Geological 'walkabouts' in Dronfield

by Michael Romano

2 - Dronfield geological walkabout (or plus car)

Walkabout logistics: Total distance – approximately 6 miles; but can be split into two or more excursions, or by car to include all localities in one outing. This excursion allows generally easy access to all localities although steps are involved with one, but does not include the youngest rocks in the Dronfield area. For these, see Geological Walkabout 3 (Frith Wood). It is advisable to check the route first (see **Fig. 1**) to see if you wish to undertake the walkabout by foot, car or whether you prefer to split it up into two separate trips. The first

Dronfield is situated on rocks of Carboniferous age and, specifically, those belonging to the Coal Measures which is the topmost subdivision of the Carboniferous Period. The rocks on which Dronfield lies are all of an age between 315-307 million years. The rocks include sandstones, shales, coals and ironstones; all the ingredients needed to foster an industrial heritage. The sediments that formed these rocks were laid down in a terrestrial environment when rivers flowed to the sea over relatively flat alluvial plains, transporting sand and mud along their channels. In between these rivers, vegetation flourished that ultimately gave rise to the abundant coal seams that characterize the Coal Measures. During this time, Dronfield lay much nearer the equator than it does today, probably less than 20^{o} latitude north, and was almost landlocked between the high ground of Scotland and Wales. Periodically these plains were inundated by the sea from the east that left their mark with the presence of fossil shells and goniatites in the shales. Goniatites are marine organisms, related to fossil ammonites and the modern pearly *Nautilus*. The nearby tropical seas supported coral reefs. The agreeable climate supported a rich life of invertebrates (insects including giant dragonflies) and vertebrates (fish, amphibians, and early reptiles) as well as a luxuriant flora.

To appreciate and understand the variety of the rocks of Dronfield, this walkabout visits a number of mainly man-made exposures (see locations on **Fig. 1**). Although it is (geologically) preferable to study the rocks in ascending order of age (from oldest to youngest – i.e. in the order in which they were laid down) as this makes an evolving story of the environment at the time, this is not always convenient. So you are advised to occasionally refer to the geological column (**Fig. 2**) to remind you where you are in the geological succession and to relate each exposure to each other.

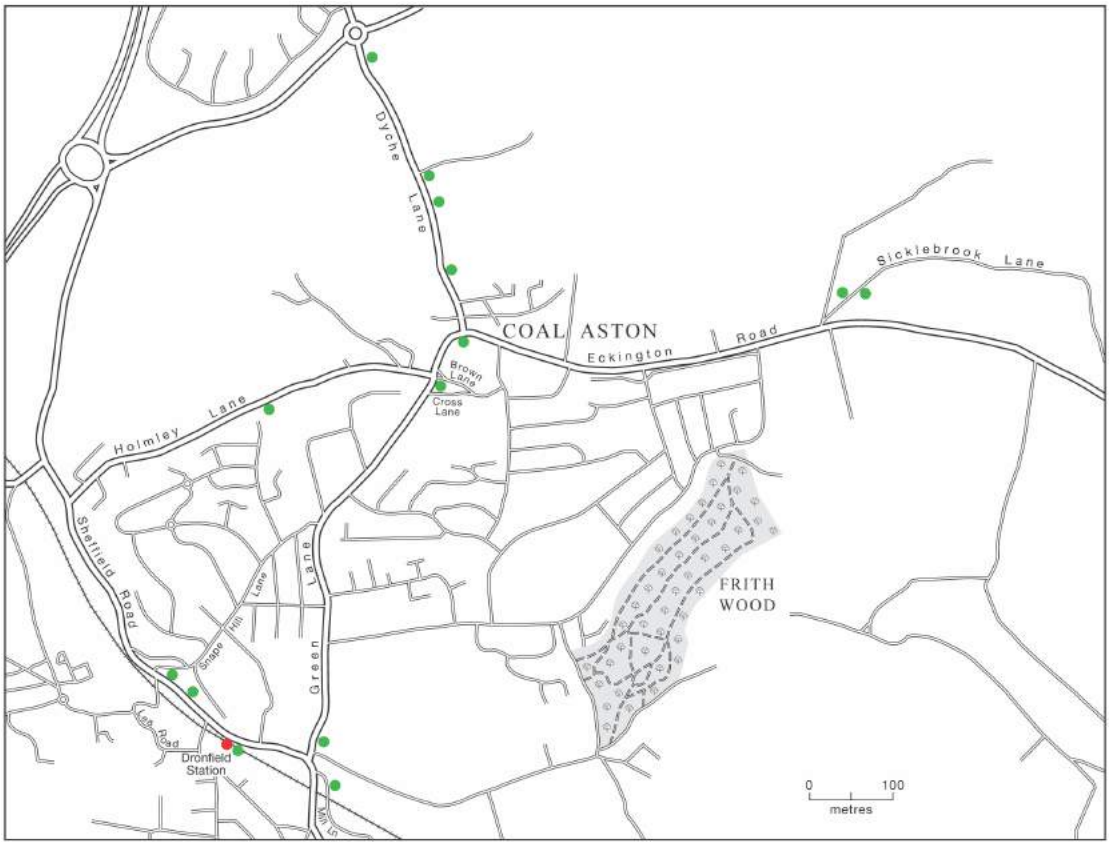
Dyche Lane
COAL ASTON
Eckington Road
Sicklebrook Lane
Brown Lane
Cross Lane
Holmley Lane
Sheffield Road
Green Lane
Mill Lane
Snape Hill Lane
Lea Road
Dronfield Station
FRITH WOOD
0
100
metres

