

The Expression of Progradation in a Large-Scale Delta-Fed Slope System: Outcrop Study of the Upper Cretaceous Tres Pasos Formation, Cerro Divisadero, Chile

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The recognition of progradation in sedimentary systems has important implications regarding lithologic prediction from reservoir to exploration scales. Recognizing this signature in depositional environments not directly tied to relative sea-level, however, is inherently challenging. Coarse-grained (>silt) deep-water systems are dominated by gravity-flow sedimentation that reflects local gradient conditions at a position for a particular flow. Flow characteristics can vary significantly from event to event and may not respond equally to similar gradient conditions. The record of these processes is a representation of changing relative confinement (i.e. flow and gradient conditions). Relative confinement is evaluated through hierarchical analysis of facies and sedimentary body architecture and, in some cases, is expressed as a systematic stacking pattern. In the example shown here, this stacking pattern represents the basinward accretion of a depositional slope.

The Upper Cretaceous Tres Pasos Formation represents the uppermost portion of a ~5,000 m thick succession of deep-water deposits in the Magallanes foreland basin of southern Chile. The Tres Pasos interval (1,500-2,000 m thick) records the progradation of a delta-fed slope system that marks the end of deep-water sedimentation in the basin. Well-exposed seismic-scale outcrops at Cerro Divisadero of four 20-50 m thick sandstone-rich successions, separated by mudstone-rich intervals of comparable thickness, suggest an overall upward increase in bypass of sediment gravity flows. Patterns of thickness, sand body geometry, internal bedding architecture, degree of amalgamation, and facies distribution are analyzed in detail. These relationships indicate a systematic increase in relative confinement upward through the preserved strata. We interpret this pattern as a change from lower gradient conditions typical of the lower- to base-of-slope position to higher gradient conditions characteristic of the middle- to upper-slope.

This progradational signature permits investigation of patterns that have implications regarding facies prediction along the depositional profile. In the case of the Tres Pasos, basin-scale knowledge (from previous and ongoing research) provides context useful for testing predictive models with large impact in exploration cases. In the case of reservoir modeling, an assessment of the stratigraphic expression of relative confinement can aid evaluation of uncertainties at reservoir scale.