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# 10 Middle and Upper Carboniferous rocks (Millstone Grit and Coal Measures) of the Sheffield region

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## Purpose

The first part of this excursion examines the sediments and fossil plants of the Millstone Grit, scarp and dip scenery, industrial archaeology (millstones) and Iron Age fortifications. The second part illustrates Coal Measure sediments, with fossil plants, fish, and non-marine bivalves.

## Logistics

The two excursions lie within an 11 km radius of Sheffield. In stratigraphic order, Excursion 10a (Burbage Edge; Namurian, Millstone Grit) should be taken first. This starts from Upper Burbage Bridge [SK 261 830], which may be reached by car from Sheffield via the A625 and Hathersage, or by Ringinglow Road from the A625 at Ecclesall Church [SK 335 833]

By bus, take routes 240, 272, or X65 from Sheffield and alight just beyond Fox House Inn [SK 263 806]; the excursion will then be started at Locality 4. Off-road parking is available for a number of cars or minibuses just to the west of Upper Burbage Bridge; limited road parking also exists to the east of the bridge. Allow a day or long half-day, involving approximately 6 km of footpath walking with occasional scrambling over boulder fields and exposures along streams.

Excursion 10b (Westphalian, Coal Measures) is a disused quarry at Bradgate Brickyard [SK 413 935] near Rotherham, northeast of Sheffield, requiring 1–2 hrs. Take the A6109 from Sheffield to approximately 300 m north of the junction with the A629. Parking is limited to minor roads to the west of the quarry and coaches are advised to find parking elsewhere.

*Note:* Parties wishing to visit Bradgate Brickyard (10b) should first seek permission from Mr J. Stothard, Swift & Co., 56 Birley Moor Road, Sheffield, S12 4W (tel: 0114 265 1023)

**Hammering is forbidden** on Burbage Edge (Excursion 10a).

## Maps

O.S. 1:50 000 Sheets 110 Sheffield & Huddersfield, and 111 Sheffield & Doncaster; B.G.S. 1:50 000 Sheets 100 Sheffield and 87 Barnsley.

## Geological background

The upper part of the Millstone Grit to the southwest of Sheffield is dominated by thick sandstone units interbedded with shales. Occasional marine incursions and subaerial exposure of the delta top gave rise to thin marine bands and the development of coals. One of the sandstones, the Rivelin (or Chatsworth) Grit, forms characteristic scarp features such as Stanage Edge, Burbage Edge and Millstone Edge. The grit is of upper Namurian (Marsdenian) age and consists of an upper and lower leaf. It is bounded below by the *Reticuloceras* superbilingue Marine Band, and above by the Ringinglow Coal. The grit is a major sandbody which was laid down in a fluvial setting as part of the advancing delta system from the north. The sandstones of the Rivelin Grit are coarse grained, occasionally pebbly, and show excellent examples of cross-bedding on a variety of scales. Different facies are present within the grit, characterized by the presence or absence of pebbles and the scale and type of the cross-bedding. The shales below the lower leaf contain rare goniatites. Drifted plant remains are more common in both the sandstones and shales. The rocks generally dip very gently to the east, although there are local variations, but the considerable downcutting of Burbage Brook has created an inlier,

exposing the beds underlying the Rivelin Grit along most of its course.

The Coal Measures overlie the Millstone Grit to the east and, owing to their similar lithological characteristics, give rise to comparable (though generally more subdued) topographic features. Bradgate Brickyard (Excursion 10b) is located in urban Rotherham, and the gently dipping sequence of middle Coal Measures provides a convenient way to see a variety of rock types (sandstones, siltstones, shales, thin coals, seatearths), sedimentary structures (cross-bedding, slump structures, lamination) and fossils (plant fragments, bivalves, brachiopods and fish remains) within a typical Coal Measure sequence. The coarsening-up cycles within the Coal Measures reflect alternating regressive and transgressive events, and represent a deltaic/fluvial environment in which periods of emergence led to the growth of luxuriant forests.

## **Excursion details**

### **Excursion 10a**

From Upper Burbage Bridge (Figure 10.1), walk to the east and take the signed footpath through the gate in the wall. There is a fine view of the area from here with the main scarp of the upper leaf of the Rivelin Grit extending 2.5 km to the south. Note also the termination of the line of crags (by a fault) to the west of Burbage Brook, and the prominent hills of Higger Tor and Carl Wark (see Localities 5 and 6). Follow the footpath south for approximately 100 m.