Fig. 1

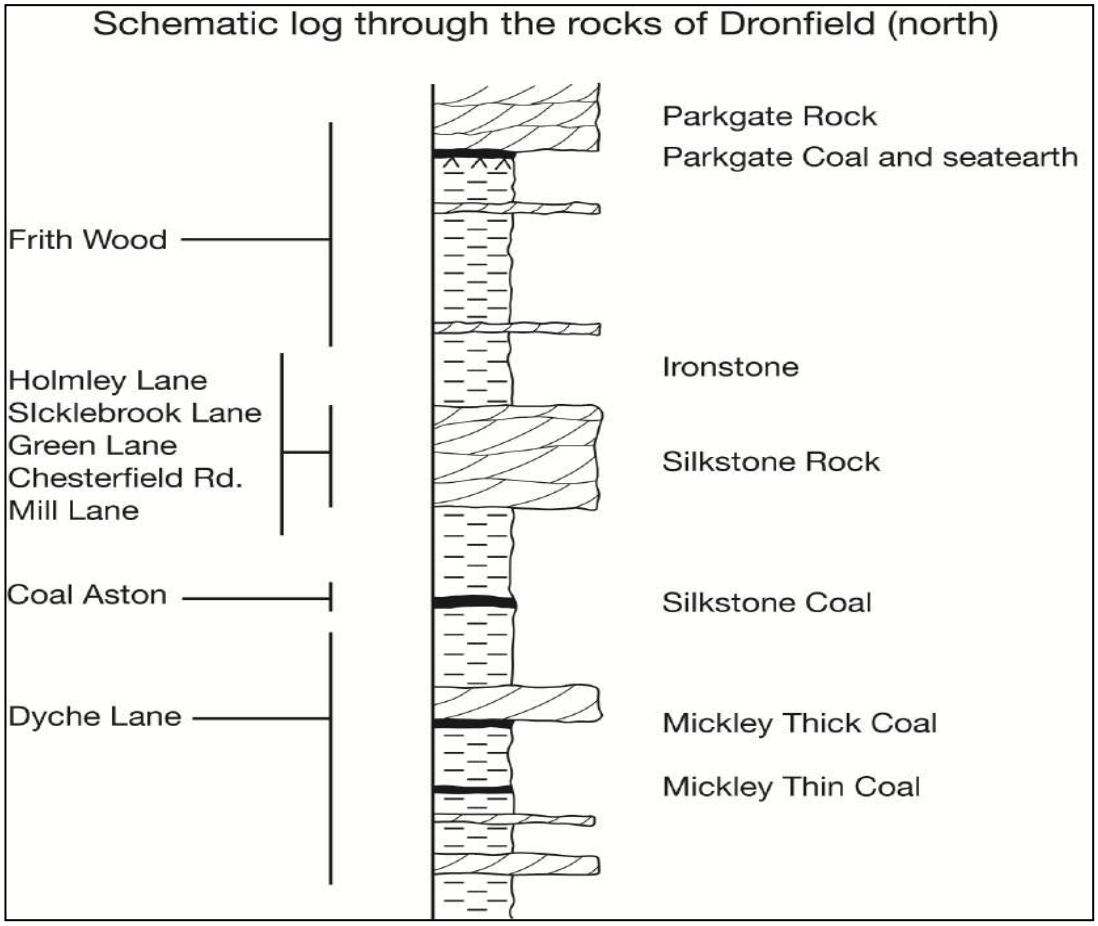
Schematic log through the rocks of Dronfield (north)
Frith Wood
Holmley Lane
SIcklebrook Lane
Green Lane
Chesterfield Rd.
Mill Lane
Coal Aston
Dyche Lane
Parkgate Rock
Parkgate Coal and seatearth
Ironstone
Silkstone Rock
Silkstone Coal
Mickley Thick Coal
Mickley Thin Coal

