THE GEOLOGY OF THE SOUTHERN PART OF THE GOYT SYNCLINE, NORTH STAFFORDSHIRE

Leader : Edward A. Francis — Sunday 6th July 1969

The Goyt Syncline extends from Derbyshire into the northernmost part of Staffordshire, and the upper part of the Millstone Grit Series (Namurian) in this fold gives rise to an upland area of great geological and scenic interest. The syncline plunges generally northwards, but this plunge is interrupted by a number of cross-faults, thus diversifying the converging ridge-and-vale topography which is a feature of the scenery. The sequence is made up of a number of thick sandstones ('grits') with intervening mudstones, the grits tending to form marked ridges, which often provide an excellent view of the 'grain' of the country. The area appropriately forms part of the Peak District National Park.

The geology of this part of North Staffordshire has many points of interest, and it is impossible to do justice to the area within a single day excursion. Therefore, three localities illustrating contrasting topics were chosen for demonstration, and the main features of the scenery in relation to the geology were pointed out *en route* between these localities.

A composite generalised sequence of the strata is as follows (shown in diagrammatic form together with a map in Francis, 1967, Fig. 15.1):-

Lower Coal Measures (lowermost part of the Westphalian)

Mudstones

Marine Band with *Gastrioceras listeri*

Coal, thin; on seatearth

Sandstone (exposed at Robins Clough, but apparently absent at Goldsitch Moss)

Mudstones, with a thin marine band, and with a non-marine lamellibranch band near the base.

Coal, thin and impersistent; on seatearth

Woodhead Hill Rock, cross-bedded sandstone to about 20 m. (70 ft) thick

Mudstones

Marine Band with *G.subcrenatum*

Millstone Grit Series (upper part : Zones R_2 and G_1)

Mudstones and sandstones, with thin impersistent coal at base

Sandstone, with seatearth at top

Rough Rock, cross-bedded sandstone to about 30 m. (100 ft.) thick

Mudstones

Marine Band with *G.cumbriense*

Mudstones

Marine Band with *G.cancellatum*

Coal, thin and impersistent; on seatearth

Chatsworth Grit, cross-bedded sandstone to about 45 m. (150 ft.) thick

Mudstones, with thin sandstone in places

Marine Band with *Reticuloceras superbilingue*

Roaches Grit, cross-bedded sandstone to about 45 m. (150 ft.) thick

Mudstones

Five Clouds Sandstone, varying in number of beds and thickness, up to a maximum of about 40 m. (130 ft.)

Mudstones, including a marine band with *R.bilingue* (late)

Sandstone, impersistent, but thickening locally to about 25 m. (90 ft.)

Mudstones, including an upper marine band with *R.bilingue*, a middle marine band with *R.bilingue* (early) and a basal marine band with *R.gracile*

Longnor Sandstone, partly cross-bedded, but mainly thin-bedded with partings of mudstone.

The excursion coach departed from Nottingham and proceeded to the Moorland Café, where the leader gave a brief introduction to the area and outlined the day's activities. The party then continued to the south along the A53 (Buxton to Leek road) for about 2 km. to the southern end of Ramshaw Rocks (SK 019 620.) This first locality lies on the eastern limb of the Goyt Syncline, and the Roaches Grit here crops out as a craggy ridge extending for about one kilometre to the north. The lower half of the sandstone comprising the Roaches Grit is well-exposed in the east-facing crags, and the party walked northwards along the feature in order to examine sedimentary structures within the rock.

At the first exposure at the southern end, the leader began by pointing out that the pebbly sandstone could be separated into a lower part, lying in parallel-sided beds, and an upper part, in which little or no bedding could be discerned. The contact between these two could be traced as a surface inclined to the north as far as the base of the exposure, and a few metres further to the north another similar surface could be seen inclined to the south. This and similar features were examined along the outcrop to the north, and it was concluded that much of the lower part of the Roaches Grit at this locality was laid down as a series of coarse pebbly sands within which were a number of erosion channels at various levels. The lower part of the channel fillings had little apparent internal structure, but in the upper part and extending beyond the clearly defined margins, the sands were bedded, with medium to small-scale cross-bedding and festoons. As far as could be seen from the several instances in which the base of the troughs was well exposed, the channels were parallel and seemed to be orientated east-west. Members of the party found much to interest them in passing from one channel to the next, and a stimulating discussion took place on the problem of the environment in which these features were formed, and the significance of the presence or absence of bedding.

Towards the northern end of the ridge, the party mounted the highest point of the crest, and the opportunity was taken, while the breath of some members was being regained, to indicate from this vantage point the layout of the syncline, the stratigraphic units contributing to the scenery and

the positions of the main faults. In addition, the very important influence of solifluxion during the penultimate stage of the Quaternary, the Weichselian, was briefly noted. As a result, many of the slopes were mantled by sheets and fans of head, from which the crags, as at Ramshaw Rocks, stood proud. A return was then made to the Moorland Café and luncheon was taken.

