Core and Outcrop Study of the Mancos B Hydrocarbon Reservoir in the Eastern Uinta Basin and Western Douglas Creek Arch, Utah and Colorado

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Abstract

The heterolithic to sandstone-dominated Mancos B reservoir is a conventional and unconventional oil and gas target within the Mancos Shale in the Uinta-Piceance Province of Utah and Colorado. Also known as the Prairie Canyon Member, the 50–800-ft-thick Mancos B is detached from shoreline sandstones of the Blackhawk Formation (Mesaverde Group) and encased by the regionally mature mudstone packages of the Upper Blue Gate and Lower Blue Gate Members of the Mancos Shale. Historically a gas producing unit on the Douglas Creek Arch and in the Piceance Basin, the Mancos B has emerged as an oil target on the western flank of the Douglas Creek Arch and eastern Uinta Basin. This study assessed Mancos B reservoir characteristics using six cores, outcrops, and geophysical logs with particular focus on the quality and extent of Mancos B reservoirs west of the Douglas Creek Arch. Core studies incorporated detailed descriptions, inorganic geochemical analyses, organic geochemical analyses, SEM-EDS analyses, and conventional core analyses. Eight sandstone and mudstone lithofacies were identified, each with unique authigenic and diagenetic clay content, porosity and permeability properties, pore geometry, and cement content. Porous (up to 14%) and permeable (up to 0.3mD) sandstones are thickest (up to 150-ft) on the western flank of the Douglas Creek Arch, where the unit is approached as a conventional oil play targeting Laramide-age structural traps. West of the Douglas Creek Arch in the relatively undeformed Uinta Basin, porous Mancos B sandstones are interbedded with tight sandstones and mudstones that have only produced modest amounts of oil from vertical wells. Detailed review of well tests and production data indicates that Mancos B hydrocarbons are highly compartmentalized across the eastern Uinta Basin, which likely is a result of variable hydrocarbon trapping associated with localized lithologic characteristics, burial history, and structural setting. A horizontal well located in the northeastern Uinta Basin (near Bonanza, UT) drilled in 2018 has showcased potential to produce stratigraphically trapped liquids from Mancos B strata, although specific targets and engineering best practices are still being developing to maximize oil production. Through combining study of reservoir characteristics in core and outcrop in conjunction with review of production data, this study offers insights into conventional and evolving horizontal play concepts that highlight the successes and challenges of producing from this unique Mancos reservoir.