Fig. 2

A brief look at an official geological map of the whole region (**Fig. 3**) (Sheet 100, 1:50 000 – British Geological Survey) immediately shows that Dronfield has made its mark! There is a geological structure marked on the official Map Sheet that bears the name **Dronfield Syncline**. A syncline is a geological structure that resembles a 'V' or, in the case of the Dronfield Syncline, a shallow downfold, where rocks slope (or dip) towards each other. This structure gives rise to the same age rocks appearing in two places. In the case of Dronfield, the distinctive **Silkstone Rock** demonstrates this particularly well. This large geological synclinal structure explains the long slopes north and south of the River Drone – the one in the south that dips in a northerly direction (as shown by the long drag up Hallowes Lane and Hallowes Rise), and the one in the north that dips in a southerly direction (as shown by the similarly long drags up Snape Hill Lane, Green Lane, Bents Lane and Ferndale Road).

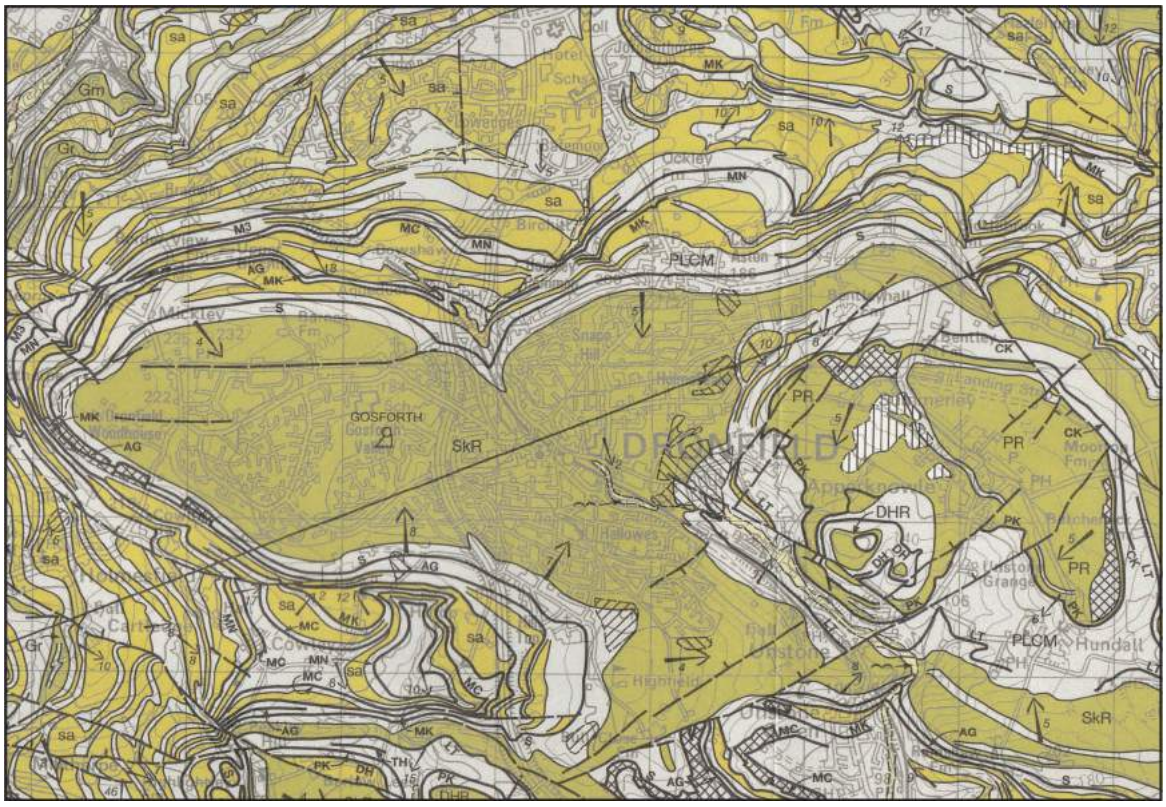

Fig. 3

Starting with the oldest rocks, the first locality is opposite the entrance to New Leaf Plant Centre on Dyche Lane. If using a car for this Walkabout, it may be convenient to park the car in the Plant Centre car park where the large display of plants may be viewed before looking at the geological localities on Dyche Lane. Opposite the entrance, in the field across the road, is a low ridge running away from the road.

This ridge (**Fig. 4**) is present because of a thin bed of resistant sandstone that is both underlain and in turn overlain by soft shales.

Fig. 4

This is an unnamed sandstone and such beds are typical of the numerous thin sandstone units within the Coal Measure succession in the Dronfield area. The more gentle slope on the southern side of this ridge indicates that the sandstone bed dips gently to the south, so that the succession to the south goes into younger rocks. Walk up Dyche Lane and you will pass over another thin bed of sandstone and the first of the coal