

## **Mixing of Freshwater and Evaporated Seawater: A Control on Porosity Distribution in Upper Miocene Carbonates of Southeast Spain**

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The Upper Miocene carbonate platform at La Molata, SE Spain, exposes sequences consisting of a lower succession of heterozoan bioclastic and hemipelagic carbonates, a middle succession of reef and fore-reef slope carbonates, and an upper succession of oolitic and microbial/thrombolitic carbonates. Primary and secondary porosity are extant in the outcrop and provide excellent reservoir analogs to a wide range of subsurface equivalents. At this location, there has been no burial diagenesis, decreasing ambiguities common in many diagenetic studies. The history of diagenetic fluids is well constrained, because previous research has already determined the history of sea-level change, evaporative concentration of the Mediterranean, duration of subaerial exposure, and paleoaquifer configuration. This study reports initial results of a campaign to employ this framework to calibrate predictive models for diagenetic controls on porosity and permeability in carbonate reservoirs. In much of the system, transmitted light and cathodoluminescence petrography shows that dolomitization and much of the moldic dissolution are closely associated; they extend to the top of the Miocene section, but not into the Pliocene, thus dating their formation as end Miocene. Porosity and permeability measured from core plugs show that diagenetic effects have exerted a major control on heterogeneity. Previous studies have shown that dolomitization of Upper Miocene carbonates of SE Spain occurred either from evaporated seawater or mixed waters. New fluid inclusion measurements yield  $T_m$ -ice ranging from -0.2 to -1.1°C, indicating salinities from 5.5 to 20.3 ppt (seawater salt equivalent). These data suggest dolomitization in a mixing zone, in which one of the two end members was freshwater and the other end member was either seawater or evaporated seawater. Carbon and oxygen isotopes of dolomite powders range from +2.1 to +6.0‰ PDB for  $\delta^{18}\text{O}$ , -1.8 to +3.0‰ PDB for  $\delta^{13}\text{C}$ . Isotopic data lie along one or two trends suggestive of both fluid mixing and evaporative concentration. The combination of the fluid inclusion and isotopic data require fluid mixing with freshwater and evaporated seawater end members. This model for dolomitization and closely associated dissolution may account for similar patterns of reservoir heterogeneity in other dolomitized platforms that were subjected to both seawater evaporation and subaerial exposure.