

Sequence-Stratigraphy and Depositional Model of an Aptian Non-Rimmed Carbonate Platform, Maestrat Basin, Spain

Enric Pascual-Cebrian¹, Telm Bover-Arnal², Ramon Salas², Peter W. Skelton³, and Eulàlia Gili⁴

¹GeoScience Limited

²Universitat de Barcelona

³The Open University

⁴Universitat Autònoma de Barcelona

Abstract

Characterisation of carbonate platform reservoirs dominated by rudist bivalves and corals requires a good understanding of the ecological zonation, platform architecture, relative sea-level changes and mineralogical evolution of the biostromes. In this regard, outcrop examples from Late Cretaceous carbonate platforms of the Tethys have received more attention than their Early Cretaceous counterparts. This study accordingly investigates the vertical and lateral distribution of Aptian rudist bivalves and corals on a non-rimmed carbonate platform succession from the western Maestrat Basin (East Iberian Peninsula). A sequence stratigraphic analysis has been performed to recognize long-term relative sea-level changes that controlled the evolution of this carbonate succession. Two depositional sequences were recognized. The oldest Early Aptian sequence was subaerially exposed and incised to a depth of ca. 21 m during a forced regressive stage of the sea level. The resulting incisions were back-filled with transgressive peritidal deposits at the onset of the subsequent depositional sequence.

During the earliest highstand stage of the first sequence, colonial corals grew on an isolated platform top environment but also on marly slope settings during higher-frequency transgressive pulses. The late highstand stage is characterized by a facies track dominated by autochthonous rudist bivalves. The vertical transition from coral-dominated to rudist-dominated platform records progradation. The late-highstand carbonate platform exhibits a mineralogical transition from proximal to external depositional environments. Rudists with thickened calcitic outer shell layers, polyconitids and requieniids, thrived in the external platform; whereas aragonite-rich rudist bivalves, mainly caprinids, were restricted to the platform interior. The spatial mineralogical pattern observed is a consequence of ecological displacement of aragonite-rich bivalves, from the margin to the internal platform, associated with the onset of a long-term cooling period during the Late Early Aptian.

This study may be seen as a potential outcrop analogue for Aptian subsurface carbonate platform reservoirs. As a consequence of secondary porosity due to repeated and long periods of subaerial exposure and aragonite-rich mineralogy prone to dissolution; better porosity and permeability may be found in the aragonite-dominated rudist biostromes and coral meadows located in the platform interior.