PERMO-TRIASSIC STRATIGRAPHY OF THE GREAT CENTRAL RAILWAY CUTTING, NORTH WEST OF ANNESLEY TUNNEL (SK 505550) NOTTINGHAMSHIRE

by

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Summary

The litho-stratigraphy of a section, near Annesley, Nottinghamshire, which has been the subject of controversial opinions, is re-examined. A sharp boundary between the mottled sandstones and under-lying red mudstones is described. The top few inches of the dolomitic limestone is mineralised and contains thin burrows, shell moulds and irregular cavities. A comparison with the Bulwell area is made.

Introduction

Closure of the Great Central Railway between Mansfield and Nottingham and the proposal to fill-in the Annesley Tunnel and associated cuttings has prompted their re-examination as an urgent problem. The Annesley cutting has been mentioned in the literature a number of times but three papers, two by Sherlock (1908, pp.115-116, fig.8; 1911, pp.81-83, fig.2) and one by Trechmann (1930, pp.325-326, Plate 22A) indicates the difficulties in interpretation. Sherlock wrote of a gradual transition from the Permian, represented by the 'Middle Permian Marls', into the Triassic represented by the 'Lower Mottled Sandstone'. Fig.8 of the 1908 paper apparently showed the south face of the cutting, whilst fig.2 of the 1908 paper probably illustrates the north face, although Sherlock did not indicate this. The text-figures referred to above suggest that the two sides of the cutting are completely different, above the Magnesian Limestone. Trechmann (1930) was concerned with the south face of the cutting and he interprets the junction of the 'Middle Permian Marl' and the 'Lower Mottled Sandstone' as being sharp and irregular.

The re-examination of the cutting has been greatly facilitated by excavations dug by National Coal Board employees under the direction of an Assistant Engineer, Mr. J.R. Saunders, in charge of operations in the tunnel.

Four shallow trenches were excavated, two on each side of the cutting, on either side of an aqueduct mentioned in Sherlock's papers and still standing. The sections were cut approximately 170 feet east and 120 feet west of the aqueduct. It was then possible to examine the remainder of the cutting, including the dolomitic limestone using outcrop evidence of the harder beds.

The excavations

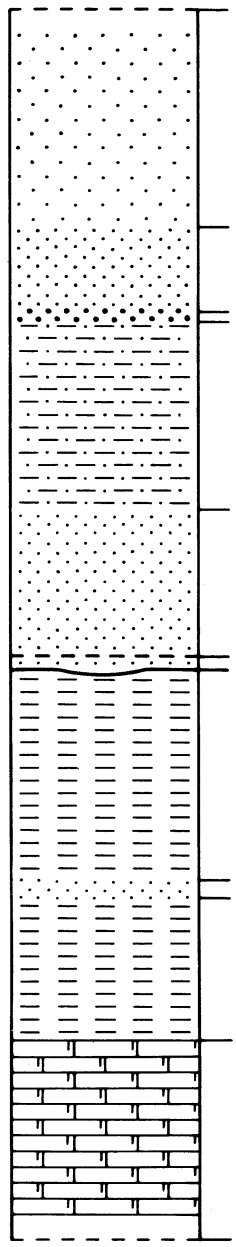
The sequence of strata exposed by the excavations turned out to be very similar in each of the four excavations so that only the most complete section is reproduced here as text-fig.1 and a revised longitudinal section of the complete north face is illstrated in fig.2. Lithological details are given below.

Dolomitic limestone

The beds of limestone average about 12 inches thick and are separated by well marked bedding planes. The limestone is coarsed grained, buff in colour and very similar in lithology

Annesley Cutting, South Side,
171 feet E. of Aqueduct.

Vertical Section of Strata.



Mottled sandstones

Red mudstones

Dolomitic limestone

4'0"	Sandy to top of the cutting.
2'0"	Brown micaceous sandstone.
0'2"	thin brown, coarse sandstone with green mottling.
6'6"	Brown micaceous siltstones and mudstones with thin green/grey sandstones.
4'6"	brown micaceous sandstone
0.9"	Grey/green sandstone, dolomitic yellow at top.
6'6"	red/brown mudstones with green patches and thin green mudstones or siltstones.
1'0"	Grey/green dolomitic sandstone, porous.
5'6"	Red/brown mudstones with green patches.
	Top 4" with bores, moulds, and irregular cavities.
4'6"	coarse dolomitic limestone. base not seen.
34'9"	Railway track.

