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Biotic Control on Architecture of Carbonate Depositional Sequences

Stratigraphic architecture of depositional sequences depends on the balance between changes in accommodation and sedimentation rate. In carbonates, these factors are interdependent. Light penetration, nutrients and temperature influence the carbonate-producing biota and, consequently, the type and loci of carbonate sediments being produced, and relative sea-level changes and sea-floor topography determine the area of the carbonate factory. Upper Miocene platforms of the Balearic Islands illustrate this interdependence between accommodation and carbonate production, and particularly they show how changes in nutrients and/or temperature produce changes in stratal patterns and facies architecture if they affect the biological system. A distally steepened ramp resulted from a biotic system that produced loose grains throughout the photic zone and particularly in the deeper oligophotic zone. A rimmed platform resulted from euphotic carbonate production in a framework-dominated reef system. These two types of platforms exhibit different facies belts, internal architecture and distribution of heterogeneities despite being deposited under similar conditions of high-frequency sea level fluctuations. Furthermore, the increase in effective accommodation space that allowed the reef-rimmed shelf to prograde onto the distally steepened ramp resulted from an ecological change (driven by a climatic change) rather than significant relative sea-level rise. The increase of accommodation was driven by the change of biota, that determined a change of base level for sediment to accumulate, by changing from loose-grains production (base level=wavebase level) into framework production (base level=sea level).