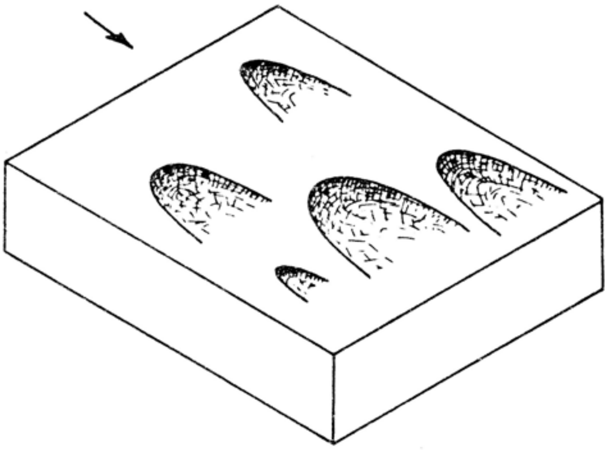
HOLIDAY GEOLOGY

Donkey Rock, Broughton-in-Furness

Broughton-in-Furness is a small attractive market town in south Cumbria just a mile from the Duddon Estuary leading to the Irish Sea. It is built on a ridge of resistant rock leading northwards towards Coniston. The rocks here form part of the Coniston Group (Silurian: Gorstian), the lower part of which is made up, in ascending order, of the Gawthwaite, Latrigg and Poolscar formations. These are thick, sandstone-dominated turbidite sequences. The formations have been tipped into a vertical position. The disused Eccles Riggs Quarry (SD 2105 8682) shows a 70 metre by 10 metre vertical face of six turbidite flow bases in the Gawthwaite Formation.

Turbidites are the result of repeated submarine slides in which sediment is transported downslope as a turbulent current. As the current slows, first coarse-grained then fine-grained sediment is deposited. The resulting graded bed is called a turbidite. Turbidity currents can erode the sea bed prior to deposition of the coarse-grained sediment. The erosive patterns, preserved as positive casts or 'sole structures' on the base of the turbidite bed, give a clear indication of the way-up in the sedimentary sequence. This is particularly helpful when, as here, the beds have been tectonically forced into a vertical position. Flute casts are distinctive sole structures, deepest and narrowest at the up-current end, which can be used to deduce the flow direction of the turbidity. In this case there is a substantial amount of hematite which infilled the original depressions. When the underside of a flow is revealed, as at Eccles Rigg Quarry, the presence of the hematite gives the positive flute casts a shiny dark red appearance.



'Donkey Rock': an impressive development of flute casts on the base of a vertical bed of Gawthwaite Formation at Eccles Riggs Quarry. Above, top: close-up view of three overlapping flute casts. The flow direction of the eroding turbidity current was from top to bottom. Above: Formation of flute marks; the arrow indicates the flow direction of the turbidity current.

The quarry has a 'Geology Area Donkey Rock' sign and a 'walkers welcome' notice on the gate. It is sited on the lane leading from Broughton-in-Furness to the estuary at Foxfield just before the junction with the A595. Travelling from the south on the A595, the road bypasses Boughton-in-Furness. After passing Foxfield railway station, take the first right, Foxfield Road and stop in 100 m by the recycling area. The quarry is on the right. No explanation has been discovered as to how the exposed face came to be called 'Donkey Rock'.

If you continue along Foxfield Road to the town square there is a footpath from the north corner leading past the Public Conveniences to the start of the walking trail along the former railway line to Coniston. This is accessible for about 2 km and reveals many more exposures of the much folded Gawthwaite Formation.

A short way from Broughton-in-Furness towards Millom on the A565 then A5093 is Millom Rock Park and a view of the working quarry. See *Mercian Geologist*, **18 (**1), August 2012, p 83.

Alan Filmer

(with additional material by the Editor)

EXCURSION

Tideswell Dale, Derbyshire

4 September 2021
Leader: Albert Benghiat

The day-long visit, organised jointly by EMGS and the North Staffordshire Group of the Geologists' Association, attracted 12 people who met at Tideswell Dale car park. Albert explained that we were going to investigate various aspects of the Dinantian Miller's Dale basaltic lavas and dolerite sills within the Bee Low Carboniferous Limestone. From the car park we walked up the slope to the east where blocky outcrops of a dolerite sill were exposed showing spheroidal weathering. Traversing upwards along the slope to the north, the trace of a rake (old lead working) was visible. Close by an outcrop showed the massive Miller's Dale Limestone in contact with the northern termination of the dolerite sill, but with little evidence of thermal metamorphism at that point.

We then moved south down the valley, observing the breaks in slope caused by the dolerite intrusion with Miller's Dale Limestone above and Chee Tor Rock (limestone) below. A large abandoned quarry showed exposures of the horizontal dolerite sill which is injected into the Lower Miller's Dale Lava and limestones of the same age. The sill has been dated at about 287 ± 13 million years (around the Carboniferous/ Permian boundary). It is now somewhat inaccessible but spheroidal weathering could be seen.

Continuing south down the valley we passed an abandoned adit, presumably for lead, before having lunch in the Wye valley. We then moved west along the Wye valley to Ravenstor where vertical cliffs of Miller's Dale Limestone showed thick bedded massive limestone with erosion surfaces. The limestone is underlain by Lower Miller's Dale Lava whose top has been weathered and eroded.

We walked along the Wye valley past the Angler's Rest and then up Meadow Lane where we viewed, but did not inspect, the Upper Miller's Dale Lava outcrop which forms a prominent feature in the trees to the north of the lane. We then traversed fields to overlook Tideswell Dale, passing another contact between the Miller's Dale Limestone and dolerite. The weather remained dry and pleasant as we returned to the car park and thanked Albert for a very enjoyable visit.

Tim Colman

Contact of Miller's Dale Limestone (above) and dolerite.

Thick bedded massive Miller's Dale Limestone with erosion surfaces at Ravesnstor.