.17: Sketch showing the ring fracture and ring intrusion system around Glen Coe. Relationships are less clear in the south where there are difficulties distinguishing the ring intrusion from neighbouring intrusions. Minor outcrops of the ring intrusion (which are numerous) have been omitted for clarity. Redrawn after Clough et al. (1909), Roberts (1974) and Garnham (1988).

The site comprises two areas: one to the north of the River Coe, extending from the banks of the river up to the western end of the Aonach Eagach ridge (Figure 9.18); and a second area to the south of the River Coe that includes the mountain spur of An t-Sron and the west side of Coire nam Beitheach (Figure 9.9).



*Figure 9.18: View across Loch Achtriochtan, Glen Coe towards the Aonach Eagach ridge on the skyline. The ring fracture enters the left edge of the photograph about halfway up and runs towards the low point of the ridge at its extreme left. This subdued expression of the ring fracture is typical, and contrasts strongly with that shown in Figure 9.9. The distinctive cliffs running down to the right are Group 1 rocks (Basal Sill Complex), which overlie Leven Schist (Dalradian basement). (Photo: BGS no. B624.)*

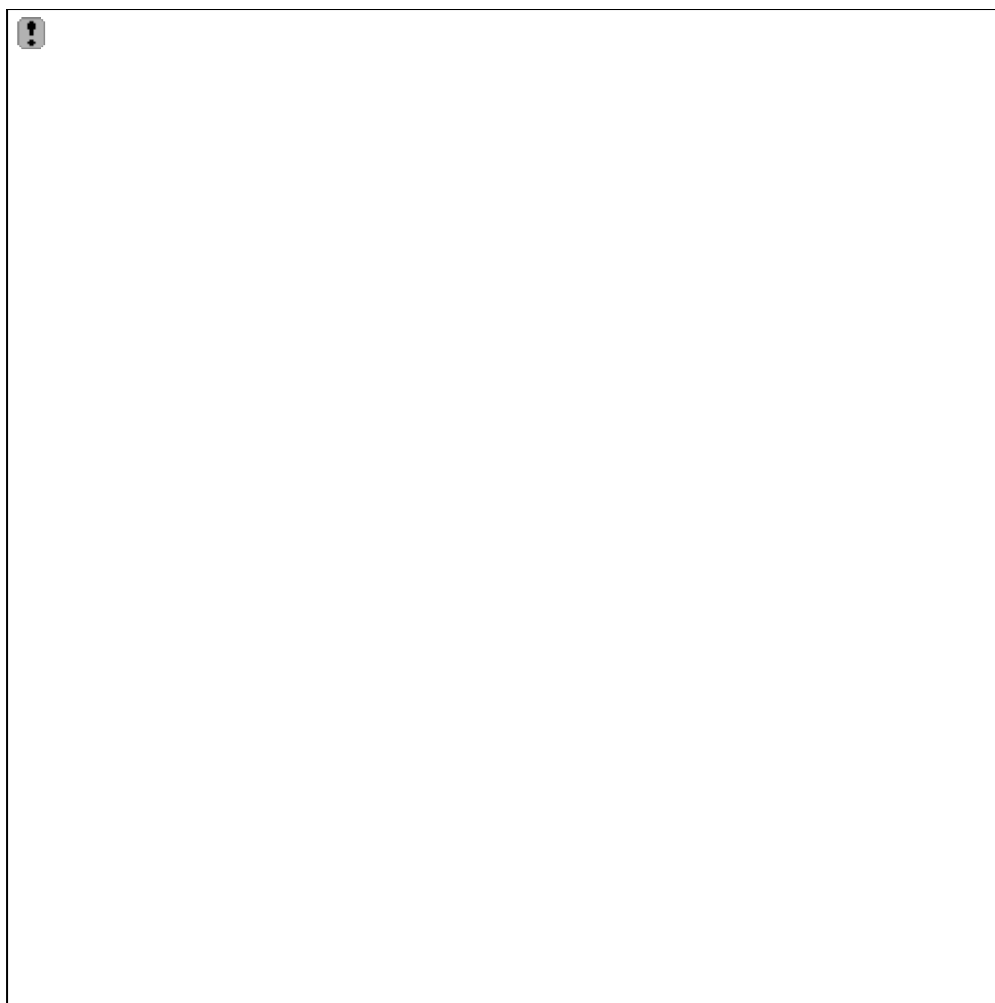


Figure 9.9: View up Coire nam Beitheach towards Bidean nam Bian, Glen Coe, showing the outcrop of groups 1 to 4, plus the ring fracture and ring intrusion. See Figure 9.10 and the text for details. (Photo: BGS no. B619.)

### Rock types

This site is dominated by Group 1 rocks and the underlying Dalradian metasedimentary rocks (Leven Schist). Outcrops of groups 2 and 3 occur high on the shoulders of Stob Coire nan Lochan and Stob Coire nam Beith.

The metasedimentary rocks that surround Glen Coe, and that form part of the down-faulted inner block, belong to the Grampian and Appin groups of the Dalradian Supergroup (Table 9.5). In Glen Coe the metasedimentary stratigraphy is complicated by the presence of two ductile slides or lags, the Ballachulish Slide and the Sgurr a'Choise Slide. This has created the structural sequence which is found in the River Coe just west of the Loch Achtriochtan GCR site and is as follows.

Leven Schist

Ballachulish Limestone

*Sgurr a'Choise Slide* Ballachulish Slate

*Ballachulish Slide* Leven Schist

Glencoe Quartzite

At this site the Leven Schist (a 'phyllite') is predominant, and forms a roughly triangular outcrop within the ring fracture. Clough *et al.* (1909) and Bailey (1960) noted that the low metamorphic grade of the Leven Schist within the down-faulted block contrasts with the higher

(i.e. garnet-bearing) metamorphic grade of the Leven Schist outside.