seams in this excursion, the **Mickley Thin** seam (see **Fig. 2**), generally less than 45 cm (18 inches) thick. Neither this thin sandstone bed nor the coal seam make prominent features in the field. However, near the top of the hill in Dyche Lane, is an exposure in the south bank of the farm track off to the left. In the bank you may see fragments of coaly shale indicating the presence of the next coal seam, the **Mickley Thick** (**Fig. 5**) and the overlying sandstone.

Fig. 5

As the name suggests, the **Mickley Thick** seam is generally thicker than its lower namesake and as the 1957 Geological Survey Memoir quotes in 'the southern approaching tunnel north of Dronfield' the seam reaches up to 1.2 m (4 ft) in thickness. The coal seam however may not always be visible owing to soil and plant cover.

Return to the road and continue a little further to near the top of the hill where, taking care to keep on the pavement and well away from the traffic on this busy stretch of road, look at the long outcrop of sandstone that is particularly well exposed to the east of the road (**Fig. 6**). This is another younger unnamed sandstone that shows large weathered-out nodules reaching up to 1m across, and are the result of iron precipitation (giving the reddish brown colour) laid down before the sediment hardened, and then resulting in ball-like structures in the solid rock (**Fig. 7**). They were then subsequently weathered away to give the gaping holes with iron staining of the rock around the holes. Note that this exposure is best visited in winter when the vegetation is low.

Fig. 6

Fig. 7

Fig. 8

Continue walking towards Coal Aston (**Fig. 1**). While on the way, when at Ferndale Garden Centre (**Fig. 8**) pause to look at the field on the east side of the road sloping down towards the large house opposite the Garden Centre (if using your car on this Walkabout, an alternative to parking at New Leaf Plant Centre, is to park in the Garden Centre car park where, as well as the plants, refreshment make be taken in the coffee shop there).

