
Article:
Murphy, PJ and Warburton, D (2013) A Lower Palaeozoic Inlier in Wharfedale, North Yorkshire, UK. Proceedings of the Yorkshire Geological Society, 59 (3). 173 - 176. ISSN 0044-0604

https://doi.org/10.1144/pygs2013-326

A Lower Palaeozoic inlier in Wharfedale, North Yorkshire.

P. J. Murphy & D. Warburton

School of Earth and Environment, University of Leeds, LS2 9JT, U.K.

(P.J.Murphy@leeds.ac.uk)

Summary: An outcrop of steeply dipping thinly bedded sandstone is described from an overflow channel of the River Wharfe near Appletreewick. This is the first bedrock exposure of Lower Palaeozoic rocks from Wharfedale and a tentative correlated with the stratigraphy of the Craven inliers is proposed.

Lower Palaeozoic rocks in North Yorkshire crop out in a number of inliers between Kingsdale [SD 695 755] and Gordale Beck [SD 911 657 to SD 912 654], along the southern margin of the Askrigg Block, a structural high underpinned by the Wensleydale granite pluton and across which there was carbonate deposition in the early Carboniferous (Arthurton *et al*. 1988). The inliers are known collectively as the Craven Inliers and are bound to the south by the North Craven Fault, one of three that make up the Craven Fault Zone, which forms the southern edge of the block (Fig 1). The Lower Palaeozoic rocks of the inliers consist of cleaved mudstones and sandstones folded into east-southeast plunging folds. Both Ordovician and Silurian strata, part of the Windermere Suprgroup (Kneller *at al.* 1994), are present and they are unconformably overlain by carbonates of the Lower Carboniferous Great Scar Limestone Group.

The rocks exposed in Gordale Beck comprise laminated siltstones assigned to the Horton Formation, of late Silurian, Ludlow age (Arthurton *et al*. 1988), and form the easternmost inlier of Lower Palaeozoic rocks mapped along the North Craven Fault. In Wharfedale, the next major valley to the east, erratics of Lower Palaeozoic rocks, often referred to as 'Silurian' by early workers, have been noted in glacial deposits down-valley from Kilnsey Crag (Sewell 1876; Dakyns *et al*. 1890; Dakyns 1893). The Carboniferous strata exposed towards the base of Kilnsey Crag (Fig 2), a glacially truncated spur, are close to the base of the limestone succession and glacial over-deepening is likely to have occurred where the two ice streams of Upper Wharfedale and Littondale met just up-valley (Raistrick 1931; Mitchell & Hughes 2012).

1 WHARFEDALE ERRATICS

Examples of 'Silurian' erratics can be seen in the dry stone walls along the B6160 near Chapel House (Fig 3). Dakyns (1877) described the lithology of the erratics as "..generally compact, close-grained Silurian Grits" and noted their similarity to rocks that crop out in Ribblesdale. Examples studied in the dry stone walls of the area today are dark fine-grained, calcareous, cleaved fine sandstones and siltstone with parallel bedding, which is best seen on the weathered surfaces. They generally take the form of slabs with the long axis aligned with the cleavage, hence their use as 'throughs' (slabs which pass through the whole width of the wall) as noted by Dakyns (1877). To date, however, no bedrock exposure of Lower Palaeozoic strata has been recorded. The area to the east of Appletreewick has been extensively mined in the past for galena and fluorspar. In the discussion of Dunham & Stubblefield (1945), Prof W G Fearnsides mentioned the recovery of a block of dark silty

material containing graptolites from a heading at Greenhow, 5 km north east of Appletreewick.

2 APPLETREEWICK

In the Wharfedale area, the southern edge of the Askrigg Block is marked by the Craven Reef Belt. This was a marginal facies of the carbonate shelf developed on the Askrigg Block. The reefs are mainly Asbian in age, though they may have developed during late Holkerian times and lasted into the Brigantian (Brunton & Mundy 1988; Mundy 1994; Rigby & Mundy 2000). The reef facies bridged the transition into the asymmetrical, extensional Craven Basin to the south. The eastern end of the reef belt today forms a series of conical hills, often referred to as reef knolls, outcropping to the south and east of Grassington. The most easterly of the reef knolls is Kail Hill [SE 045 607], east of Burnsall.