Between the Leven Schist and the Group 1 Basal Sill Complex is a variable and discontinuous sequence of sedimentary rocks varying from conglomerates (clasts up to 3 m) to finely bedded shales. Conglomerates are well exposed on the southern slopes of the Aonach Eagach in a prominent outcrop running along the base of the cliffs that trend SE from Coire Leith towards Achtriochtan farm. The bed (1–20 m thick) dips at c. 30° to the SE, and typically infills hollows in the irregular palaeosurface of Leven Schist. The clasts are set within a matrix consisting of either coarse sandstone or sandy shale; larger clasts are well-rounded, whereas smaller clasts tend to be more subangular (Clough *et al.*, 1909; Bailey 1960). The dominant clast type is quartzite, although minor schist, andesite, granite, quartz porphyry, and kentallenite are reported by Bailey (1960).

The Leven Schist outcrop forms fairly subdued topography, in contrast to the more-resistant rocks of the sill complex. Consequently, the rocks of the sill complex form prominent crags that enable its base to be traced with ease throughout the site. On the south side of the River Coe, sheets of the sill complex dip at approximately 15° to the SE.

### *The ring fracture*

South of the River Coe is a striking (and rather atypical) topographical expression of the ring fracture. Much of the impressive and deeply incised gully known as The Chasm of An t-Sron follows the ring fracture, which passes just east of the summit of An t-Sron where it appears as a distinctive notch (Figure 9.9). On the southern slopes of An t-Sron the ring fracture forms a narrow (but pronounced) gully. The subdued topographical expression of the ring fracture just south of the River Coe, and its continuation north of the River Coe up to the summit of the Aonach Eagach ridge, is more typical (Figure 9.18). The line of the ring fracture over such terrain is not obvious from a distance, but it can be traced with ease when walking along the contact. Within this site the ring fracture changes direction abruptly: the strike is almost N–S from An t-Sron north to the River Coe, whereas it strikes NE to the north of the River Coe.

On the slopes of An t-Sron, south of the River Coe, the down-faulted rocks in contact with the ring fracture are Leven Schist up to the 350 m contour, with Group 1 rocks at higher elevations. Throughout the site, the ring fracture dips between 65° and 85° inwards (i.e. towards the centre of the down-faulted inner block), and flinty crush-rock (see the Stob Mhic Mhartuinn GCR site report) is commonly found at the contact between the ring intrusion and the ring fracture.

