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Improved Stratigraphic Modeling of Miocene Carbonate Ramps and Reef-Rimmed Platforms by Integrating Sedimentology, Sequence Stratigraphy, Carbonate Productivity and Paleoclimatology

The specificity of carbonate platforms is the production of most of the sediments within the system. Carbonate productivity changes through time and space, as a function of ocean chemistry, relative sea-level, external clastic inputs and climate. In short, rates and loci of production/accumulation differ between carbonate systems. We envisage that the evolution from one carbonate system (homoclinal ramp) to another (reef-rimmed platform) can be induced by a drastic change of the carbonate factory. In order to test this hypothesis, we used the Dionisos software, a stratigraphic simulator currently developed at IFP. It simulates the filling of a sedimentary basin based on three parameters: accommodation (subsidence and eustatism), sediment supply (in situ production for carbonates) and transport (gravity-driven diffusion). The power of Dionisos is the possibility to take into account several production curves for main carbonate producers (e.g. foramol/rhodalgal, chlorozoan). The change of a carbonate factory is here studied on the Miocene platforms outcropping in the Balearic Islands. Detailed 2-D geological models, based on more than 20 field sections and boreholes, highlight the evolution from a ramp to a reef-rimmed platform without an abrupt change of sea-level. This platform evolution is simulated in 2-D just by changing the loci of production/accumulation, due to a change of climatic conditions. Two Miocene systems of the Mediterranean (Balearic Islands and Turkey) were finally simulated in 3-D in order to validate the parameters used by the Dionisos carbonate module (i.e. the production curve, the initial bathymetry, the 3-D wave energy and the competition between carbonate producers).