Recent geological mapping of the Kail Hill area has identified an outcrop of steeply dipping sandstone with bedding up to 45 cm thick. Cross bedding can be seen in the thicker beds. The sandstone beds are fine to medium grain size, micaceous and patchily recrystallized. The sandstone beds have erosive bases (Fig 4) and are separated by finer beds of darker sandstone. The bedding dips 65 degrees to the north east with a northwest-southeast strike and the sandstone apparently underlies the reef facies limestones. The exposure is in an overflow channel of the River Wharfe and is potentially easily covered by flood deposits of the River Wharfe.

3 DISCUSSION

The stratigraphy of the Craven Inliers has been studied since Sedgwick (1852) first recognized they were of Lower Palaeozoic age. Work by Marr (1887), Dakyns *et al.* (1890), Hughes (1902, 1907) and King & Wilcockson (1934) have all contributed to the stratigraphical scheme proposed by Arthurton *et al*. (1988). No fossils have been recovered from either the Appletreewick outcrop or from 'Silurian' erratics in the dry stone walls so any attempt to attribute the rock types to the detailed stratigraphy known from the Craven Inliers will be based on lithology alone and so is extremely tentative. Cleaved calcareous silts are known from both Ordovician and Silurian succession of the Windermere Supergroup. However, the erosive base of the sandstone units, the mineralogical immaturity and the presence of cross bedding are consistent with an origin as proximal turbidites, suggesting a correlation with one of the coarser units of the Silurian succession from the Craven Inliers, perhaps the Austwick Formation, the Studfold Sandstone Member of the Horton Formation or the Neals Ing Formation. Attribution to the Neals Ing Formation would fit with the overall outcrop pattern seen in the Craven Inliers, where successively younger units crop out towards the south east (Fig 1). Calcareous siltstones such as those seen as erratics in dry stone walls are recorded from both Ordovician and Silurian strata, but the highly cleaved nature of the siltstones from the Kilnsey Crag area would fit with a possible source from the Ordovician Norber Formation.

The Appletreewick inlier identified in this paper may be a fault bounded sliver of Lower Paleozoic rocks incorporated in the Craven Fault Zone. Perhaps the presence of Lower Paleozoic rocks within the fault zone may act as foundations for the development of the reef knolls of the Craven Reef Belt.

4 Conclusion

The clastic lithology, stratigraphical position beneath the Great Scar Limestone facies carbonates, steep dip and strike orientation all support an interpretation of the Appletreewick outcrop as an extension of the Craven Inliers to the east along the line of the Craven Fault zone. This is the first record of in situ potential Lower Palaeozoic rocks from Wharfedale. The presence of this outcrop supports Dakyns (1890, 1893) explanation of the 'Silurian' erratics as having been sourced within the valley.

5. Further work

It may not be possible to decide between these alternative correlations without palaeontological evidence. A search of the erratic blocks between Kilnsey and Burnsall may well produce such fossil evidence and so enable a correlation of the cleaved fine sandstones/siltstones with the stratigraphy of the Craven Inliers.

REFERENCES

Arthurton, R.S., Johnson, E.W. & Mundy, D.J.C. 1988. Geology of the country around Settle: *Memoir of the British Geological Survey*, Sheet 60 (England and Wales): London, Her Majesty's Stationery Office.

Brunton, C.H.C & Mundy, D.J.C 1988. Strophalosiacean and aulostegacean productoids (brachiopoda) from the Craven Reef Belt (late Visean) of North Yorkshire. *Proceedings of the Yorkshire Geological Society*, **47**, 55-88.

Dakyns, J.R. 1877. On Silurian erratics in Wharfedale. *Proceedings of the Yorkshire Geological and Polytechnic Society*, **VI**, 159.

Dakyns, J.R. 1893. Glacial phenomena in Wharfedale between Bolton Abbey and Kettlewell. *Proceedings of the Yorkshire Geological and Polytechnic Society*,**XII**,29-305.

