EXCURSION REPORT: CHURNET VALLEY AND BROWNEND QUARRY

Leaders: N. Aitkenhead and T.J. Charsley (BGS) Sunday 10th July 1988

There were two main purposes to this excursion to Staffordshire. One was to see the Carboniferous Limestone at Brownend Quarry a Site of Special Scientific Interest (SSSI) at Waterhouses. The other was to examine the Carboniferous sequence spanning the Namurian-Westphalian boundary in the thickly wooded gorge of the Churnet between Froghall and Cheddleton.

On the journey to Waterhouse, a brief stop was made on the A52 at a point overlooking the valley of the River Dove above Mayfield near the boundary between the Triassic sandstones and the Carboniferous limestone. Here, Mr. Charsley gave a brief resumé of the glacial history of the area as expounded in detail in the forthcoming Ashbourne Memoir (Chisholm, Charsley and Aitkenhead, 1988). There was evidence for two or possibly three pre-Devensian ice advances into the Ashbourne district. The extensive ?Wolstonian till sheet south of Ashbourne had a nearly flat surface that was probably the result of solifluction effects during the Devensian (Jones and Charsley, 1985). The limit of the Devensian ice sheet lay just upstream of the gorge of the River Churnet to be visited later in the day, the gorge being attributed largely to the action of meltwaters discharging from the ice.

After leaving the coach at the former Waterhouses Station, a ten minute walk took the party to Brownend Quarry. This SSSI was recently purchased by the Staffordshire Nature Conservation Trust with the help of financial contributions from a few individuals and several organisations including the EMGS. At this point we were fortunate to be joined by Patrick Cossey and Don Steward of the North Staffs Group of the Geologist's Association who are playing a leading part both in the conservation of the Quarry and in carrying out and encouraging continuing research there.

A description of the Quarry is included in the forthcoming memoir and the diagrammatic section from the memoir (Fig. 1) is reproduced here by permission of the Director of the BGS. About 87 m of the Milldale Limestones and 9 m of conformably overlying conglomeratic limestones assigned to the Hopedale Limestones are exposed dipping steeply to the west. Dr. Aitkenhead explained the changing ideas about the age of these beds: age-diagnostic fossils were scarce and some new discoveries had led to an adjustment of the position of the stage boundaries. Most of the taxa that have been recognised are indicated with their stratigraphic positions in Fig. 1. The current BGS view that the entire succession may be Chadian in age is the result of work done by Dr. N.J. Riley who has made both new determinations and a reappraisal of the previous findings of Ludford (1951) and Morris (1970).

Dr Cossey drew member's attention to some of the other fossils well displayed in the Quarry including crinoids with current-oriented stems, a few crinoid calyces and the trace fossil *Zoophycos caudagalli*; trilobites had also been found. He also reminded the party that the remains of a wooly mammoth had been discovered in a fissure in the limestone during quarrying in the last century (Brockbank, 1864).

The Quarry also shows several features of sedimentological interest. The muddy limestones that predominate in the lower part of the sequence contain two prominent lenses of micritic 'reef' limestone ('Waulsortian' carbonate mud mounds) at least one of which has been found by Dr. Cossey and his colleague C. Edwards to be detached and inverted. Fairly deep quiet marine conditions are represented by these sediments. The coarser cross-laminated and massive peloidal limestones (grainstones) occurring higher in the sequence, and the change to graded conglomeratic limestones at the top, may reflect penecontemporaneous tilt block movements (Smith, Smith and Holliday, 1985). The latter rocks are partly obscured by dense vegetation but Dr. Cossey mentioned that there were plans to improve access in the future.

The North Staffs Group of the Geologist's Association provided the following history of the Quarry:

1. Quarrying began mid 18th century.
2. Worked for 200 years (usually by hand) typical production late 1940's—5000 tons per annum.
3. Quarry included in Peak District National Park in 1950.

Mercian Geologist, vol. 11, no. 4,
pp. 285–288.

