A BOREHOLE PROVING DOLOMITE BENEATH THE DINANTIAN LIMESTONES NEAR MATLOCK, DERBYSHIRE

by

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Summary

A recent borehole in the Via Gellia valley has proved the thickness of the Griffe Grange Bed to be 105 m. An underlying suite of darker-coloured quartzose dolomites with subordinate limestones was proved, 51 m of these being penetrated without reaching the pre-Carboniferous basement.

Introduction

A borehole put down in 1979 in search of water at Ryder Point, Derbyshire, started near the base of the exposed Carboniferous Limestone sequence and encountered dolomite, the existence of which was previously unknown. The limestone succession in the area has been described by Smith, Rhys and Eden (1967, pp. 8-11) as follows:

Hoptonwood Group:	pale grey coarse to medium-grained granular limestones	77 m
Griffe Grange Bed:	pale grey porcellanous limestone with granular bands	36 m+

The top of the Griffe Grange Bed was drawn by these authors at the top of the highest porcellanous bed exposed in a roadside crag [SK 2617 5644] close to the borehole site and about 6 m above it. The borehole therefore started about 6 m below the top of the Griffe Grange Bed. The strata at the borehole site are almost horizontal, so that depth measurements in the borehole can be regarded as stratigraphical thicknesses.

Details of Ryder Point No. 3 water bore

Location: SK 2620 5642 Depth: 150 m Surface Level: about 178 m O.D.

Chipping samples were recovered during the drilling at approximately three-metre intervals. Representative material from each sample was etched in hydrochloric acid and examined with a binocular microscope. Thin sections were prepared from a few of the

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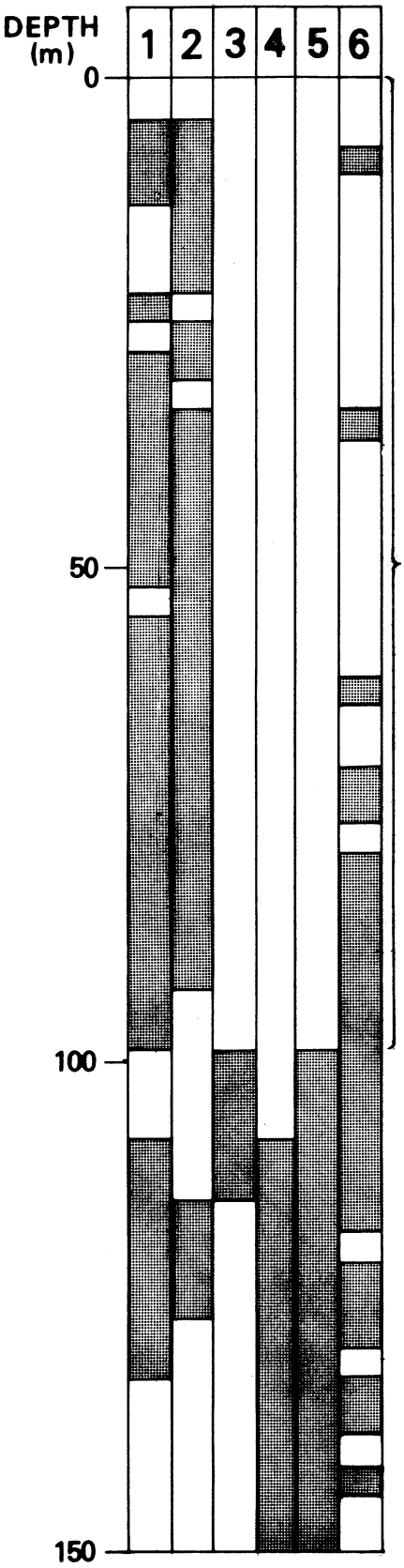
1981, pp. 225-228, 1 text-fig.



RYDER POINT NO. 3 WATER BOREHOLE

Shaded areas indicate presence of lithology or component as follows:

Columns 1-4: main lithologies present in chipping samples.

