



## **Non-marine carbonate facies, facies models and palaeogeographies of the Purbeck Formation (Late Jurassic to Early Cretaceous) of Dorset (Southern England).**

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Non-marine carbonates are relatively poorly understood compared with their more abundant marine counterparts. Sedimentary facies and basin architecture are controlled by a range of environmental parameters such as climate, hydrology and tectonic setting but facies models are few and limited in their predictive value. Following the discovery of extensive Early Cretaceous, non-marine carbonate hydrocarbon reservoirs in the South Atlantic, the interest of understanding such complex deposits has increased during recent years. This study is developing a new depositional model for non-marine carbonates in a semi-arid climate setting in an extensional basin; the Purbeck Formation (Upper Jurassic – Lower Cretaceous) in Dorset (Southern England).

Outcrop study coupled with subsurface data analysis and petrographic study (sedimentology and early diagenesis) aims to constrain and improve published models of depositional settings. Facies models for brackish water and hypersaline water conditions of these lacustrine to palustrine carbonates deposited in the syn-rift phase of the Wessex Basin will be presented.

Particular attention focusses on the factors that control the accumulation of in-situ microbialite mounds that occur within bedded inter-mound packstones-grainstones in the lower Purbeck. The microbialite mounds are located in three units (locally known as the Skull Cap, the Hard Cap and the Soft Cap) separated by three fossil soils (locally known as the Basal, the Lower and the Great Dirt Beds) respectively within three shallowing upward lacustrine sequences. These complex microbialite mounds (up to 4m high), are composed of tabular small-scale mounds (flat and long, up to 50cm high) divided into four subfacies. Many of these small-scale mounds developed around trees and branches which are preserved as moulds (or silicified wood) which are surrounded by a burrowed mudstone-wackestone collar. Subsequently a thrombolite framework developed on the upper part only within bedded inter-mound packstones-grainstones. Finally a discontinuous basal laminated subfacies can be found overlaying the fossil soils.

The overall control on facies and their distribution is the tectonic control as highlighted by the activity of the two main extensional faults during Purbeck times. The tectonic control on development of microbialite mounds is indicated by their relationship with the relay ramp. Their occurrence is controlled by palaeotopography generated on sub-aerial exposure surfaces, palaeosols and early conifer trees and developed mainly on the shallowest area of the lake as indicated by their relationship with the inter-mound packstone-grainstone facies and the palaeosols. The new depositional models developed in this study integrate sedimentological facies models with the syn-rift setting of the Wessex Basin to explain the distribution of the microbialite mounds.