Dakyns, J.R., Tiddeman, R.H., Gunn, W & Strahan, A. 1890. The geology of the country around Ingleborough, with parts of Wensleydale and Wharfedale. *Memoir of the Geological Survey of Great Britain* (sheet 50).

Dunham, K.C. & Stubblefield, C.J. 1945. The stratigraphy and structure of the Greenhow mining area, Yorkshire. *Quarterly Journal of the Geological Society of London*, **100** , 209-268.

Dunham, K. C. & Wilson A. A. 1985. Geology of the Northern Pennine Orefield: Volume 2, Stainmore to Craven. Economic Memoir of the British Geological Survey.

Hughes, T. McK. 1902. Ingleborough. Part 2. Stratigraphy. *Proceedings of the Yorkshire Geological Society,* **14**, 323-343.

Hughes, T. McK. 1907. Ingleborough. Part 4. Stratigraphy and palaeontology of the Silurian. *Proceedings of the Yorkshire Geological Society*, **16**, 45-74.

King, W.B.R. & Wilcockson, W.H. 1934. The lower Palaeozoic rocks of Austwick and Horton in Ribblesdale, Yorkshire. *Quarterly Journal of the Geological Society of London*, **90**, 7-31.

Kneller B C, Scott R W, Soper N J, Johnson E & Allen P M 1994. Lithostratigraphy of the Windermere Supergroup, Northern England. Geological Journal, **29**, 219-240.

Marr, J.E. 1887. The Lower Paleozoic rocks near Settle. *Geological Magazine*, **4**, 35-38.

Mitchell, W.A. & Hughes, A.L.C. 2012. The late Devensian glaciation in the Yorkshire Dales 34-36 in: O'Regan, H. J., Faulkner, T. & Smith, I. R. *Cave Archaeology and Karst Geomorphology of North West England*. Field Guide. Quaternary Research Association. London.

Mundy, D.J.C. 1994. Microbialite-sponge-bryozoan-coral framestones in Lower Carboniferous (Late Visean) build-ups of northern England (UK). In: Embry A F, Beauchamp B & Glass D J (eds), Pangea: Global environments and resources. *Canadian Society of petroleum geologists Memoir,* **17**, 713-729.

Raistrick, A. 1931. The glaciations of Wharfedale, Yorkshire. *Proceedings of the Yorkshire geological and Polytechnic Society*, **XXI**, 9-30.

Rigby, J. K. & Mundy, D. J. C. 2000. Lower Carboniferous sponges from the Craven Reef Belt of North Yorkshire. *Proceedings of the Yorkshire Geological Society*, **53**, 119-128.

Sedgwick, A. 1852. On the Lower Palaeozoic rocks at the base of the Carboniferous chain between Ravenstonedale and Ribblesdale. *Quarterly Journal of the Geological Society of London*, **8**, 35-54.

Sewell, E. 1876. Notes on the drifts and boulders in the upper part of the valley of the Wharfe. *Report of the British Association for the Advancement of Science*.

Soper, N. J. & Dunning, F. W. 2005. Structure and sequence of the Ingleton Group, basement to the central Pennines of northern England. *Proceedings of the Yorkshire Geological Society,* **55**, 241-261.

List of Figures:

Fig 1. The Craven Inliers ad their regional setting. Based on Fig 3 of Arthurton *et al.* (1988).

Fig 2. The geology of the Craven Fault Zone. Adapted from Fig 1 of Dunham & Wilson (1985).

Fig 3. ‘Silurian grit’ slab used as a through stone in a dry stone wall near Chapel House, Wharfedale. The slab is next to the hammer handle two courses below the wall top. The two slabs below the hammer are from the Millstone Grit.

Fig 4. View of the outcrop described in a flood overflow channel of the River Wharfe. The black outline shows the position of Fig 5.

Fig 5. Blocky well bedded sandstones typical of the Appletreewick outcrop described in this paper. The overlying sandstone unit has an erosive contact with the underlying unit.