Recognition and Significance of Ancient Bayhead Delta Deposits: Examples from the Western Interior, Uinta Basin, Utah, USA

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Bayhead deltas develop at the innermost part of wave-dominated esturaries; their deposits provide critical sequence-stratigraphic markers because they indicate the landward extent of transgression and the shift from transgression to regression. Despite the high preservation potential of estuarine deposits and recent advances in estuarine facies models, bayhead delta facies are not widely recognized in the stratigraphic record. Moreover, the external controls on their genesis, such as climate, tectonics, sediment supply and coastline morphology, are poorly understood.

This study presents: (A) sedimentologic analyses of three, superb bayhead delta deposits from Campanian strata in the Uinta Basin (middle Castlegate Sandstone in the Willow Creek and Little Park Wash areas, and Neslen Formation near Coal Canyon) and criteria to recognize them, (B) potential relationships between bayhead delta development to reduced accommodation during the Sevier-Laramide transition based on a regional (400 km) correlation and isopach maps. Detailed sedimentologic analysis suggests the following criteria to identify bayhead delta deposits in outcrop: (1) presence of small-scale clinoforms (5-15 m height; 100-1000 m length), (2) overall coarsening-up pattern, (3) down-clinoform decrease in grain-size and paleocurrent energy, (4) increasing abundance of mud interbeds toward the clinoform toe, (5) basinward-directed paleocurrent with definite fluvial input, (6) more pronounced tidal influence toward clinoform toe, (7) brackish trace and body fossils and (8) general position within a transgressive interval.

In the Uinta Basin, bayhead delta deposits preferentially cluster within a stratigraphic interval that has an anomalous, amalgamated sequence architecture, and extensive (>300 km) transgressions and regressions. This study proposes that a fundamental change in basin dynamics during the transition from Sevier- to Laramide-style deformation reduced basin-scale accommodation and lowered the basin slope. The reduced long-term accommodation, shallower basin slope and more extensive transgressions/regressions facilitated the development of incised valleys during sea-level fall, and the development/preservation of estuarine deposits within the valleys during sea-level rise.