Tectonostratigraphic Controls of the Emerging Lewis Formation Play, Eastern Greater Green River Basin, Wyoming

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Abstract

The Lewis Formation of the Greater Green River Basin (GGRB) has produced oil and gas from turbidite sandstone reservoirs conventionally for decades. Recent horizontal wells drilled in the Lower Lewis have proven to be more productive than vertical wells by several factors, establishing the viability of the Lewis Formation as an unconventional reservoir system. Presently, horizontal drilling has been limited to the Wamsutter Arch region of the GGRB, however, this study presents a tectonostratigraphic framework that extends key unconventional play elements from the Wamsutter Arch south to the Cherokee Ridge. Analysis of 3D seismic and well log data suggest the Cherokee Ridge fault zone was active during Lewis time and created a bathymetric high that limited the basinward transport of coarse-grained Dad Member turbidites and recorded repeat sequences of distal turbidites and organic-rich offshore mudstones. This study presents the following lines of evidence that these distal sequences represent potential stacked unconventional reservoirs: (1) production and well tests from vertical wells (2) petrophysical evidence and cuttings analysis that show significant total organic carbon (TOC) enrichment and, (3) analysis of shear logs that suggest the presence of brittle siltstones and sandstones interbedded with organic-rich mudstones which represent ideal zones to land and hydraulically stimulate a horizontal well. The thickness of these alternating sand-siltstone and mudstone beds could support multi-level development and significantly increase recoverable resource density. While additional geochemical and rock mechanics analysis would help test this claim, further exploratory horizontal drilling will be needed to prove the stacked potential of the play.