1. Pale granular limestone
2. Pale porcellanous limestone
3. Medium-grey limestone
4. Medium-grey dolomite

Columns 5-6: accessory components.

5. Quartz present in carbonate chippings
6. Greenish mudstone and/or pyrite present

Text-fig. 1: Summary of data on chipping samples

chippings. Data on the samples are summarized in text-figure 1. In interpreting the data, more importance is attached to the first appearance of a particular lithology than to its persistence in depth.

The pale porcellanous and granular limestones of the Griffe Grange Bed persist with little change to 93 m, but below this depth the porcallanous lithology dies out, and between 93 and 105 m the colour of the limestone chippings becomes gradually darker. The change to medium-grey takes place at 99 m. Below this depth, several new lithologies appear, notably a medium-grey fine-grained limestone with a pale argillaceous residue and dispersed detrital quartz grains at 111 m and a medium-grey quartzose oolite at 114 m. A dolomitized equivalent of the fine-grained lithology is also present in the 111 m sample. Quartzose dolomites dominate the samples from 117 m to the bottom of the borehole. Most are fine-grained like that just described but coarser-grained dolomites are also found below 132 m.

The quartz first appears as sparsely scattered sand-sized grains in a pale grey limestone at 102 m and continues as an accessory constituent (10% or less) in the underlying dolomites. In the basal sample, at 150 m, half the chippings consist of dolomite with between 30 and 50% of quartz sand. A thin section of this material shows that the majority of grains are sub-angular unstrained quartz, with a few of strained quartz and some lithic grains of polycrystalline quartz.

Greenish-grey generally pyritic mudstone, present as whole chippings and as wisps in chippings of other lithologies, is taken to be a product of contemporaneous volcanic activity (Walkden 1972). The occasional chippings of green clay in samples from the uppermost 64 m of the borehole probably reflect the presence of a small number of discrete clay wayboards interbedded with the limestones. Below 70 m, however, greenish mudstone and pyrite are more generally distributed as patches and wisps in the limestones and dolomites, although everywhere as minor constituents.

Pale limestone chippings that form a significant proportion of the samples between 111 m and 132 m are thought to represent contamination from higher levels in the hole.

Discussion

Griffe Grange Bed

The base of the unit is drawn at a depth of 99 m in the borehole, because below this level the limestones are medium-grey rather than pale. The full thickness of the Griffe Grange Bed, including the 6 m exposed at surface above the bore site, is thus 105 m. Most of this thickness was proved in a recent IGS borehole sited [SK 2619 5645] a short distance from the present hole, and a detailed account of the lithological sequence has been published (Cox and Harrison 1980).

Ryder Point dolomites

The downward passage to quartzose dolomite is gradational, for although quartz first appears in the 102 m sample, dolomite does not appear until 111 m. No formal name is proposed for the strata below the Griffe Grange Bed, in view of the fact that chipping samples provide only a generalized record of the sequence. However, both the Griffe Grange Bed and the underlying strata can be classified in terms of the current IGS nomenclature for the Derbyshire shelf limestone province (Aitkenhead and Chisholm, in preparation) as members of the Woo Dale Limestones Formation.

The age of the strata at the bottom of the borehole is not known with certainty. The only faunal evidence is that recorded at outcrop from the top part of the Griffe Grange Bed (Ramsbottom *in* Smith, Rhys and Eden 1967, p. 47), where there are sparse brachiopods and corals thought to be indicative of the S_2 Zone (≡ Holkerian). On this basis the dolomites are of Holkerian age or older. The existence of dolomites in the lower part of the Carboniferous

Limestone in Derbyshire and Staffordshire is well known (Dunham 1973; Cope 1973; Institute of Geological Sciences 1978, p. 11). All these occurrences are of Holkerian age or older. The progressive downward increase in the amount of detrital quartz in the dolomites suggests that the base of the Carboniferous Limestone may lie not far below. Geophysical evidence (Maroof 1976, pp. 63-5) points to the same conclusion.

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