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**Coral-Microbial build-ups development in an Upper Jurassic Carbonate Ramp**  
**(Kimmeridgian, Sierra de Albarracín, Spain)**

M. Aurell, B. Bádenas & G. San Miguel

Departamento de Ciencias de la Tierra, University of Zaragoza, 50.009 Zaragoza, Spain

Continuous Upper Kimmeridgian outcrops located in the Sierra de Albarracín area (NE Spain) provide complete and extensive 3D exposures of the Iberian carbonate ramp succession in both depositional dip and strike directions. Critical questions regarding the development of coral-microbial build-ups in low-angle ramp systems can be addressed using these continuous exposures that encompass a full range of inner to outer ramp facies.

The Upper Kimmeridgian succession studied in this work consists of five high-frequency cycles (A to E), bounded by discontinuities that can be traced across the entire studied area (e.g., Aurell & Bádenas, 2004; Mancini et al., 2004; Bádenas & Aurell 2010). Lithofacies and bounding surfaces have been mapped and were complemented by measured sections and petrographic analysis. Coral-microbial build-ups of different size and shape occur within middle ramp lithofacies of these high-frequency sequences. They consist of patches (1–3 m high) and pinnacles (conical to cylindrical shape, up to 19 m high), developed mostly in the foreshoal and offshore-proximal areas. Reef fabric consists of framestones of corals, stromatoporoids and chaetetids, with a variable proportion of micritic to peloidal microbial crust (i.e., from coral-bearing thrombolites to coral-microbial fabrics) including a rich association of encrusting organisms (serpulids, bryozoans, *Tubiphytes*, *Terebella*, *Koskinobullina*, *Lithocodium*, *Placopsilina*, *Cayeuxia*, *Bacinella* and *Thaumatoporella*). Flank facies around the coral-microbial build-ups are represented by aprons of debris of reefal facies (skeletal-intraclastic rudstones-floatstones); oncolitic associated facies include irregular oncoids of thick cortices with serpulids, bryozoans, *Lithocodium*, *Bacinella*, *Koskinobullina* and *Girvanella*, that reflect favourable areas to microbial activity.

The outcrops around *Jabaloyas* village studied over the last years provide a continuous and extensive exposure of the Upper Kimmeridgian ramp succession in both depositional dip and strike directions across a 12 km<sup>2</sup> area (i.e., 4 x 3 km). Detailed facies analysis allowed a precise knowledge of the distribution and density of the coral-microbial reefs across the carbonate ramp. The distinguished facies associations represent different sedimentary environments in the shallow areas of the carbonate ramp system (i.e lagoon, backshoal, shoal, foreshoal and proximal off-shore environment).

Successive stages of reef development have been mapped and characterized. The lower *Stage 1* (Sequence B) includes coral-bearing thrombolites with pinnacle morphology up to 5 m thick, surrounded by oolitic grainstones; these reefs were located in the foreshoal areas and were dominated by microbial crusts with lower diversity of micro-encrusters (*Tubiphytes* and *Terebella*). The reefs developed in *Stages 2 and 3* consist of coral-microbial buildups up to 10 m thick, mostly colonizing the relatively depth *offshore-proximal* environments. These two stages

represent the late transgressive and early highstand episodes of the Sequence C respectively (see Aurell & Bádenas, 2004). The inter-reef facies are mostly dominated by bioclastic-peloidal-intraclastic wackestone-packstones (Facies 2 y 3). Accumulation of lime mud and bioturbation during quiet periods led to the observed mixture of wackestone to packstone textures. During the later *Stage 4* (i.e., the late highstand of Sequence C), the sea floor was colonized by different groups of builders, which formed continuous carpets or small-relief patch reefs. From offshore to inshore, there is a lateral and vertical gradation from facies dominated by the red algae *Marinella*, coral-patch reefs formed by colonies of branching corals and facies defined by the presence of larger spherical boulders of stromatoporoids.

#### REFERENCES

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