This (dip) slope (**Fig. 9**) towards the house is formed by the top of the sandstone unit seen at the previous locality at the top of the hill on Dyche Lane. Continue to Coal Aston roundabout (the junction of Green Lane, Eckington Road and Dyche Lane) (**Fig. 10**). Here the next important geological unit, the **Silkstone Coal** runs nearly under the roundabout in a broadly E-W belt. Unfortunately there are no exposures of this important coal within the present excursion. The **Silkstone Coal** proved to be 4 ft 5 inches (1.3 m) thick in a borehole at Apperknowle and has been extensively mined along its outcrop from west of Rotherham to the south of Dronfield.

Fig. 9

Fig. 10

A short distance above the **Silkstone Coal** is the **Silkstone Rock** (see **Fig. 2**), perhaps the most important rock unit in the area in terms of forming prominent features in the landscape and affecting the hills and valleys of Dronfield. The **Silkstone Rock** is a thick, composite unit that sometimes is a single thick sandstone, while other times is split into several sandstone beds separated by finer grained siltstone or mudstone. Around Dronfield it forms a thick sandstone unit that covers a large area (large green area labelled **SkR** in the centre of the map in **Fig. 3**) reaching up to 24 m (80 ft) in thickness. Although reportedly not being a 'particularly good building-stone" (see Geological Walkabout 1), it must certainly have been used for local buildings. The **Silkstone Rock** may be studied in a number of localities. Although the base of the unit is not presently exposed, the feature it makes above the underlying coal and shales may be seen either along Sicklebrook Lane, 1.5 km east of Coal Aston crossroads, or behind the houses along the south side of Holmley Lane.

Fig. 11

At the former locality, first look north to a low ridge in the fields (**Fig. 11**) running more or less parallel to Sicklebrook Lane. This ridge is formed by a thin bed of sandstone.
To the south of Sicklebrook Lane a prominent ridge, again running more or less parallel to the south of the lane, is formed of the lower part of the **Silkstone Rock** (**Fig. 12**). At the small roadside exposure (**Figs 13, 14**) near the top of Green Lane, between Cross Lane and Brown Lane, approximately 2m thickness of the **Silkstone Rock** is exposed that shows cross-bedding (**Fig. 15**) described in Geological Walkabout 1.

Fig. 12

Fig. 13

Fig. 14

Fig. 15

However, to examine the **Silkstone Rock** more closely in larger exposures, the following localities are readily accessible and easy to reach. There are a number of quarry faces along, and just away from, the main Sheffield-Chesterfield Road at which the unit may be conveniently and safely studied. From west to east, the best and most accessible are:

a) Take the steps that lead up to Snape Hill Lane (**Fig. 1**), and on the right is a quarry face at the top of the grassy slope. The face is truncated by a garden fence but, although partly covered with vegetation, shows sufficient features that characterize the **Silkstone Rock**. Note the wedge-shaped sandstone beds with internal dipping layers and the occasional cross-bedding.

b) Opposite the top of the ramp that leads from the sharp bend in Lea Road down to Sheffield Road (**Fig. 1**), and on the other side of the road is a quarry situated back from the road. The quarry face is clean (**Fig. 16**) and stretches for about 20 m long and 5 m high. Wedge-shaped beds up to 1 m thick with erosive upper contacts and internal cross- (or current) bedding are clearly visible in the quarry face showing current flow to the right (east) and **Liesegang Rings** (see Geological Walkabout 1).

Fig. 16

c) Mill Lane – At the entrance to Mill Lane on the left hand side of the road is a quarry face (**Fig. 17**) with space used as a car park. The vertical face is approximately 40 m long, and 6 m high. Unfortunately the rock face is now masked by a protective wire mesh, held on with rock bolts, and vegetation is slowly obscuring the face.

