Backside Beck

[SD 699 998]–[SD 698 979]

Introduction

This site is highly significant, both stratigraphically for the shelly faunal zonation of the type Ashgill Series and regionally for the understanding of late Ashgill volcanicity and sedimentation in northern England.

The succession in Backside Beck was used by Marr (1913) as the type development of the Ordovician rocks of the Cautley inliers, which, in turn, constitute the type area for the Ashgill Series (Ingham and Wright, 1970, p. 233). The historical and current stratigraphical terminology used in these inliers is outlined above. Ingham (1966, p. 462, pl. 26) published a geological map of the Westerdale Inlier that includes Backside Beck. He noted that the gently dipping succession is strongly affected by faulting but that Marr's (1913) interpretation of the faunal succession was essentially correct. The section contains outcrops and typical faunas of all the local Ashgill divisions of the Cautley Mudstone Formation, apart from Zones 3 and 4, which are faulted out. The overlying Ashgill Formation, with the Cystoid Limestone at the base, is also well exposed. The upper part of the formation in Spengill, at the head of Backside Beck, includes a coarser unit that was described originally by Marr and Nicholson (1888, p. 700); the succession across the Ordovician–Silurian Boundary here was discussed by Rickards (1970, 1978, 1988). Brenchley (1984) outlined the geochemistry of the succession from the upper Rawtheyan to the lower Silurian in Spengill.

Description

Backside Beck flows southwards through the Westerdale Inlier (Figure 11.18). The succession has a fairly gentle (15–30°) northward dip, but extensive faulting, especially at the southern end of the site, is probably responsible for departures from this pattern. In general, the succession youngs northwards along the stream, and some of the higher units are also seen in streams draining the adjacent hillsides. Two of these [SD 6925 9845]–[SD 6955 9845] and [SD 6925 9850]–[SD 6955 9855] are incorporated in the site.

A small area of Pusgillian rocks is faulted against Silurian rocks at the southern end of the site, and the overlying lowest Cautleyan strata are exposed a few metres to the north (Figure 11.18). The boundary between Zones 1 and 2 is faulted, with the line of the fault marked by a lamprophyre dyke. The upper boundary of Zone 2 is also faulted, with upper Zone 5 strata cropping out to the north. This part of the succession contains a large transgressive felsite sheet and is repeated by several faults such that there is almost continuous exposure of Zone 5 mudstones, locally very fossiliferous, and the sill for almost 600 m along the stream to just beyond the confluence of Whatley Gill. A fault-bounded felsite to the north of this may be the same sheet or another at a higher level, within Zone 6. Mudstones of Zone 6 are exposed immediately to the north and to the east of the site, especially around and to the north-east of Mountain View Farm (Figure 11.18). The mudstones are succeeded by tuffs of the Cautley Volcanic Member ('Group' of Ingham, 1966).

The volcanic member is overlain in Backside Beck and the adjacent hillsides by about 24 m of grey mudstones with impersistent limestones containing the sparse but characteristic shelly fauna indicative of Zone 7. This zone is repeated twice by faulting and is succeeded by pale-grey pyritic limestones of the Cystoid Limestone Member at the base of the Ashgill Formation. The overlying mudstones of that formation may be up to about 60 m thick and contain a sandy and conglomeratic horizon near the top, in the lower reaches of Spengill (Ingham, 1966, p. 479; Rickards, 1988, fig. 1). A thin (0.36 m) limestone at the base of the overlying Skelgill Formation was previously considered to be the basal bed of the local Silurian but may be latest Ordovician in age, in view of the modern definition of that system (Rickards, 1988).

