Characterizing the Northern Margin of the Uteland Butte Lacustrine Play, Green River Formation, Uinta Basin, Utah

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Abstract

The recent expansion of horizontal drilling programs in the Central Basin subregion of the Uinta Basin have driven the basin to record production and have fueled renewed interest in identifying the extent of the lacustrine source rocks, which drive modern oil and gas development. In particular, the Uteland Butte member (UB) of the Lower Green River Formation has been the predominant development target oil production throughout the basin, with particularly strong well results in the Central Basin. The regionally-correlative UB records the initial transgression of Lake Uinta across the entirety of the Uinta Basin. Recent efforts to map the environments of deposition (EOD) across the basin have identified distinct lithofacies zones ranging from shallow palustrine and deltaic EODs in the outcrop belt exposed along the southern rim of the basin to open lacustrine EODs in the north as evidenced by subsurface cores and wireline logs collected along the depositional axis of the basin. Alluvial, fluvial, and deltaic deposits shed from the Uinta Mountains abruptly truncate lacustrine facies in the Green River and Wasatch Formations with several criteria proposed for identifying the sharp lacustrine/shoreline boundary. Despite the obvious change in wireline log character along this margin, little work has been published describing the lithologic relationships that define this transition. Core description and geochemical analyses from legacy core stored at the Utah Core Research Center in Salt Lake City, Utah were combined with geophysical wireline logs to compare lacustrine sequences from the Lower Green River and Wasatch Formations for the purpose of assessing reservoir quality of the two different units. Core-derived lithofacies descriptions demonstrate a stark distinction between organically-depleted deltaic sandstones and palustrine carbonate grainstones within the UB and organic-rich open lacustrine shales and minor littoral carbonates of the Kyune Creek member of the Upper Wasatch Formation (KC). Proximal deltaic and shoreline deposits in the UB mark a distinct shift in lithofacies from typical open lacustrine facies directly south. In contrast, open lacustrine facies persist within the KC with limited proximal clastic input. These findings suggest that Lake Uinta was persistent across the NW Uinta Basin through during Upper Wasatch deposition but not during Lower Green River Formation deposition, marking a notable reversal of common lithofacies. The rapid vertical change in lithofacies at this boundary suggests that the razor-sharp boundary identified in subsurface maps accurately describes the rapid lateral changes in lithofacies at this fundamental stratigraphic boundary. This study confirms that significant accumulation of organic-rich lacustrine source shales are persistent within the KC in the far northwest of the Uinta Basin, providing a significant target for future expansion of oil and gas development.