#### **Locality 1 [SK 262 829]**

Cross-bedded sandstones are well exposed along the scarp edge in this area (Figure 10.2). The rock is a typical 'grit' a coarse-grained feldspathic sandstone with common pebbly layers. The grains are subangular and consist of colourless quartz, pink/ cream-coloured weathered feldspars, and occasional mica flakes. The rounded pebbles are dominantly of vein quartz. Cross-bedding is ubiquitous and foreset beds at this locality commonly indicate a transport direction towards the northwest. The rocks are well-jointed along two dominant directions (northwest–southeast and northeast–southwest).

Continue south along the sandy footpath (material derived from adjacent sandstones), noting marshy patches with rushes and mosses near the footpath where water passing through the permeable and porous sandstones meets the impermeable shales underneath (see Locality 4), and seeps out at the surface as springs. Also note the large-scale foreset beds in the scarp and the land surface strewn with boulders resulting from solifluction.

#### **Locality 2 [SK 268 815]**

After about 1 km the prominent scarp becomes less well-defined. Just to the south the scarp becomes much more prominent again but is some 400 m to the east of the path. This abrupt change in position is due to a fault downthrowing to the north. However, to the west, of the prominent flat-topped hills Carl Wark (see Locality 5) and Higger Tor (see Locality 6), Higger Tor to the right (north) is over 45 m higher, indicating its relative upward displacement. A further 500 m along the footpath to the southwest, a large quarry is visible in the scarp to the east. Leave the path and ascend to this quarry, taking care as you go through the boulder field below the quarry entrance.

#### **Locality 3 [SK 266 810]**

The Rivelin Grit here has been extensively quarried and the 20 m high, vertical joint faces (popular among climbers) show large foreset beds dipping towards the south. Numerous millstones, in various stages of completion, lie around the quarry entrance; some are up to 1.9 m across and nearly 0.4 m thick. Also visible in the adjacent scarp to the south of the quarry are boreholes showing the method of extraction of the sandstone blocks. Follow the quarry path obliquely across the boulder field to the southwest and pass through the old stone gate posts along the track to the quarry approximately 60 m from the junction with the main footpath. There is a fine example of a stone trough (difficult to locate when the bracken is high), and yet more millstones, just before the junction with the main path. Take the minor track at [SK 262 808] to the northwest, towards Burbage Brook, where there are small exposures of shales which underlie both leaves of the Rivelin Grit.

#### **Locality 4 [SK 262 809]**

A larger exposure occurs on the west bank 75 m further north (access via the west bank). Here, fissile dark-grey shales along a track in a north-northwest direction.

#### **Locality 5 [SK 260 814]**

At Carl Wark the Rivelin Grit may be examined and palaeocurrent directions determined. A few millstones may be seen among the boulders on the eastern slopes of the hill. Carl Wark (Earl Wark on old maps) is the site of an Iron Age Fortification (2500–2000 years old) and on the western side of the hill a 7 m wide earth rampart and a 2 m high stone wall form impressive reminders of the fort. A former entrance and stone trough (Iron Age or Roman) can also be seen and an information plaque is located near the entrance. The footpath route then continues in a north-northwest direction to Higger Tor.

#### **Locality 6 [SK 257 819]**

From Higger Tor there are splendid views of Burbage Edge, Carl Wark and the form of the Burbage inlier, as well as further scarp edges of the Rivelin Grit at Over Oowler Top towards the south-southwest. Note the pebbly nature of the grit and various scales of cross-bedding. The direction of transport may be measured and compared to that at the previous localities.

The quickest way back to the car park and Locality 8 is to drop down to the road on the footpath, over steps recently constructed to combat erosion, and then turn right. However, if time permits, an additional locality may be visited at Callow Bank where the lower leaf of the Rivelin Grit is exposed. From Locality 6, cross the road after having descended from Higger Tor and take the footpath opposite. After about 40 m another path is reached; turn left and continue for some 100 m before branching off to the right and follow the contours to the prominent scarp and landslip area of Callow Bank.