4. 1953—access bridge strengthened and planning permission granted for extraction of 600 tons per week (not carried out).
5. Quarrying ended—mid 1960's.
6. Site notified as possible Site of Special Scientific Interest in 1978. S.S.S.I. status confirmed by the Geological Conservation Review Unit in 1984.
7. Quarry purchased by Staffordshire Nature Conservation Trust in 1987. Site to be developed as the Trust's first geological nature reserve under the guidance and supervision of the North Staffs Group of the G.A.

After spending about one hour at Brownend Quarry the party returned to the coach and after a 25 minute drive arrived at Hazles Farm [003 479] near Kingsley for the main walk of the day. A clamber down the steep wooded slopes of the Churnet Gorge led to the first exposure, a 15-metre high cliff of coarse-grained feldspathic sandstone showing large-scale cross bedding. Mr. Charsley explained that this was the Woodhead Hill Rock of typical fluvial 'Millstone Grit' facies although it was in fact in the Lower Coal Measures of Westphalian A age. The lateral impersistence of the cliff was due to the presence of two N-S trending faults on either side throwing down the sandstone to river level and forming a horst-like structure. Some distance directly below the cliff, just above the level of the river swollen by the intermittent rain, lay mudstones forming the Subcrenatum Marine Band at the base of the Coal Measures underlain by a sandstone, the Rough Rock forming the river bed at this point. Unfortunately, only the most agile members of the party were able to climb down to examine this exposure and see the crushed goniatites and the bivalve *Dunbarella* in the marine band.

The full sequence here given by Chisholm and others in the forthcoming memoir is as follows:

	Thickness m
Mudstone, grey and purple, fissile at base	0.79
Mudstone, grey with *Dunbarella sp., Gastrioceras subcrenatum* and *Anthracoceratites sp.*	0.55
Mudstone, purplish grey striped	0.30
Seatearth, purplish grey	0.70
Sandstone, white, fine- and medium-grained (Rough Rock)	1.00

The existence of a marine band here was first noted by Molyneux (1864), and yet the process of rediscovery still proved exciting to those members who fought their way along the river bank to this spot.

A three quarter mile walk along the valley bottom (traversed by a canal and a little used railway but no through road) brought the party to the next stop: lunch at the Black Lion, Consall Forge. A short distance from this pub on the opposite side of the valley is a row of large well preserved stone-built lime kilns; members discussed the possible reasons for locating the kilns at this particular site.

The next objective was to find evidence for the presence of the Froghall ironstone and overlying Crabtree Coal in a tributary stream of the Churnet below Far Kingsley Banks. Thick sodden vegetation made the going difficult but members searching the stream bed did eventually find some pieces of the ironstone in the typical form of bright red hematitic mudstone. Vegetated mounds in the wood nearby were probably old dumps from the ironstone workings. The experience of geologising in wet jungle terrain continued further upstream [9985 4838] and the now somewhat depleted party were rewarded with a section showing both the Crabtree Coal and traces of the overlying Listeri Marine Band.

On returning to the coach, Mr. Charsley made an offer to show members a probable lateral moraine of the ?Wolstonian ice sheet. Showing their customary insatiable appetite for geology, the party gave a near unanimous 'Yes' vote to this offer and the coach duly proceeded to Walk Farm from whence a 20 minute ramble took members to a disused gravel pit at the foot of the Weaver Hills [1007 4587], where the Pennines end and the lowlands of the Midlands begin. This pit exposes several sections up to 1.5 m of a partially cemented, unstratified, poorly sorted deposit consisting of subangular to subrounded boulders and smaller clasts of limestone in a matrix of angular to subrounded granules and limestone. In addition, there are rare 'Bunter' quartzites and Triassic sandstone blocks.

The coach arrived back in Nottingham to be greeted by a torrential downpour that made the intermittent rain that had dampened the party all day seem trifling in comparison.

