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Paleotopographic Controls on Carbonate Facies During an Interval of Warming Climate: Miocene, Cerro de Ricardillo, Southeast Spain

Well-exposed upper Miocene (Tortonian-Messinian) carbonates in the Cerro de Ricardillo area of southeastern Spain provide an opportunity to study the influence of substrate topography on basin-margin carbonate facies during warming and appearance of basinal evaporites. Five depositional sequences (DS1A, DS1B, DS2, DS3, and the TCC) were deposited on a substrate with ~260 meters of relief.

DS1A, DS1B, and lower DS2 cycles consist primarily of relatively coarse-grained mollusc-bryozoan packstones and volcanic detritus. These facies are consistent with the heterozoan association typically found in temperate-climate environments. The steep (>17°) substrates caused bypass of sediment produced in shallow water, funneling the sediment into areas of lower paleoslope (4-9°). DS2 comprises 12 shoaling-upward cycles reflected in fining upward from coarse molluscan deposits to cross-bedded mollusc-bryozoan packstones with abrasion and sorting of grains.

Chlorozoans first appear in uppermost DS2 cycles, indicating the beginning of tropical conditions. In DS3, fringing reef strata became dominant, building steep relief in shallow-water areas and producing progradational, aggradational, and downstepping geometries just predating the onset of evaporite deposition in the Mediterranean basin. Later, ooid grainstone and stromatolitic boundstone of the TCC represent a relative rise in sea level, conditions consistent with tropical climate, and deviation from normal marine conditions.

Because the substrate of this area was almost 100 meters higher in elevation than other substrates in the region, the Ricardillo area carbonates represent short-lived deposition only during the higher stands of sea level. Evaporites were not deposited because of the high paleotopographic position on the basin margin.