#### **Locality 7 [SK 252 823]**

At Callow Bank 0–15 m of dark grey shales, with occasional flat, tabular sideritic nodules and rare plant fragments, crop out below the lower leaf of the Rivelin Grit. The shales, which have yielded rare specimens of *Gastrioceras* crop out *in situ* as well as forming part of a slumped area (recognized by the hummocky ground) below the crags of the Rivelin Grit. Continue examining the shale outcrops up the slope towards the crags and note that they coarsen slightly until, just below the grit, the shales are interbedded with thin cross-laminated siltstone and fine sandstones. The lower leaf of the Rivelin Grit rests with a sharp junction (scoured surface) on the interbedded siltstones and sandstones. The grit is formed of apparently massive sandstones, but careful observation will reveal the presence of diffuse bedding and interbedded siltstone horizons. Further up the slope a poorly exposed interval indicates the presence of a finer-grained unit before further thick sandstones are exposed at the top of the slope. To reach Locality 8 at Upper Burbage Brook, return to the road and continue in a northerly direction (passing the car park) until Upper Burbage Bridge is reached. Descend to the exposures between the road and the confluence of the two streams.

#### **Locality 8 [SK 261 829]**

Here, on the top bedding surfaces of the small scarp, bedding planes of the sandstones show numerous, but poorly preserved and crudely aligned plant fragments (some as casts, others partly carbonized). From here, descend into Burbage Brook and follow the stream southwards. If the water level is low enough, very soon exposures of horizontally bedded carbonaceous siltstones and thinly bedded sandstones appear in the bed and banks of the stream. These beds occur below the upper leaf of the Rivelin Grit; the lower leaf being poorly exposed downstream. Intermittent exposures of shales are present along the length of the stream in the Burbage area. Marine fossils (?*Gastrioceras*) have been recorded at [SK 262 825] and some of the shale exposures show thin interbeds of ironstone.

Return to the car park by walking north along the stream, or head west or northwest (depending how far south you are in Burbage Brook) towards the southwestern end of the prominent scarp on the skyline. The road is close and it is a short distance to the car park.

## Excursion 10b

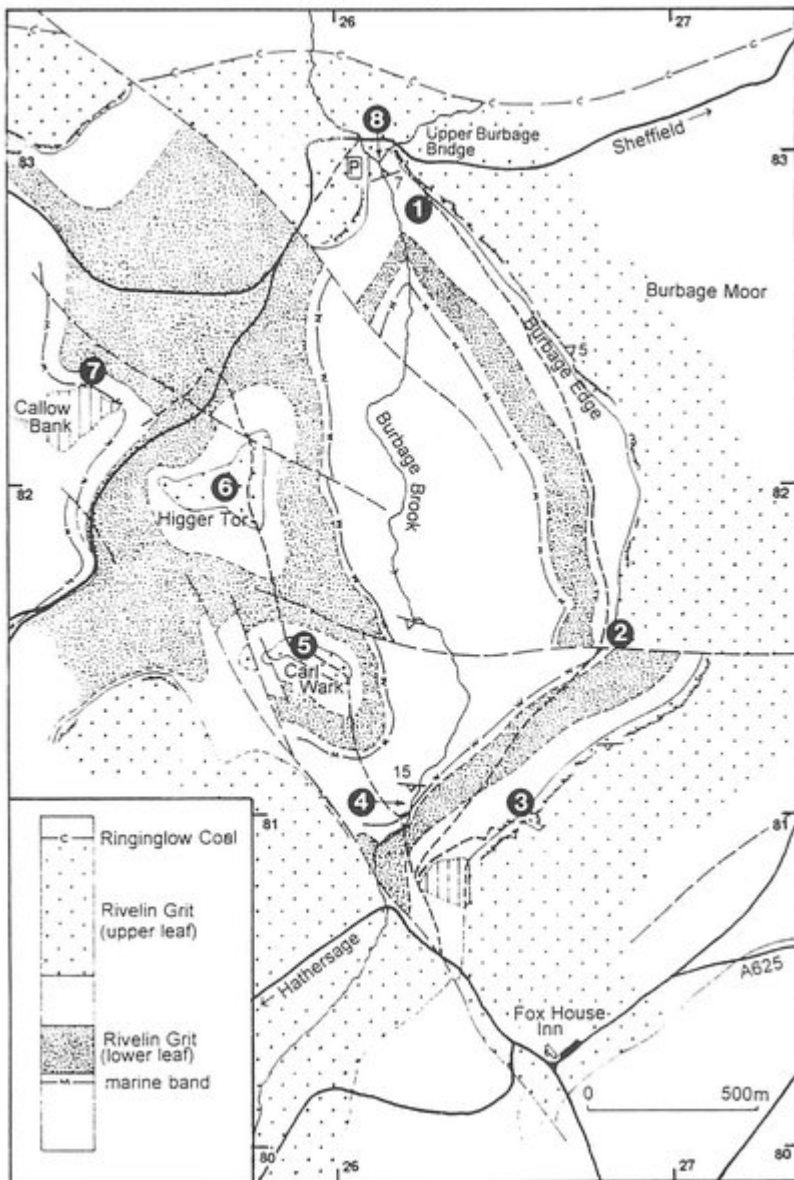
### Locality 1, Bradgate Brickyard [SK 413 935]