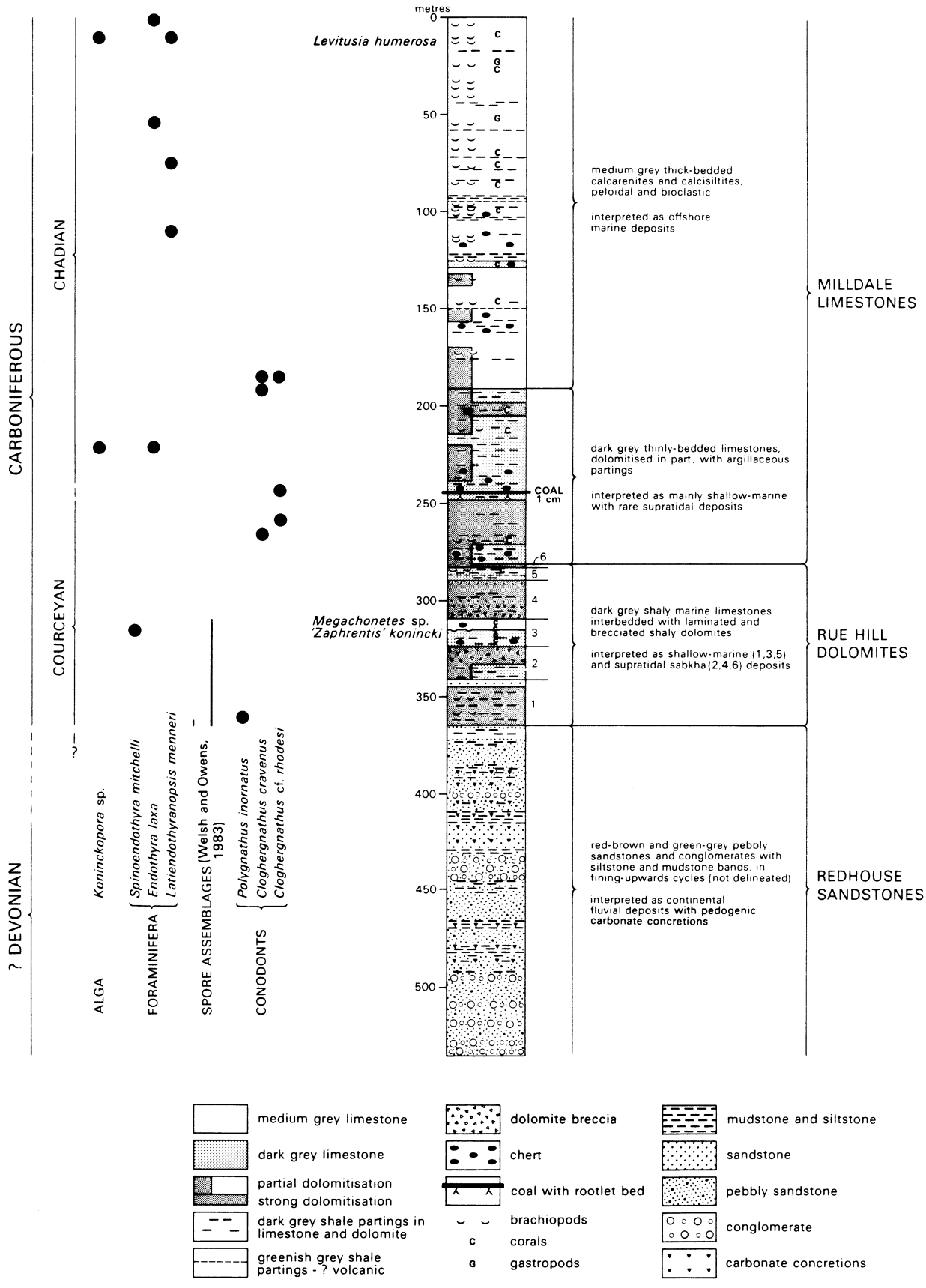

Fig. 1. Section of strata in Brownend Quarry with an indication of the fossils that have been identified from various levels in the succession by Mr. M. Mitchell and Dr. N.J. Riley. From Chisholm, Charsley and Aitkenhead, 1988 Fig. 6. By permission of the Director, British Geological Survey.

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