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Diagenetic Salinity Cycles: A Link Between Carbonate Diagenesis and Sequence Stratigraphy

Hydrogeology in coastal settings is controlled by base-level and climate, linking sequence stratigraphy to diagenesis below coastal-zone unconformities. Here, we evaluate the concept of "diagenetic salinity cycles" as that link, by studying two ancient examples. A complete cycle starts with marine diagenesis followed by a progression from mixed, fresh, mixed, and marine diagenesis. Changes in elevation of the water table can link some cycles to relative sea-level fluctuations.

The study areas include the Cretaceous of Monte Camposauro, Italy and the Pleistocene of Sa Bassa Blanca cave, Mallorca, Spain. Data are based on field work, hand-specimen, transmitted-light and cathodoluminescence petrography, fluid-inclusion, and stable-isotope analyses. For Monte Camposauro, 26 paragenetic events occured during development of one unconformity, comprising five diagenetic salinity cycles, four of which preserve evidence for relative change in sea-level. Radiaxial fibrous calcite and aragonite formed from seawater. The mixing zone caused dissolution and precipitation of bladed and overgrowth calcite. Freshwater conditions caused dissolution and precipitation of calcite. For Mallorca, there are at least 19 groups of paragenetic events, composed of alternation between aragonite, rhombohedral and fasicular optic calcite, red-clay deposition, dissolution, and vertical fluctuations of water-table precipitates. These results point to multiple diagenetic salinity cycles along with evidence for relative change in sea level.

This study has shown that diagenetic salinity cycles are preserved during times of "aragonite seas" and "calcite seas". This preservation opens the possibility for prediction of depositional sequences downdip from diagenesis updip, as well as prediction of diagenesis updip from sequence stratigraphy downdip.