



### Glacial erratics of Norber, UK

Spread across a limestone spur on the southeastern flank of Ingleborough in the Yorkshire Dales, the Norber boulders are famed as both glacial and karstic landforms; they are justifiably popular as a destination on field trips. The erratic boulders are greywacke, which distinguishes them so well from the local limestone bedrock. They form a conspicuous train that can be traced northwards to their source in Crummack Dale, where outcrop crags caught the full force of Devensian ice heading south from the Dales Ice Centre. Because the greywacke also forms the floor of the dale, the Norber erratics are often cited as evidence of the uphill flow of ice sheets. In reality, there was probably hardly any uphill flow, as a gentle fold in the limestone means that the source crags reach higher than the Norber bench to which the erratics were carried. Because many of the erratics stand on low pedestals of bedrock limestone, it has been suggested that the greywacke prevented rainfall reaching the limestone beneath, thereby preventing dissolution of the latter. Consequently the pedestal heights could be taken as an indication of the amount of post-glacial surface lowering, by dissolution, of the surrounding limestone. However, this delightfully simple story is now largely discredited, partly because the weathering processes are more complex and partly because most pedestals owe much of their height to their positions on the edges of low scars. The debate on dissolution rates is unresolved, but a remarkably smooth, corrosion-free limestone surface was exposed when the most photographed of the erratic boulders tipped off its pedestal in 2009 (hence the comparison of these ‘before’ and ‘after’ photographs). Sadly, the demise of the boulder was aided by vandalism, when a crowbar under one corner was enough to tip the boulder off its narrow base; the top of the tilted erratic then sheared off in a natural failure along the conspicuous bedding. It is open to surmise that such a slipped top could have eventually overbalanced the erratic without the vandal’s assistance. © *Photograph and text by Tony Waltham Geophotos*