Glaciation of Borrowdale

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We met outside Rosthwaite Village Hall where the background to the Lake District glaciation was explained. The peak of the glaciation was some 30,000 years ago when the Lake District had its own ice cap within the overall ice sheet. In the following 15,000 years the glaciers exploited the previous radial drainage system, steepening the sides and forming basins which later became lakes. The ice probably all disappeared before returning briefly at the valley-heads around 12,000 years ago. Rosthwaite village sits on a roche moutonnée, called The How (NY 258146). Nearby are 3 ridges of glacial debris which are the end-moraines of a glacier entering Borrowdale from Stonethwaite and Langstrath. The flat plain to the north represents the floor of a lake (Figure 1).

On the way to the River Derwent we examined the Rosthwaite Moraines which, according to inconsistent dating, seem to be over 15,000 years old. We noted that the stone walls were composed of subrounded boulders that had been transported at the base of the glacier (Figure 2).

On a bend in the river (NY 254140), on the way to Seatoller, the river has eroded the outermost of the three Rosthwaite moraines to reveal a poorly sorted texture typical of a deposit from basal glacier ice (Figure 3).

Nearby are potholes produced by the turbulent glacier melt water. Potholes are a common feature in subglacial channels where the water is under pressure.

After walking up the hillside above Seatoller to Little Gatescarthdale (NY 232137) the effects of the glacial deposition during the Younger Dryas were pointed out. It is thought that the landforms represent ‘dynamic retreat’ i.e. that the ice was still flowing forward and dropping material. This is similar to the processes observed in Svalbard in the Norwegian Arctic, where low-angle fractures in the glacier bring



Figure 1. Borrowdale viewed from King’s How. The route of our excursion traversed the hillside on the right. Off the picture to the left is the Stonethwaite valley; its glacier produced the moraines at Rosthwaite, which is mid-left on the valley floor. Beyond is Glaramara and the hanging valley of Coombe Gill. Further to the right Scafell Pike is visible in the background, below which is Seathwaite at the head of Borrowdale. Great Gable is the rounded summit mid-right. Little Gatesgarthdale is “round the corner” to the right.



Figure 2. Subrounded glacial boulders in a wall in front of a Rosthwaite moraine

debris to the surface before being deposited. The resulting landforms are push- or thrust-moraines.

Then we took the high-level path on the west side of Borrowdale towards Castle Crag.

Diamicton (NY 243154), which by definition is a sediment with a wide range of clast shapes and sizes, was observed at the side of the path. It was discussed that to establish the process of deposition the grain size, the percentages of silt-plus-clay, sand and of gravel needed to be considered, together with the character of bedding, clast shape and orientation of the long axis of clasts (Figure 4). The attributes at this locality allowed us to interpret that this was a basal glacial sediment (or more strictly a "subglacial traction till").

We then looked at the bigger picture to where we were in the morning. The flat area was a proglacial lake dammed by a moraine by the Jaws of Borrowdale (Castle Crag and King's How). The notch to the west of Castle Crag may have been an outlet for the meltwater (Figure 5).



Figure 3. Basal glacial debris in Rosthwaite moraine. (above)



Figure 4. Discussing the origin of diamicton, and interpreting it as of subglacial origin. (left)



Figure 5. Walking towards Castle Crag, with King's How centre-right, and with Jaws of Borrowdale between, and notch to left of Castle Crag.

On the path there were grooves and striations on glacier-smoothed rock outcrops and 'p' forms i.e. plastically moulded depressions formed by high pressure meltwaters.

Half-way up Castle Crag (NY 250159) we stopped and looked towards Borrowdale to note that the volcanic rocks upstream of the glacier looked 'plucked' whereas if we looked downstream they would look smooth and abraded – representing distinct forms of glacial erosion.

From the top of Castle Crag (NY 249159) there is a good view across Derwentwater to Skiddaw and Blencathra (Figure 6). Derwentwater is in a rock basin scoured out by a glacier, with Skiddaw Group to the west and Borrowdale Volcanic Group to the east, while a strike-slip fault occurs down the east side. There are several smooth mounds and islands in the lake near Keswick, which are all drumlins

We then continued to Grange (NY 253175) to examine the roche moutonnée under the bridge which also showed glacial striations and 'p' forms. Mike was thanked for a fascinating walk.



Figure 6. Looking north from Castle Crag across Derwentwater to Skiddaw and Blencathra.