The quarry is located to the right of the road at the top of a grassy bank, just after crossing over the roundabout with the junction of the A629. The quarry face may be in variable states of degradation but most of the features described below should be exposed. The gentle northeast dip (Figure 10.3)b is clearly visible, as is the range of rock types that make up typical Coal Measure cycles. Shales and mudstones with ironstone nodules, in which comminuted plant debris is locally abundant, dominate the sequence. Thin coal seams, seatearths and variably developed siltstones and fine-grained sandstones also occur. The mudrocks are dominantly non-marine but show evidence of occasional marine incursions; the siltstones and sandstones are the result of mainly fluvial activity, while the coals and seatearths indicate plant colonization during periods of emergence.

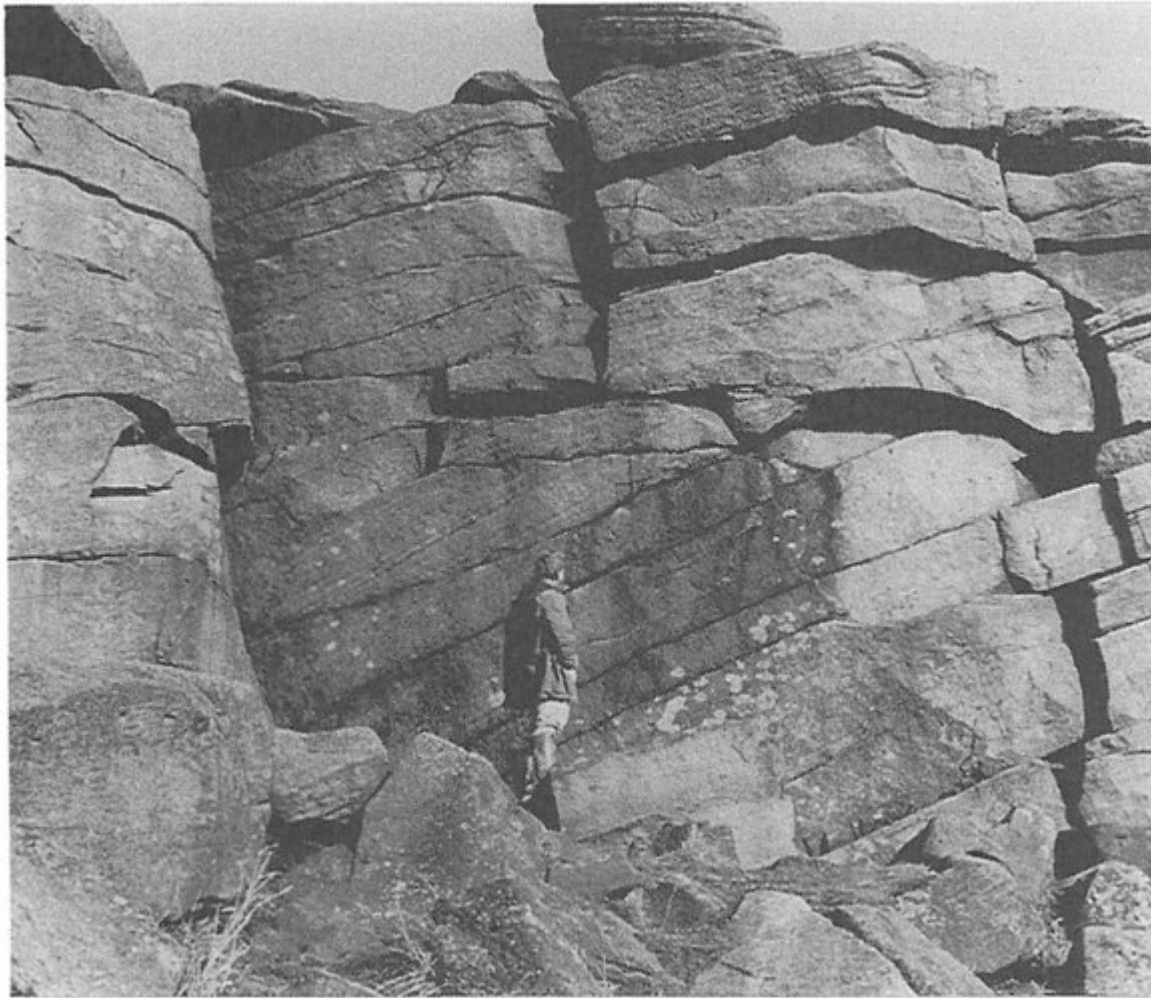
Point A (not shown on (Figure 10.3)) is the level of the Joan Coal and overlying shales; these are usually obscured by scree. The Joan Coal lies approximately 14 m below the sandstone bed at B. The dark grey shales immediately above the coal have yielded the inarticulate brachiopod *Lingula* (horizon equivalent to Clay Cross Marine Band in this area). The geological features within the 15 m of strata exposed in the quarry may be followed on the log (Figure 10.3)a with reference to the five prominent beds or units B–F. Point G (not shown on (Figure 10.3)) is the level of the Lidgett Coal (rarely exposed) which occurs approximately 5.5 m above the top of the sandstones at F. Thin coal seams are present between the sandstones at F and the Lidgett Coal.

