

Evolution from a Laterally Mixed System to Reciprocal Deposition on the Sacramento Shelf, New Mexico: Relative Influence of Late Paleozoic Ice Age Glacioeustasy and Ancestral Rocky Mountains Tectonism

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Abstract

Pennsylvanian reservoir intervals of the greater Permian Basin were deposited during the Late Paleozoic Ice Age (LPIA) and active Ancestral Rocky Mountains (ARM) tectonism, both of which influenced cycle-to-basin scale depositional patterns. Data from continuous outcrops in the Sacramento Mountains, NM are used to improve our understanding of a Pennsylvanian outcrop analog of a land attached carbonate ramp, bisected by a siliciclastic thoroughfare. Thirty measured sections, extensive photopan mapping and UAV imagery constrain a laterally mixed system in the Gobbler Fm (Desmoinesian-Missourian), that records the early phase of a 15 m.y. transition to reciprocally mixed shelf. In the carbonate platform, outer ramp and slope deposits contain spiculitic thin-bedded bryozoan-brachiopod wackestones, crinoidal sediment gravity flows, fine-grained skeletal-rich channel belts and cohesive slide blocks. Middle ramp facies are mainly mud-dominated packstones with locally abundant bryozoans, brachiopods, crinoids and *Komia* branches. Inner ramp carbonates are encrinites and mixed skeletal grain-dominated packstones that form nearly flat-lying, planar stratified accumulations deposited on a wave-swept shelf. Cycles are capped by exposure surfaces juxtaposed on variable subtidal facies. Within the siliciclastic thoroughfare the facies assemblage includes (1)

coarse sand to pebble channel fills with >50% marine carbonate grains, (2) medium grained combined flow rippled sand with no carbonate sediment fraction, (3) heterolithic medium grained siliciclastic sand with fissile and micaceous fine sand and silt. This assemblage suggests deposition in a tide-dominated estuary or sandy tidal flat. Paleocurrent measurements (n=310) indicate a dominant northwest ebb transport direction. Cycle tops are picked on most regressive facies indicated by increase in grain size, Skolithos “pipe rock” trace-fossil assemblages, or plant detritus. Flooding events are interpreted where marginal marine siliciclastic facies fully transition to offshore carbonates and/or black fissile mudstones. Cycle stacking and facies proportions indicate 2 composite sequences and at least 8 high frequency sequences that can be correlated across carbonate and siliciclastic depozones. Significant expansion of siliciclastic facies in the upper Desmoinesian composite sequence may coincide with renewed exhumation of source terrains and initial reorientation of the Sacramento Shelf.