

irregularly scattered spine bases. Cardinal process short and broad, two- or four-lobed. Median septum of dorsal valve broad posteriorly, high and narrow anteriorly. Brachial processes anterior to centre of adductor muscle-impressions, brachial ridges spreading, elongate and crescentic, partially enclosing the prominent brachial cones. In ventral valve deeply striate muscle impressions on either side of median pseudoseptum, which passes anteriorly into a median hollow; hollows for reception of brachial cones deep or shallow. Cardinal area often present on ventral valve, rarely on dorsal.

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## CORRESPONDENCE

## CARBONIFEROUS REEF LIMESTONES

SIR,—In his paper “The nomenclature of Lower Carboniferous ‘Reef’ Limestones in the North of England” (*Geol. Mag.*, lxxxvii, 1950, 267), Dr. Bond implies (p. 269) that the limestone knolls at Grassington recently described by me (*Proc. Yorks. Geol. Soc.*, xxviii, 1950) are “true reef-knolls” as visualized by Tiddeman, and are similar to the diagram of a “true reef-knoll” shown in fig. 1 (p. 269) of his paper. This is only partly true. Firstly, the Grassington knolls consist of a core of partly recrystallized calcite mudstone, which may be bedded in its outer part but is usually unbedded or poorly bedded throughout, overlain by thinly-bedded crinoidal limestones which are bedded over and around the core. It is necessary, therefore, to distinguish between the core or knoll and the immediately overlying beds. The latter show original dips of deposition but they are no more “reef” limestones than are the hundred or so feet of evenly bedded limestones of the same highly crinoidal lithology which lie above them. Secondly, none of the Grassington knolls is a “discrete accumulation of organic debris” (Bond, *op. cit.*, p. 269). Macrofossils are few and are mainly dwarfed brachiopods. Thin sections show abundant bryozoans, but these make up only a small proportion of the rock, which is largely calcite mudstone, partly recrystallized. The Grassington knolls do correspond to reef-knolls as envisaged by Tiddeman, in that they originated as mounds on the sea-floor. If they are to be called “reef-knolls” that term must be redefined so as to exclude organic debris as an essential major constituent. I would strongly support such a redefinition.

It is interesting to note that the lithology of these Grassington knolls is very similar to that found in the Bowland knolls—an unbedded or poorly bedded calcite mudstone which may be extensively recrystallized. Other types

of limestone may occur in addition, but the calcite mudstone seems to be an invariable constituent and the original knoll topography is moulded in it. This rock is one of the rare autochthonous limestones in a succession which is essentially allochthonous. It apparently accumulated in a quiet environment as a chemical or biochemical precipitate which retained its original and irregular mound-covered surface because of the absence of currents which elsewhere were sorting and distributing the constituents of the clastic limestones. That this surface was often extremely complex can be and has been demonstrated by Dr. Parkinson in the Clitheroe and Whitewell districts of Bowland. I find it very difficult to see in what way these limestones are different from the "unbedded reef-limestone", discussed by Dr. Bond, the "main body" of which is "invariably pale-coloured unfossiliferous calcite mudstone" (Bond, *op. cit.*, p. 274). Also, since he agrees that the Grassington and Bowland knolls are knolls of original deposition I do not understand his difficulty in seeing "how the unbedded reef limestone (of Cracoe) could have accumulated as distinct mounds" (Bond, *op. cit.*, p. 277). The same rock type is concerned in all three cases. Is it not possible that there are original knolls at Cracoe and that some of the dips in the limestones are in part depositional and in part tectonic in origin?

I would also venture to suggest that there may be difficulty in establishing an original knoll form where the covering rock is also a limestone and behaves similarly under erosion. Thus, at Scaleber and Malham it seems to be necessary to distinguish between knolls of three distinct ages. Firstly, the original knoll topography of the calcite mudstones which was quickly covered by limestones of  $D_1$  and  $D_2$  age; secondly, the erosional knolls which were formed when these limestones were cut into by Pre-Namurian erosion and which, as Dr. Hudson has stated on numerous occasions, have no affinity with "reef-knolls". Nevertheless, they often contain one or more of the original knolls. Thirdly, the erosional knolls of the present day which are being produced by the removal of the Bowland shale cover and by further erosion of the erosional knolls of the second age.

Finally, I would suggest caution in basing any reconstruction of conditions of deposition on the evidence of "tufa". Work on which I have been engaged for some time suggests that some at least of this "tufa" is of secondary origin.

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#### NEW "SPECIES"

STR.—The last paragraph of Mr. J. L. Begg's recent paper (1950) on Girvan trilobites contains a remarkable acknowledgment "... to Dr. A. E. Trueman for the suggestion that, meantime, this example [of *Teratorhynchus* sp.] should not be given a specific determination". The specimen in question is incomplete and poorly preserved. That Mr. Begg should have considered erecting a new species upon a study of this material is a matter of some interest to geologists, representing as it does a very common approach to descriptive palaeontology. Recent publications by Burma (1948), Jeletzky (1950), Simpson (1941), and Simpson and Roe (1939), have drawn attention to the need for a more conservative treatment of questions of specific differentiation and at the same time to various "blind-spots" in some palaeontological work.

The possibilities of variation between closely related individuals or groups of individuals in an animal population are well-known and limited in number, being due to the presence of:—

1. *Subspecies*, usually mutually exclusive geographically, but capable of intermingling and replacement. It is worth noting that lateral (geographic) range of some animals is much underestimated by many palaeontologists. To some extent this may be attributed to a regrettable