Fig. 17

However, you may approach the rock safely to examine some of the geological features. The face is made up of more or less horizontal irregular beds of sandstone. Beds may be up to 1 m thick but are commonly wedge-shaped and show internal cross-bedding. Can you decide which way the current was flowing to produce the cross-bedding? It will almost certainly vary throughout the quarry face, but a good example of cross-bedding (**Fig. 18**) showing current flowing to the right (east) may be seen at the right hand end of the quarry.

Fig. 18

At the base of some of the sandstone beds are rows of small rounded pebbles that have washed along by the river. Also present are small ironstone fragments or clasts (**Fig. 19**).

Fig. 19

Fig. 20

Finally, by keeping your eyes open you will be rewarded with further examples of this major rock unit (**Silkstone Rock**) which so dominates the scenery and topography of Dronfield. The small roadside exposure (**Fig. 20**) near the bottom of Green Lane under the wall of The Green Care Home is such an example, while the outcrop along the south side of the rail track to the east of Dronfield station opposite the large station car park once provided a long, if inaccessible, exposure of the unit (**Figs 21, 22**).

This was cleared of vegetation by Network Rail some years ago but has now become overgrown again.

Fig. 21

Fig. 22

These exposures of the **Silkstone Rock** are the highest (youngest) beds seen in this walkabout, and those along the main Sheffield-Chesterfield road occur in the middle of the **Dronfield Syncline**. If you wish to continue the story into younger rocks, this is available in Geological Walkabout 3 (Frith Wood).

Acknowledgements
Figure 3 is reproduced with permission of the British Geological Survey and Ordnance Survey. Mr Paul Coles is thanked for constructing Figs 1-3.

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This document reflects the views of the author and in no way necessarily reflect the views of Dronfield Heritage Barn. If you have any comments about this document please email them to m.romano@sheffield.ac.uk.

Dr M Romano (2019)

Figures

Fig. 1 – Street plan of Dronfield showing localities (green circles) mentioned in the text. The excursion in Frith Wood is covered in Geological Walkabout 3.

Fig. 2 – Simplified geological log through the Carboniferous rocks of the Dronfield district.

Fig. 3 – Geological map of Dronfield. Taken from BGS Sheet 100 Sheffield, 1:50 000 scale.

Fig. 4 – View across the road from New Leaf Plant Centre showing steep scarp ridge produced by a thin sandstone bed.

Fig. 5 – Section of shales and Mickley Thick coal seam (not exposed at time of writing) in bank below sandstone along start of track to farm at the top of Dyche Lane.

Fig. 6 – Sandstone in cutting at top of Dyche Lane.

Fig. 7 – Weathered out nodule in sandstone in cutting on Dyche Lane.

Fig. 8 - Entrance to Ferndale Garden Centre.

Fig. 9 – Dip slope of sandstone at top of Dyche Lane seen across the road from Ferndale Garden Centre.

Fig. 10 – Junction of Dyche Lane, Eckington Road and Green Lane. Silkstone Coal passes under the Coal Aston roundabout.

Fig. 11 – Sandstone ridge in field looking north from Sicklebrook Lane.

Fig. 12 – Scarp face of Silkstone Rock running parallel south of Sicklebrook Lane.

Fig. 13 – Top end of Green Lane with view of the scarp face of the Silkstone Rock.

Fig. 14 – Roadside exposure of the Silkstone Rock at the top end of Green Lane between Cross Lane and Brown Lane.

Fig. 15 – Detail of Figure 16 showing cross-bedding.

Fig. 16 – Quarry face in Silkstone Rock on Sheffield Road opposite top of ramp leading to Lea Road.

Fig. 17 – Quarry face in the Silkstone Rock at the start of Mill Lane (before the wire mesh was erected!).

Fig. 18 – Detail of Figure 18 showing current (cross-) bedding.

Fig. 19 – Detail of Figure 18 showing ironstone clasts (fragments).

Fig. 20 – Small outcrop of the Silkstone Rock at the base of The Green Care Home wall at the bottom of Green Lane.

Fig. 21 – Temporary exposure of Silkstone Rock in a cutting along the train track east of Dronfield Station following vegetation clearance.

Fig. 22 – Detail of Figure 22, showing the beds dipping into the bank.