INTRODUCTION

The Upper Triassic beds of the southwestern United Kingdom (SW UK) contain a laterally extensive (~2,000 km$^2$) dendritic and stromatolitic carbonate microbialite facies that extends from ~25 km north of Bristol southward through Taunton (Somerset) and into Seaton (Devon) (Fig. 1) (Owen 1754; Hamilton 1961; Mayall and Wright 1981; Wright and Mayall 1981). Alternating episodes of dendrolite and stromatolite are arranged into lenticular, biothermal mounds (~20 cm thick, decimeters to meters in diameter) separated by a mudstone to wackestone matrix. Its mammilated surface and internal treelike architecture have made the microbialites—known regionally as the “Cotham Marble,” although it is a limestone—a geologic curiosity around the SW UK since at least the 18th century (Owen 1754); polished slabs are commonly termed “landscape stone” (e.g., Short 1903). The most recent review of the origins of the Cotham Marble suggests it resulted from the interplay of sedimentation, bioturbation, and commensalism between an algal community and serpulid worms in a coastal lagoon setting (Wright and Mayall 1981).

Determining the morphogenesis of the Cotham Marble is of particular interest given its unique mesomorphology and occurrence within the Triassic–Jurassic “boundary interval” (Hesselbo et al. 2004; Mander et al. 2008), a time of global environmental and biotic crises (Raup and Sepkoski 1982; Benton 1993; Hesselbo et al. 2002; Hautmann 2004; Kiessling et al. 2007; Wignall et al. 2007; Greene et al. 2012a). Despite the attention the Cotham Marble microbialites have received (Hamilton 1961; Wright and Mayall 1981), the microstructure, which is necessary to resolve specific depositional environmental and mechanisms of formation, is rarely figured. Here, we analyze the mesofabrics and microfabrics of the Cotham Marble and assess how its microscopic features contribute to and result in the construction of its mesostructure and macrostructure. We also discuss the significance of the Cotham Marble with respect to its expansive areal extent and its occurrence within the Triassic–Jurassic boundary interval.

LITHOLOGY AND ENVIRONMENTAL SETTING

Bioherms of the Cotham Marble are restricted to the top of the Upper Cotham Member of the Lilstock Formation. The Cotham Member (divided into the Lower and Upper Cotham) is a ~2.5 m thick sequence of sedimentary rocks that succeed the dark laminated shales of the Westbury Formation (Swift and Martill 1999). The Lower Cotham Member is composed of thin interbedded siltstones and fine-grained calcareous sandstone, which is commonly wave rippled (Mayall 1983). A laterally extensive “deformed bed” exhibiting apparent soft sediment deformation extends for much of the SW UK (Mayall 1983) and has been interpreted as the result of seismic activity associated with the opening of the Atlantic Ocean (Swift and Martill 1999), or deformation caused by an extraterrestrial impact (Simms 2003, 2007). The “deformed bed,” which marks the boundary between the Lower and Upper Cotham Members, is capped by a fissured surface with desiccation cracks up to ~90 cm deep (Hesselbo et al. 2004).

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