Text fig. 1.

to that of the Bulwell district, 7 miles to the south (SK 530455). The bedding is emphasised by thin clay partings. The dolomitic limestone is usually referred to as the Lower Magnesian Limestone. The upper surface of the top bed is mineralised with barytes and an iron mineral producing a very hard, well cemented top layer. No other minerals were noted. Despite its hardness, the layer is very porous, being traversed by numerous thin burrows, some extending down from the top surface. These tubes have a circular cross section 0.5 to 1 mm. in diameter. There are also cavities showing moulds of bivalve shells and other irregular cavities, possibly the result of solution. Some of the cavities are lined with a few calcite crystals.

Red mudstones

Above the limestones, there is an abrupt change of lithology as mentioned by Sherlock. The mudstones, have a characteristic colour which is reddish-brown with green mottling, either in patches or as thin seams parallel with the bedding. Within this blocky mudstone sequence some of the green seams persist laterally for some distance, locally increasing in thickness and grain size to siltstones or sandstones, the latter being porous with a small amount of dolomite or calcite as matrix. Such a dolomitic sandstone occurs 5 feet above the top of the dolomitic limestone. In the excavations the maximum thickness of this sandstone was 5 feet.

Mottled sandstones

Above the red mudstones there is a marked lithological change to a second green dolomitic sandstone, coarse at the base, fining upwards into brown sandstones with abundant mica. It is presumably the occurrence of mica on the bedding plane surfaces that made Sherlock (1911 p. 82) compare these beds with the Waterstones of the Nottingham area. The thickness of the mottled sandstones is variable in the four excavations because of erosion at the surface, but there is a minimum of 4 feet 6 inches. The mica gives the rock a certain fissility which Sherlock refers to as flaggy, however, at the present time more partings than this term would warrant are evident possibly the result of continued weathering. Within the sandstones, the beds may contain an appreciable amount of clay, but the colour and the mica is sufficient to distinguish even the finer beds of this part of the sequence from the red mudstones above the dolomitic limestone. Finally in those excavations which show the highest horizons, further brown micaceous sandstones are present.

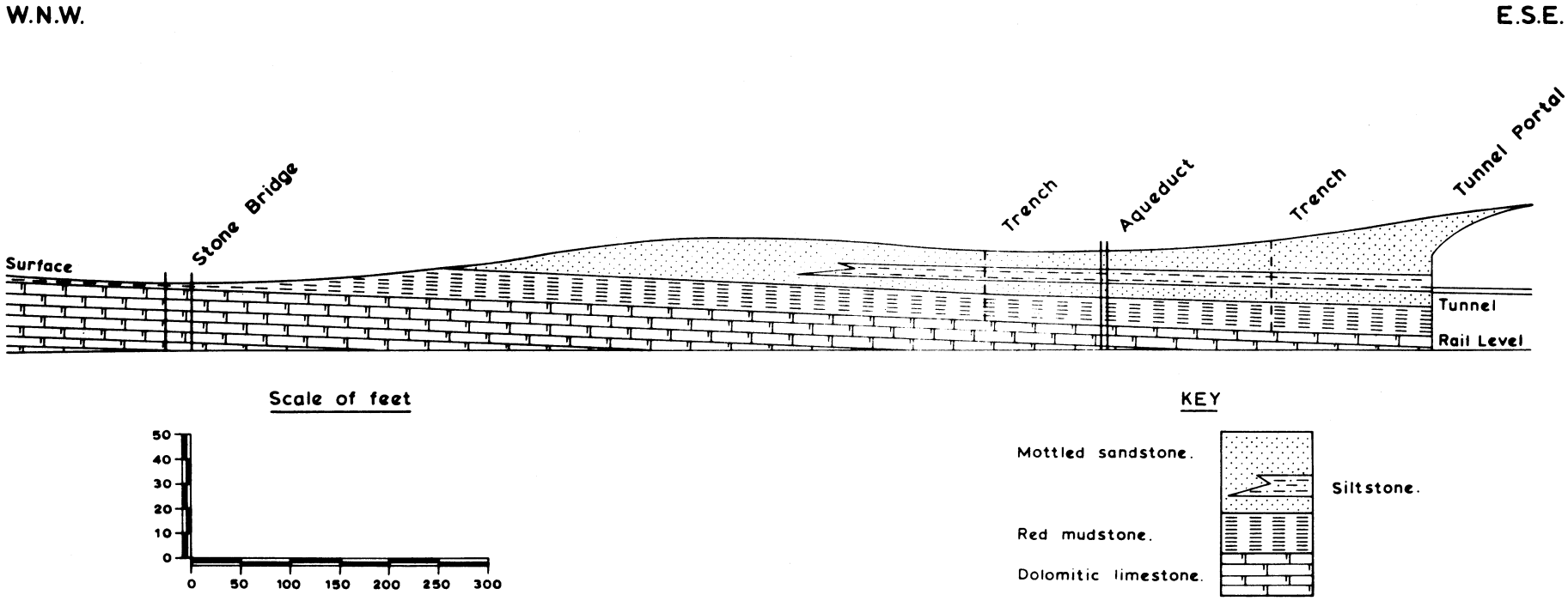
The remainder of the cutting

Once the position of the harder layers has been established in the excavations their lateral extent can be traced throughout the cutting. The dolomitic limestone dips to the E.S.E. at a very low angle, about 2^{o}. The top layer is mineralised and contains burrows, shell moulds and small irregular cavities throughout. These features persist further to the west, where the railway divides into two branches.

