

Incised Valleys in the Parkman Sandstone, Wyoming: New Sequence Analysis Opens Up New Exploration and Development Opportunities in the Powder River Basin

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ABSTRACT

The Upper Cretaceous (lower Mesaverde) Parkman Sandstone (PS) of the Powder River Basin is a significant tight oil play that has continued to be a successful target even since the 2014 commodities price drop. The PS is a deltaic succession that displays an overall progradational parasequence set stacking, with depositional environments ranging from offshore marine to coastal plain deposits that show strong wave and some tidal influence. Shoreface facies of the PS are excellent reservoirs, however, lack of structural closure or stratigraphic trapping configurations meant that interest in the PS waned throughout the 90's until the discovery in 2002 of Savageton Field. The tight oil reservoir facies at Savageton is the distal portion of a single parasequence at the base of the lower PS. Several papers were published on the Parkman in the 1960s and 70s, prior to the advent of sequence stratigraphy. However, since then nothing has been published except for the publication on Savageton production. New ideas offer a great opportunity to increase prospectivity in the PS interval.

The Parkman crops out along the western Powder River Basin at Teapot Dome. Nine sections were measured and integrated with observations of previous outcrop work to create a new proximal framework for the PS that suggests the occurrence of a previously unrecognized, major sequence boundary near the top of the lower Parkman in outcrop. Above the sequence boundary a valley fill system is composed of a series of estuarine to fluvial successions showing marine influence in the basal portion of the fill. Although relief on the larger valley incision has not yet been determined, individual fluvial channels display relief on the orders of meters, with multiple channels stacking 10's of meters thick.

Abundant core, log and outcrop data integrated with new ideas on sequence frameworks in the PS have enabled a much improved understanding of the basinward reservoir potential and the potential for stratigraphic traps associated with incised valley development. Distal shale occurrences can be mapped landward to improve our understanding of inter-Parkman seals and baffles for much improved development planning.