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Formation of Deep Incisions into Tide-Dominated River Deltas: Implications for the Stratigraphy of the Sego Sandstone, Book Cliffs, Utah, U.S.A.

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Abstract

The Upper Cretaceous Sego Member of the Mancos Shale in east-central Utah is composed of tidally deposited sandstones interbedded with intervals containing marine shales and thin wave-deposited sandstones. The tidal sandstones have been interpreted to comprise multiple amalgamated estuarine valley fills above a major sequence boundary that is incised into distal marine deposits of the underlying Buck Tongue Shale. According to this interpretation, the deposits constitute the base of a thick transgressive succession within the Sevier foreland clastic wedge. Alternatively, lower Sego sandstones have recently been interpreted by the authors to be tide-dominated river delta deposits in an overall regressive interval of the foreland succession. A cross section showing facies variations and stratigraphic surfaces within the lower Sego Member along 100 kilometers of the eastern Book Cliffs is used in this paper to refine depositional and sequence stratigraphic interpretations of these tidal deposits, particularly the origin of deep incisions within the Sego sandstones.

A strike-oriented section of the lower Sego Member reveals tidal sandstone lenses, 40-50 kilometers wide and tens of meters thick, separated laterally by areas tens of kilometers wide that have no tidal sandstones. Facies variations within the tidal sandstones reflect depositional processes on tide-dominated deltas that prograded obliquely into the shallow intracratonic Western Interior Seaway of North America. Two major episodes of delta progradation and subsequent transgressions are interpreted to have formed tidal sandstone layers within the lower Sego Sandstone. Thinner tidal sandstone layers, of more local extent, are interpreted to reflect changes in tidal current strength but not necessarily shifts in shoreline position or major changes in water depth. Multiple origins are suggested

for incised erosion surfaces within the lower Sego sandstones. Firstly, the tide-dominated deltaic sandstones are floored by laterally discontinuous erosion surfaces. These basal surfaces, marking abrupt vertical changes in depositional process and coarsening of grain size, are interpreted to record tidal scouring of the sea floor during shoreline progradation. Secondly, sharp-based upward-coarsening deltaic sandstones are cut by numerous deep incisions with tens of meters of relief, and locally they are entirely removed by erosion. Some of this deep erosion within the lower Sego Sandstone may reflect the upstream avulsion of incised distributaries during forced regression of deltas into the basin, whereas others may have formed by tidal erosion of abandoned distributaries during more gradual progradation and subsequent retrogradation of deltas. Highly variable facies trends within incision fills are related to pronounced changes in sediment supply to different distributaries on the delta, to differences between incisions cut during delta regression versus those cut during the start of transgression, and to varying distances from delta axes. When the entire coast was transgressed, the influence of tides waned and wave-generated currents ravined delta tops. Depositional interpretations of the Sego Member indicate that the Buck Tongue to Neslen interval lies in a broadly regressive part of the foreland basin fill.

GeoRef Subject
Grand County Utah Book Cliffs Mesozoic sandstone clastic rocks sedimentary rocks Cretaceous Mancos Shale Utah United States Uintah County Utah Upper Cretaceous

Index Terms/Descriptors

basins | Book Cliffs | clastic rocks | coastal environment | Cretaceous | deltas | depositional environment | fluvial environment | foreland basins | Grand County Utah | intertidal environment | Mancos Shale | Mesozoic | sandstone | sedimentary rocks | sequence stratigraphy | Uintah County Utah | United States | Upper Cretaceous | Utah | Sego Sandstone

Latitude & Longitude

N39°25'00" - N40°49'60", W110°04'00" - W109°04'60"
N38°30'00" - N39°31'00", W110°13'00" - W109°02'60"

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