There is abundant field evidence of marginal steepening of rocks of the down-faulted inner block immediately adjacent to the ring fracture. For example, the primary foliation of the Leven Schist at An t-Sron increases from c. 35° some 20 m away from the ring fracture to c. 70° immediately adjacent to it. This marginal steepening is observed both in the metasedimentary rocks and in Group 1 rocks adjacent to the ring fracture.

### *The ring intrusion*

At this site the ring intrusion is present outside the ring fracture, except where it is absent for short stretches north of the River Coe and at the summit of the Aonach Eagach ridge (Clough *et al.*, 1909). At An t-Sron, the ring intrusion has its greatest development anywhere in Glen Coe and forms a large intrusive mass that extends almost 2 km from the ring fracture (Clough *et al.*, 1909). Here, there is an abundance of accidental fragments, especially quartzite, in the ring intrusion. Most of the quartzite fragments are angular to subangular, and they vary from white to red in colour. The provenance of these fragments is unknown, but precise classification would clarify the emplacement mechanism of the ring intrusion.

## **Interpretation**

The Basal Sill Complex (Group 1) is well developed at this site and at the adjacent Bidean nam Bian GCR site (where it is discussed in detail), in strong contrast with its absence from the eastern parts of Glen Coe (see the Stob Dearg and Cam Ghleann GCR site report). This suggests that the sedimentary basin intruded by the sills of the sill complex was restricted to

the western part of Glen Coe and may have developed due to precursory subsidence related to Group 1 magmatism.

Clough *et al.* (1909) and Bailey (1960) interpreted the presence of garnet in the Leven Schist outside the down-faulted inner block as indicating a higher metamorphic grade than the non-garnet-bearing rocks of the inner block. Cauldron subsidence then brought rocks with similar lithologies yet contrasting metamorphic grade into juxtaposition. However, it is now known that subtle compositional differences can have a marked effect on index mineral development in metasedimentary rocks (e.g. Yardley, 1989). Consequently, it would be necessary to confirm that the Leven Schist lithologies in juxtaposition are compositionally identical before placing too much emphasis on this original interpretation.

The abrupt change in the strike of the ring fracture at this site was noted by Clough *et al.* (1909) and Bailey (1960). They mapped several persistent N–S-orientated shatter belts throughout Glen Coe (two are exposed on the south slopes of the Aonach Eagach ridge), and conjectured that the prominent N–S strike of the ring fracture at An t-Sron may coincide with one of these. Disruption of the ring intrusion at An t-Sron may also relate to this shattering. The shatter belts apparently pre-date cauldron subsidence and the intrusion of the Etive dyke swarm (Clough *et al.*, 1909), yet there is evidence that the shatter belts were also active after cauldron subsidence; Roberts (1974) noted that 'flinty crush-rock' at An t-Sron showed post-emplacment fracturing.

The marginal steepening of rocks adjacent to the ring fracture was interpreted by Clough *et al.* (1909) as resulting from frictional drag on the outer margins of the down-faulted inner block. Taubeneck (1967) agreed with this interpretation, and argued that it provides strong evidence for a predominant inward dip of the ring fracture and consequently an upward opening cone shape for the down-faulted inner block.

## Conclusions

Outcrops at this site reveal spectacular features that accompanied late-stage cauldron subsidence within the Glencoe volcano. Metasedimentary rocks that formed the eroded landscape before volcanic activity began are preserved in the down-faulted inner block. The ring fracture that separates the down-faulted inner block from the undisturbed metamorphic rocks outside is also well exposed and, in the prominent gully of An t-Sron, it has a particularly impressive topographical expression. While the down-faulted inner block was subsiding, magma rose from depth and intruded the rocks outside the ring fracture. This magma is known as the ring intrusion, which at this site has its most extreme development in the mountain of An t-Sron (where it extends up to 2 km from the ring fracture).

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