LATERAL VARIATIONS IN THE TOPMOST PART OF THE BLUE LIAS AND BASAL CHARMOUTH MUDSTONE FORMATIONS (LOWER JURASSIC) ON THE DEVON AND DORSET COAST

R.W. GALLOIS[1] AND C.R.C. PAUL[2]

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The beds adjacent to the junction of the Lower Jurassic Blue Lias and Charmouth Mudstone formations are intermittently exposed in cliff and foreshore sections over a distance of 8 km on the east Devon and west Dorset coast on either side of Lyme Regis. Comparison of the successions in the highest part of the Blue Lias shows little lateral variation in thickness or lithology, with the exception of minor thickness changes in the two highest limestone beds. In contrast, the basal beds of the Shales-with-Beef Member, the lowest part of the Charmouth Mudstone, are laterally variable. Up to five beds of limestone that are present in the most westerly exposure in Devon are absent at the more easterly exposures in Dorset. This lateral variation does not appear to be related to contemporaneous fault activity. It is largely due to an unconformity at the base of the Shales-with-Beef which cuts out successively more of the basal beds when traced from west to east. The strict application of the definition of the Blue Lias Formation, currently taken at the top of the highest limestone in an interbedded mudstone-limestone succession, would include beds previously classified as Shales-with-Beef in east Devon.

[1]*92 Stoke Valley Road, Exeter, EX4 5ER, U.K.*
(E-mail: gallois@geologist.co.uk).
[2]*Department of Earth Sciences, University of Bristol, Wills Memorial Building, Queens Road, Bristol, BS8 1RJ, U.K.*
(E-mail: glcrcp@bristol.ac.uk).

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INTRODUCTION

The highest part of the Blue Lias and the lowest part of the overlying Charmouth Mudstone formations, are intermittently exposed over a distance of 8 km in cliff and foreshore sections between The Slabs [SY 286 894], Devon and Canary Ledges [SY 355 929], Dorset (Figure 1). The succession comprises interbedded fossiliferous marine mudstones and limestones, and contains numerous laterally persistent lithologically and faunally distinctive marker beds (Figure 2) that enable detailed correlations to be made between all the exposures. The Blue Lias exposed along the Devon-Dorset coast consists of a rhythmic succession of thinly interbedded organic-rich mudstones, calcareous mudstones and limestones in which the limestones make up about 40% of the total volume. The overlying Charmouth Mudstone Formation is composed of a similar range of lithologies in a succession that contains less than 3% of limestone by volume.

The organic-rich beds in the Blue Lias Formation are mostly laminated, pyritic and contain little bioturbation or calcareous fauna. In contrast, the calcareous beds and the nodular and tabular limestones that occur within them, are mostly highly bioturbated and richly fossiliferous. The limestones, which occur as tabular beds and lines of concretions, were formed by cementation with calcium carbonate in the carbonate-rich parts of the succession during early diagenesis, prior to compaction (Paul *et al.*, 2008). Many of the boundaries at the bases of the organic-rich deposits are sharp and indicate breaks in sedimentation, although few are of sufficient duration to have been detected in the palaeontological succession. The origin of the rhythms has been much debated. The current consensus is that they are related to climate change induced by Milankovitch orbital cycles (Weedon, 1986). Prominent among the numerous sedimentological and palaeontological studies of the Blue Lias Formation are those of Hallam (1957, 1960a). These and other early studies of the Lias of the Devon-Dorset coast, including specialist accounts of particular aspects of the biostratigraphy and sedimentology, have been reviewed by Callomon and Cope (1995), Hesselbo and Jenkyns (1995) and Simms *et al.* (2004).

In Victorian times, the limestone beds in the upper part of the formation were extensively worked for building stone and cement manufacture in the cliffs and intertidal areas adjacent to Lyme Regis. Woodward (1893) recorded the quarrymen's bed names in the first detailed description of the sections, and these names were used in a slightly modified form by Lang (1914). Lang (1914) allocated odd numbers (beds 1 to 49) to the limestone beds of the upper part of the Blue Lias and even numbers (beds 2 to 48) to the intervening mudstones in the sections at East Cliff [SY 345 924], Lyme Regis. Blue Lias bed numbers referred to in the text are those of Lang (1924) for the lower part (H1 to H52) and Lang (1914) for the upper part (1 to 49). He subsequently (in Lang *et al.*, 1923) continued the numbering system into the Shales-with-Beef (beds 50 to 75). Wright (1860) placed the junction of the Blue Lias and the Lower Lias Clay (now Charmouth Mudstone Formation) at the top of Table Ledge (Bed 53). In the current nomenclature, which defines the base of the Charmouth Mudstone as the top