Cow Green Geological Trail

Approximately 4 kilometres each way, this linear trail uses well-marked footpaths and minor roads. A longer (12 km) circular route can be made by continuing past Widdy Bank Farm to the Cow Green Reservoir. Use maps 1:50 000 Geological Sheet 31 Brough under Stainmore and 1:25 000 Geological Sheet 25 Alston and 1:25 000 Explorer OL31 North Pennines Teesdale and Weardale.

Useful maps:
Ordnance Survey 1:25 000 Explorer OL31 North Pennines Teesdale and Weardale

Park at Wheathill Side car park at Cow Green (NY 811 309) and follow the route on the map, stopping at the points marked. (N.B. These do not correspond to the nature trail markers).

1 Car park viewpoint
Far to the west are the distinctive peaks of Great and Little Dun Fell and Cross Fell. Their bulky form and flat tops, especially Cross Fell, reflect the almost horizontal layers of sandstone, limestone and shale of which they are built. About 100 metres on from the viewpoint, to the right of the road, is a conspicuous area of flat grey rocks. These are the Smiddy Limestone, one of many beds of limestone of which the North Pennines are built. These limestones were formed as layers of soft limey mud on the floor of a shallow tropical sea, about 330 million years ago during the Carboniferous period of Earth history. The Smiddy Limestone is particularly striking here as it is overlain by the Peghorn Limestone, which forms a prominent ridge to the west. The sharp contrast between green grass on the limestones and the heather on sandstone or shale can be seen across a small stream. At stop 7 there is a steep, scrambly descent. If you do not want to negotiate this then turn around at the top of Cauldron Snout and return to the car park.

2 Limestone, sandstone and shale
Looking back from the gate you can see a line of low crags. These are outcrops of the Smiddy Limestone. The narrow area of ground beneath the crags marks the outcrop of the beds of sandstone and shale which separate the Smiddy and the Peghorn Limestone (which you are about to cross). During Carboniferous times layers of mud that accumulated on the sea floor became the shales we see today. Beds of sand, washed in by ancient rivers, are preserved today as sandstone. Rocks like these, formed from ancient sediments, are called sedimentary rocks. Much of the North Pennines consists of regular alternations of beds of limestone, shale and sandstone.

As you continue along the narrow road, notice how limestone beds form low lines of grey crags separated by gentler slopes on the outcrops of shales and sandstones. Notice too the sharp contrast between green grass on the limestones and the heather on sandstone or shale. This makes a gentle alternative walk of about 5 km.

3 Rod’s Vein - old mine workings
Mineral veins are vertical bands of mineral which filled fissures, usually faults, within the surrounding rocks. The old spoil heaps contain fragments of the minerals found in the vein. White barite is most abundant, with traces of grey metallic galena, the main ore of lead. The veins at Cow Green contained insufficient lead to be workable, but the barite was mined for use in the paint and chemical industries until 1952.

The narrow area of ground beneath the crags marks the outcrop of the beds of sandstone and shale which separate the Smiddy and the Peghorn Limestone (which you are about to cross). These outcrops form a prominent ridge to the west. The sharp contrast between green grass on the limestones and the heather on sandstone or shale can be seen across a small stream. This makes a gentle alternative walk of about 5 km.
4 **Sugar limestone**

The small outcrops of rock, most noticeable to the left of the road, are of Melmerby Scar Limestone. Unlike the limestones seen at the beginning of the walk, these are white and crystalline and show a distinctive crumbly weathering, earning them the local name of ‘sugar limestone’.

The ‘sugar limestone’ is actually a marble (a limestone which has been altered and recrystallised by the effects of great heat millions of years ago). Such rocks are called metamorphic rocks. The source of this heat will be explained at the next stop.

5 **The Great Whin Sill**

The rusty brown rocks over which flows Red Sike and which gives the stream its name, is known by geologists as dolerite. Unlike the limestones, sandstones and shales, dolerite was not formed from ancient sediments, but formed by the cooling and crystallisation of molten rock. Such rocks are called igneous rocks.

The rock at Red Sike is at the top of a huge sheet of dolerite known as the Whin Sill. 295 million years ago, this was injected into the layers of limestones and other rocks as a hot liquid at over 1100°C. Here in Teesdale this layer is almost 75 metres thick. As it cooled it baked the surrounding rocks, turning the limestones near to it into marble, or ‘sugar limestone’.

6 **Cow Green Dam**

You may notice that the dam wall is actually in two parts. The part nearest to you is a solid concrete wall built on hard Whin Sill. The other part is an earth bank built where the dam crosses the old river channel that is filled with boulder clay.

Just before the bridge, turn off the road and follow the Pennine Way to the top of Cauldron Snout.

7 **Top of Cauldron Snout**

Here the River Tees flows across the very hard outcrop of the Whin Sill dolerite. Notice the well-marked vertical cracks or joints in the rock. These are known as columnar joints and they formed during the very final stages of cooling of the dolerite. Giant’s Causeway and Fingal’s Cave are well known examples of more regular columnar jointing.

Follow the very steep footpath down the side of Cauldron Snout, taking particular care on the rocks, which may be slippery. If you are unsure about using the steep path you can view parts of the next stop from the top before returning to the car park.

8 **Foot of Cauldron Snout**

The Whin Sill dolerite forms both the waterfall and many small craggy outcrops on both banks of the river. You can see how a huge area of the western bank is smooth and grassy and completely free of rocky outcrops. This is the old channel of the River Tees, dating back to before the last glacial period. Debris, mainly boulder clay dumped by the ice, plugged the old valley to such an extent that when the ice melted and the river began to flow again it was diverted to where it cut a channel through the hard Whin Sill dolerite, forming the waterfall of Cauldron Snout.

9 **Falcon Clints**

Between Cauldron Snout and Widdy Bank Farm the river flows in a steep sided gorge cut through the Whin Sill. Downstream from the waterfall, white marble, also part of the Melmerby Scar Limestone, may be seen beneath the dark grey crags of the Whin Sill. This is the bottom contact of the Whin Sill from Red Sike (point 5) to here, you have travelled the depth of the Whin Sill at this location.

Notice the striking vertical columns of dolerite in the cliffs on Falcon Clints and further downstream, on Cronkley Scar.

10 **Conglomerates**

The footpath here crosses small outcrops of a rather nubbly-looking rock known as conglomerate. This is made up of pebbles of a variety of older rocks set in a mud. These conglomerates date back to early Carboniferous times about 330 million years ago when the old rocks, now buried beneath the North Pennines, were pushed up to form a mountain chain. Pebbles and other detritus produced by the erosion of these mountains is preserved here as conglomerate. As the area was gradually submerged below the Carboniferous sea muds, sands and silts gradually buried the conglomerate. These can be seen in the steep river banks, immediately above the conglomerate. Eventually these were in turn buried beneath the Mельmerby Scar and other later limestones.

The older rocks, representatives of those that make up the Lake District mountains, are exposed on the south bank of the river at Pencil Mill, about 1km east of Widdy Bank Farm.

This is the end of the trail, you now have the option of turning around and retracing your steps to the car park or continuing along the Pennine Way until you reach Widdy Bank Farm, following the track to the Cow Green road and on to the car park (approximately another 2.7km).