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Prograding vs. Aggrading Slope to Platform Transitions in a Steep and High Relief Carbonate Platform Margin (Pennsylvanian, Northern Spain)

Progradation and aggradation of carbonate platform are expressed by reflection geometry in seismic images. These stratal patterns can be linked to lithofacies character and spatial distribution only in combination with multiple boreholes or through well-exposed outcrop analogs. Seismic-scale, continuous outcrops of a rotated, Pennsylvanian platform in northern Spain provide depositional models of slope-to-platform transitions in both progradational and aggradational systems. Stratal patterns were tracked using sub-meter precision DGPS and integrated with detailed lithofacies analysis.

Steep (~208) and high relief (~650 m) slopes prograded for more than 10 km. They were followed by 400 m of nearly vertical aggradation with slopes dipping ~288. The progradational slope is predominantly massive microbial boundstone (clotted peloidal micrite, fenestrate bryozoans, botryoidal and radiaxial fibrous cement) passing downslope into breccia deposits. Outer platform facies, several hundreds of meters wide, are dipping ~88 and are composed of boundstone alternating with several meters-thick ooid shoals. Aggradational slopes consist of microbial boundstone in the upper ~300 m with a gradual downslope transition into breccias of boundstone debris and platform-derived grain beds. The upward transition into outer platform beds is geometrically abrupt (from steep to horizontal) but gradational for lithofacies. The narrow outer platform belt (~150 m) consists of algal-rich boundstone with radiaxial fibrous but lacking botryoidal cement. Several meter-thick boundstone alternate with a few meter-thick ooid and crinoid-dominated grainstone.

This study demonstrates the different relationships between stratal patterns and depositional facies for prograding and aggrading carbonate systems. It provides important implications for reservoir prediction in comparable platform margins.