Deep-Water Plays in a Forearc Depositional System: Shelf-Margin Deltas to Basin Floor Fans, Northern San Joaquin Basin, California

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Regional gravity-magnetic, reflection seismic and well data are used to construct a depositional model for the Cretaceous forearc deep-water gravity-flow depositional system of the northern San Joaquin Basin, California. This active-margin forearc model is compared to the more traditional passive margin model of seismic sequence stratigraphy.

Regional 2D reflection profiles down the axis of fault controlled paleo-valley systems image a succession of sandprone depositionally thick bodies in inner-shelf, outer-shelf, shelf-margin, canyon-mouth, toe-of-slope and basin floor settings. Analysis of a 3D seismic volume demonstrates that each of these depositional elements can be placed into a sequence stratigraphic framework for this tectonically driven forearc depositional system. The lowstand depositional facies include basin-floor fans, toe-of-slope prograding complexes, canyon-mouth 'thicks', and shelf-margin prograding complexes. Each of the depositional elements occurs where dramatic geomorphic transitions provided accommodation space and consequent changes in flow velocity that result in sand-prone facies being deposited. Exploration wells provide critical calibration of both potential reservoir and seal facies, and confirmation of the predrill depositional model.

During times of tectonic emergence of the basin margin, sand-prone sediment flux was very high and accumulation was largely restricted to the deep-water depositional axis of the forearc basin. As the basin margin subsided and sediment flux decreased due to denudation of the Sierra Nevada terrain, depocenters transgressed first onto the outer shelf as retrograde packages and subsequently toward the basin margin where paleo-river systems supplied relative highstand prograding systems. Transgressive to early relative highstand mudstones blanketed the basinal areas providing regional seals that separate geopressured compartments.