The grey/green dolomitic sandstones form distinctive ledges where they are well developed and the footings of the aqueduct rest on the lower of these sandstones. The lower dolomitic sandstone is best developed below the aqueduct on the north side of the cutting and on the south side, near the tunnel portal. The upper sandstone, at the base of the brown micaceous sandstones is thickest on the south side of the cutting, near the western excavation and on the north side, near the eastern excavation.

The brown micaceous sandstones are associated with steeper features and hydrophilous vegetation. This evidence and that from the four trenches indicates that the finer grained material, sandwiched between the brown micaceous sandstones thins or passes out towards the west. Adjacent to the cutting on the south side, a well marked feature, with characteristic soil colouring represents the scarp of the lower part of these sandstones. A little to the west is a clay hollow occupied by the red mudstones which in turn are followed by the dip slope of the dolomitic limestones.

Adjacent to the western excavation on the south side of the cutting a small landslip exposes the junction between the brown micaceous sandstones, with the green dolomitic sandstone as its



Text fig. 2. GENERALISED SECTION OF GREAT CENTRAL RAILWAY CUTTING NORTH OF ANNESLEY

base, and the red mudstones. This is possibly the slip mentioned by Techmann (1930). To the writers the lithological change at this junction is sharp in each of the four trenches but the colour of the brown sandstones has penetrated into the coarse green sandstone below, forming an irregular base for the colour change. It is possible that this colour change was regarded by Trechmann as the bed junction (1930 p. 326), but it is more likely that he included the green sandstone with his "Lower Mottled Sandstones". Elsewhere in the cutting the colour of the coarse sandstone at this horizon, may be yellow or buff.

Comparison with a Bulwell section

The similarity of the Annesley section with that at the Bulwell Pottery (SK 530455) is most striking. In both places the top surface of the dolomitic limestone (Lower Magnesian Limestone) is mineralised. At Bulwell the minerals include galena, asphaltite and wolframite (Deans.1961) but lacks barytes and iron. Above the dolomitic limestone there is the same thin sequence of reddish-brown marls or mudstones with dolomitic sandstones. Above the upper of these at Bulwell there is a further 3 or 4 feet of red mudstones, succeeded by brown micaceous sandstones.

Stratigraphical interpretation

The interest created by the Annesley exposure stems from the fact that previous authors have wished to draw the Permian and Triassic boundary somewhere within the cutting. There seems to be no disagreement concerning the approximate horizon at which this should be done, only in the character of the junction. The view of Sherlock, generally accepted by those who have examined the cutting, is that the 'Permian' strata grade imperceptably into 'Triassic' lithology the boundary being taken for convenience at the top of the red mudstones. Trechmann (1930) on the other hand, was convinced that there should be and was, a break between the two systems. He placed the junction at the base of the brown micaceous sandstones including the upper green dolomitic sandstone with its irregular base. As was pointed out by Trechmann for this area and by Taylor (1966) for the area to the south, it is possible that the upper beds of the red mudstones have been eroded and incorporated with the brown micaceous sandstones here forming the local sharp base for the mottled sandstones (Lower Mottled Sandstones of previous authors). The position of the junction of the Permian with the Triassic System however may be at the top, within or at the base of the Mottled Sandstones; the authors cannot be specific at this stage without palaeontological evidence.

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References

DEANS, T. 1961. A galena-wolframite-uraniferous-asphaltite horizon in the Magnesian Limestone of Nottinghamshire. Miner. Mag. Vol. 32, pp. 705-15.

SHERLOCK, R.L. 1908, in Gibson E., et at. 1908 The Geology of the southern part of the Derbyshire and Nottinghamshire Coalfield. Mem. Geol. Surv., U.K., 199 pp. 1 plate.

1911. The relationship of the Permian and the Trias in Nottinghamshire. Quart. J. Geol. Soc., London, Vol. 67. pp. 75-117, Pl-5, 6 text-figs.

TAYLOR, F.M. 1966. Geology. Chapter I in Edwards K.C., (Ed), Nottingham and its region. Brit. Assoc. 538 pp.

TRECHMANN, C.T. 1930. The relationship of the Permian and the Trias in North East England. Proc. Geol. Assoc., Vol. 41 pp. 323-335.

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