Interpretation

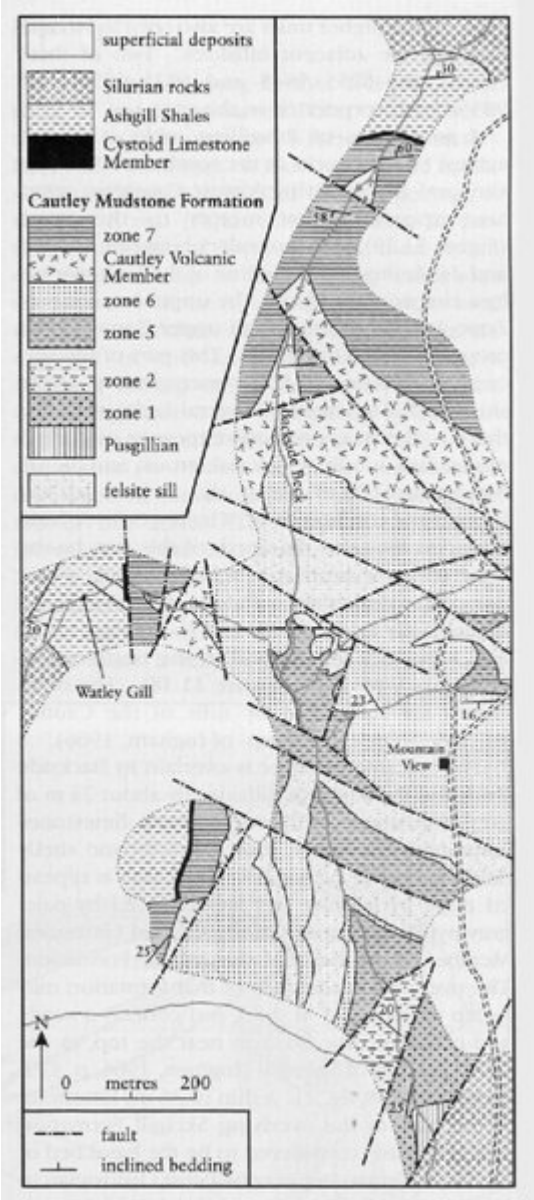
In establishing the Rawtheyan Stage, Ingham and Wright (1970, p. 238) highlighted the upper reaches of Backside Beck as containing the best section through Zone 7 in the Cautley inliers. Ingham (1966, p. 474) noted that in the Westerdale Inlier the Cautley Volcanic Member is considerably thicker than in the Murthwaite Inlier (see the Sally Beck site report), where it is about 12 m thick, and that the tuffs in the lower part of the group are coarser. He therefore suggested that the volcanic source lay a short distance to the west of the Westerdale Inlier. Kneller *et al.* (1994) considered that the tuffs may have been emplaced as turbidites or pyroclastic flows into water and equated them with the Appletreeworth Formation of the southwestern Lake District, the High Haume Volcanic Formation of the Furness area and the Dam House Bridge Tuff and Jop Ridding Sandstone members of the Sowerthwaite Formation in the Craven Inliers.

In contrast to the Taythes Inlier (see the Ecker Seeker Beck site report), where the latest Rawtheyan Cystoid Limestone rests on mudstones of Zone 5, the amount of erosion was much less in the Westerdale Inlier, and it overlies strata of Zone 7. The limestone above the Ashgill Formation may equate to part of the *persculptus* graptolite Zone, and a thin (20 mm) bentonite separates it from shales containing graptolites of the basal Silurian *acuminatus* Zone (Rickards, 1988, fig. 1).

Conclusions

Backside Beck contains the original type development of the Ashgill in the Cautley inliers (themselves the type area for the Ashgill Series). The site is internationally important for the understanding of the shelly faunal zonation of the Ashgill and is the type locality for several species of fossils. It includes the best sections in the Cautley district through Rawtheyan Zone 7 and across the Ordovician–Silurian boundary. The development of a thick, coarse unit of Rawtheyan tuffs and the relatively limited gap below the latest Rawtheyan Cystoid Limestone have wide implications in the interpretation of the Ashgill history of northern England.

References



(Figure 11.18) Geological map of the Backside Beck area of the Westerdale Infier, Cautley district, based on Ingham (1966, pl. 26) and Ingham (1970–1977, fig. 4).