Please keep any disturbance of the rock face to a minimum.

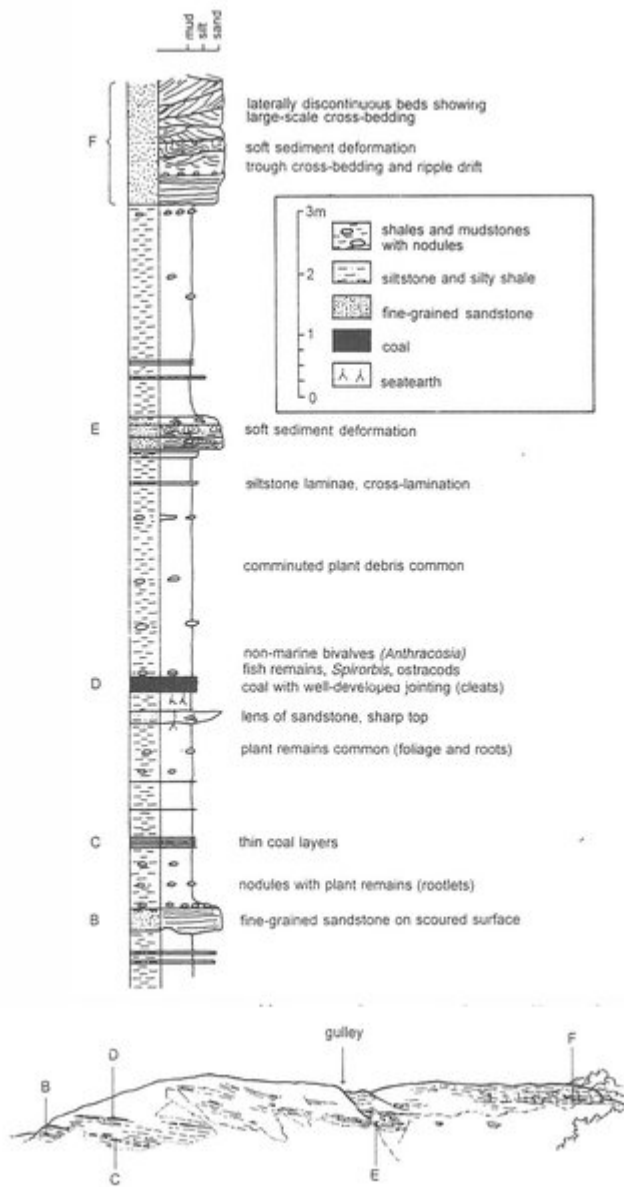
### [Bibliography](#)



(Figure 10.1) Simplified geological map of the Burbage area.



*(Figure 10.2) Large-scale cross-bedding in the upper leaf of the Rivelin Grit (Locality 1). Photo: M. Romano.*



(Figure 10.3) (a) Simplified sedimentary log of the sequence exposed in Bradgate Brickyard quarry. (b) Field sketch of the sequence exposed in Bradgate Brickyard quarry.