The second main locality to be examined was reached by following the A53 road northwards towards Buxton and turning off towards Knotbury. Along this road, the offsetting of the outcrop of the Longnor Sandstone by a number of cross-faults was pointed out. The road towards Knotbury closely follows another line of faulting, and the Roaches Grit is seen to be offset to the north-west on the northern side of this. The party left the coach at the fork along this road, and walked to the right along a track which passes through a gap, partly along the line of a branch of the fault followed beforehand. The strong ridge to the right, Drystone Edge, is undoubtedly formed by the Chatsworth Grit, and the feature to the left appears to be the Rough Rock, though this is not proved. The party left the track before reaching a bridge over the stream and began to examine the section of strata exposed along the stream valley in the beds overlying the Chatsworth Grit. Interbedded bands of sandstone and purple mudstone were seen, and beyond the bridge, the position of the overlying thin coal was found. Although thin, a number of shafts had been sunk nearby to this coal.

The overlying mudstones, which include the marine bands with *Gastrioceras cancellatum* and *G.cumbriense*, are exposed in a small gorge, Orchard Bottom, through which the stream flows, though in the absence of recent rain, the discharge is very low and the remnant of the stream then commonly finds its way through the mudstone debris at the mouth of the gorge rather than over the surface. Within the gorge however, the mudstones crop out *in situ* forming the bed of the stream. Both walls of the gorge provide excellent continuous exposures of the *G.cancellatum* Marine Band and members of the party took advantage of this facility to examine the abundant fossils to be found at this excellent locality (SK 0226 6902). Examples of all the previously noted goniatites (identified by Dr. W.H.C. Ramsbottom in Francis, 1967, p.114) were found after careful search: *Anthracoceras sp.*, *Agastrioceras carinatum*, *G.crencellatum*, *G.cancellatum*, *Homoceratoides aff. divaricatus* and *R.subverbilingue*. Particular bedding planes were crowded with *Dunbarella elegans*, and *Caneyella multirugata* and *Posidonia insignis* were also found.

Further upstream (SK 0231 6911), the *G.cumbriense* Marine Band was located, and its two parts, separated by unfossiliferous grey mudstone, were dug out. The full marine fauna was again seen including *G.cumbriense*, *G.* cf. *crenulatum* and *Ht.* aff. *divaricatus*, together with various lamellibranchs. Several examples of contorted beds (Cope, 1946) lie in this sequence above the Chatsworth Grit, and that immediately overlying the *G.cancellatum* band is particularly prominent. The leader recounted Cope's conclusion that these contorted beds were the result of bedding-plane slip on the least competent beds during folding, and the party found evidence supporting this in the form of shear planes and drag folds. There was some discussion on the precise nature of the lithology in which the contortion took place, and the leader expressed the view that the character particularly responsible was a close laminar fissility in the shales, and that relative movement took place initially along the planes of fissility. Although the initial impression was of a very sharp upper margin, careful examination showed that there were irregularities, and here and there could be found undisturbed pockets of shale below the level to which adjacent structures penetrated.

Having examined localities at which the main interest was respectively sedimentological and palaeontological, the party next visited the River Dane upstream from the bridge at Quarnford (SK 001 664), where the structure was of interest. The first exposure on the left bank of the stream north of the bridge shows sandstone (mapped as Rough Rock) dipping to the south-east, while the next meander bluff on the opposite side of the valley shows mudstones and siltstones dipping in the opposite direction, below the outcrop of the Rough Rock. The leader explained

that the problem was how to get the Rough Rock down into the valley bottom across a contrary dip, and recalled that the primary geological surveyors in the nineteenth century had inferred a fault along the valley. However, after examining exposures further along the river, the party accepted the leader's conclusion that a fault was unnecessary and that the structure could be explained basically as a south-east facing monocline. By careful mapping, the base of the Rough Rock could be traced down into the valley bottom. It was noted that in the cross-bedded Rough Rock proper, the beds in the fold curved over with a certain amount of fracturing, whereas in thin-bedded sandstones, folds were markedly angular. One of the latter caused some amusement, for at first sight, the structure resembled an angular unconformity, with overlying beds dipping west-north-westwards at about 5^{o}, and underlying beds dipping east-south-eastwards at about $80\text{-}85^{o}$. However, on closer examination, single beds could be traced continuously over the sharp angular hinge of the fold. The line of structures was traced as far as a cross-fault, where they seemed to terminate. The party then returned to the coach, which, after successfully negotiating a right-angled turn and steep narrow bridge, made its way across Goldsitch Moss. This, an outlier of Lower Coal Measures in the core of the syncline, was formerly an area where several thin coal seams were extensively worked largely by bell-pits.

The excursion was concluded at the Moorland Café, where, in expressing the appreciation of the party, the President (Mr. R.E. Elliott) commented on the variety of interest in the area and looked forward to a further excursion under the guidance of the leader. The coach then returned to Nottingham.

REFERENCES

COPE, F.W. 1946. Intraformational contorted rocks in the Upper Carboniferous in the Southern Pennines. Quart. Jl. Geol.Soc., Lond., vol.101, pp.139-176.

FRANCIS, E.A. 1967. The Namurian and lowermost Westphalian rocks in the southern part of the Goyt Syncline. in NEVES, R. and DOWNIE, C. (Eds.) : Geological Excursions in the Sheffield Region and the Peak District National Park, pp.109-115. Sheffield: University of Sheffield and J.W. Northend Ltd.