

EXCURSION

Minerals of the Northern Pennines

Leader: Trevor Bridges

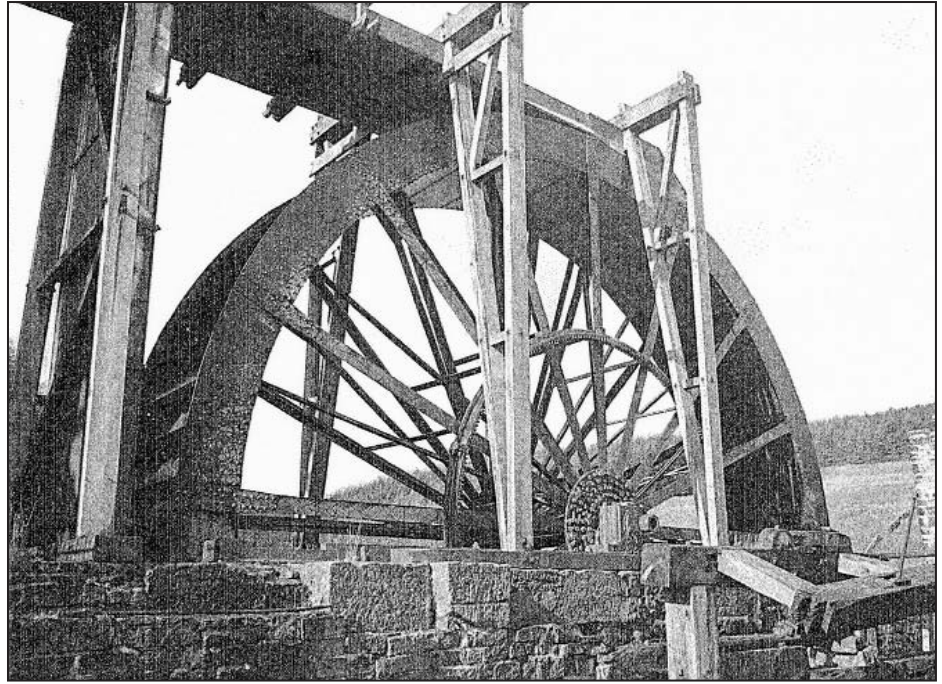
Weekend 2nd-3rd October 1999

On a rather wet and blustery Saturday, 31 members of the Society met at 10.30 am in the car park at Cow Green Reservoir (810312) at the top of Teesdale; this was a record number for a weekend excursion. Our leader, Trevor Bridges, previously a member of the Society and still an active member of the Russel Society, had always been interested in mines and minerals. When he lived in Derby, the minerals of the Peak District were his passion, but his attention transferred to the Northern Pennines orefield when he moved to live near Newcastle.

Cow Green Reservoir covers the site of Cow Green Mine, an important source of lead and iron ore, but subsequently for barytes until its closure in 1954. There is still plenty of evidence of past mining activity in the area. From the car park we walked a short distance to the north up the steep-sided rocky valley of Winter Hush. Joining this hush at an angle from the northeast was Green Hush. Trevor explained that hushing was a method used by miners to remove the waste rock from the area of a vein. They dammed a stream higher up the hillside, and periodically released the water in order to scour the outcrops of rocks and veins down the hill, giving them access for further quarrying of the ore. Mineralisation of this vein showed a brown impregnation of the country rock with iron and magnesium carbonates, including ankerite and siderite. There were traces of galena, but barite was more plentiful. Barite is confined to the outer zone of the Northern Pennines ore field, whereas the central zone is dominated by fluorite. The Lower Carboniferous country rock is unlike that in the Peak District, as it consists of cyclothem sequences of limestone, shale and sandstone with seat earth and an occasional coal seam.

Sir Kingsley Dunham, Director of the British Geological Survey 1966-1975, spent much of his professional life in the area, first as a student at Durham University and later as Professor of Geology, and became an authority on the orefield. Trevor related how Dunham's concepts of the mineralisation of the area had changed over the years. In 1934, at the end of three years of postgraduate research, he published a paper suggesting that a concealed granite intrusion might be responsible for supplying the mineralising fluids. Early in the 1950s, two research students from Cambridge approached him with a proposal for a gravity study of the Alston block. Their results showed a Bouger anomaly of reduced gravity across the centre of the area, indicating the possible existence of a granite pluton. In 1960, government funding was obtained to drill a borehole at Rookhope, and the granite was reached at more than

The Killhope water wheel at the Lead Mining Centre in Weardale.



300 m below the surface. However it had an eroded surface and was subsequently dated to the late Devonian; it could not be the provider of the mineralising fluids in the Carboniferous limestone. It has been suggested that the mineralisation may have occurred late in the Carboniferous, when relatively high geothermal heat flow up through the granite may have aided migration of mineralised fluids from the adjacent sedimentary basins.

We returned to the car park, where we examined an exposure of limestone displaying fossils of crinoids and corals, including *Dibunophyllum*, on a large, almost horizontal bedding plane, that had probably been used as a mineral dressing floor. We then walked south along the road to the Cowgreen Dam. On the way, we passed an exposure of "sugar" limestone, that is Melmerby Scar Limestone marmorised by heat from the Whin Sill. Its gritty texture has created a good growing medium for the alpine spring gentian in one of its few British habitats. Further along the road, outcrops of fine grained, dark crystalline dolerite were part of the Whin Sill, the massive sill that was intruded right across the northern Pennines and Northumberland in the late Carboniferous. Below the dam, the outflow cascades over the sill to form the spectacular waterfalls of Cauldron Snout, which looked very impressive between walls of eroded dolerite with columnar jointing. Looking back at the dam, Trevor pointed out that the eastern half of the dam is a concrete gravity structure where it stands on the strong and stable Whin Sill, while the western part is a rockfill embankment that imposes lower loads on the drift fill of a small buried valley.

In deteriorating weather of the afternoon, we drove down Teesdale to Bow Lees Country Park (907284), on the landscaped site of a limestone

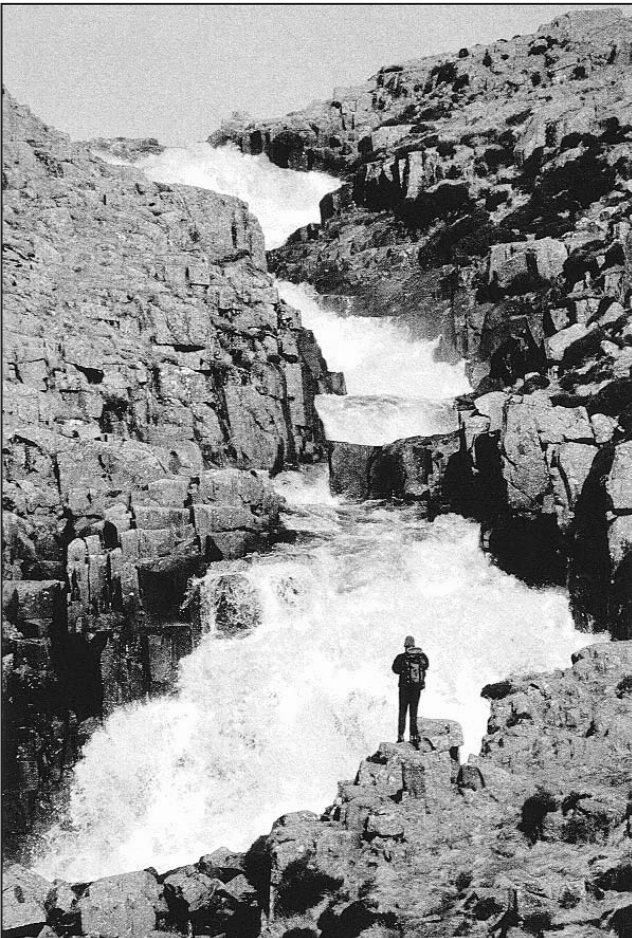
quarry and crushing plant that closed in 1968. Here we grouped into fewer cars for a journey up a gated road onto the moors. We had permission from Raby Estates to visit the Pike Law workings (905314), but a ban on mineral collecting was one of their conditions for access. In pouring rain, we slithered down a steep rocky path into another hush, rather deeper and wider than the one at Cowgreen. Despite the weather, it was worth the effort, as the mineralisation was exceptional. We were in the fluorite zone, and there were beautiful purple cubes of the mineral, as well as large lumps of galena, ankerite, siderite and calcite. One specimen was found that demonstrated the change in mineralisation of a vein from ankerite on the outside to fluorite inside. A bonus find was an abandoned kestrel's nest, with a collection of small bird bones beneath it.

The Sunday was spent at Killhope Lead Mining Centre in Weardale (824433). We first walked across the road and up the hill to examine the sequences of sandstones, shales and limestones that make up the cyclothems, although there was no evidence of coal. About 100 m up the road, the bank was composed of a thick band of sandstone overlain by the Great Limestone, and the junction between the two beds formed the base of the Namurian, in marked contrast to the stratigraphy of the southern Pennines. There was some discussion about the wavy partings in the limestone. Were they best described as thin shales or as stylolites? Trevor related that the best ores have been found in the Great Limestone. Across the road, a stream section exposed thin mineral veins with ankerite, fluorite and galena in altered limestone; the mineralisation had hardened the country rock, so that the veins stood out as small waterfalls. There were also fossil beds with both *Dibunophyllum* and productids.

Back at the mining centre, we divided into groups for guided tours, firstly along one of the old adits into the mine. This has been modified with very realistic fibreglass in places, to create a circular tour that demonstrates the mining techniques. As the rain began to fall more heavily, we were joined by Trevor's wife Shelagh, who helped to show us around the outdoor exhibits. The large overshot water wheel, which is the symbol of the museum and was used to drive the machinery, has been renovated. The dressing floor has been restored so that visitors can see how the ore was concentrated by the women and children ready for dispatch to the smelters. Some members tried "hotching" - a process for separating out the heavier lead ore - and found it harder work than it looked. Finally we went inside to see examples of minerals and other museum acquisitions, followed by very welcome cups of tea. Trevor recommended a book recently published by the Friends of Killhope under the title *Out of the Pennines*; it contains 15 short papers by local enthusiasts about various aspects of the history of mining in the area (and has been very helpful in preparing this report).

Many thanks to Trevor and Shelagh for bringing the Northern Pennines orefield to life.

Judy Small



The waterfalls of Cauldron Snout, where the River Tees cascades over the Whin Sill.