Pay Distribution and Basin Architecture of the Wolfcamp Shale in the Delaware Basin

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The Wolfcamp formation consists of a multiple billion barrel oil equivalent resource opportunity in the Delaware Basin. Subsequently, the bulk of recent drilling activity has been targeting the Wolfcamp shale. This review will examine the Wolfcamp shale pay distribution, corresponding optimal landing zones, and elucidate the thermal maturity corundum that exists across the Delaware Basin.

The Delaware Basin can be divided into two GOR thermal regimes; low GOR to the east and high GOR to the west. Multiple hypotheses may explain this segregation; chromatographic migration, basin inversion, heat flow fluctuation, etc. This review will explore these alternatives to thermal maturity and demonstrate the potential for fluid flow in low permeability systems not only at a local scale, but more regionally.

The remaining Total Organic Carbon (TOC) content of shale source rocks plays a key role in the characterization and development of self-sourced unconventional plays. Resource in-place calculation and landing zone selection for horizontal wells commonly reflect the magnitude of TOC in the reservoir which varies across the basin. The underlying assumption is that the permeability of shales is insufficient to allow for the migration of hydrocarbon generated during the thermal maturation process. Subsequently, remaining TOC is a good proxy for original hydrocarbon in place (OHIP). The Wolfcamp can be differentiated into 5 stratigraphic pay zones distributed across the basin. A review of the basin stratigraphy and architecture will demonstrate this, followed by a discussion leveraging core data showing 1) the middle and lower Wolfcamp reservoirs (Wolfcamp C & D) where TOC and OHIP are co-located and 2) log-based techniques used to characterize these reservoirs. We also discuss the upper Wolfcamp reservoir (Wolfcamp A & B) where the hydrocarbon generated during the thermal maturation process has migrated, at least at a local scale. Production logs verify TOC-based pay calculations can lead to suboptimal landing zone placement in the upper Wolfcamp. Thus, an alternative OHIP-based characterization is the preferred pay and subsequent landing zone identification. This petrophysics workflow can provide insight in qualifying pay in hybrid lithologic systems.

Finally, there will be a short review of a deep (28,000 foot) exploration well drilled by Chevron in the southern Delaware Basin.

BIO

Ken is currently Chevron's Permian Exploration/Appraisal team lead. Ken has 15 years of oil industry experience and has worked the Rocky Mountains, Gulf Coast, South Texas, Angola, Nigeria, Alaska, and the Permian Basin. Ken received his BS Geology degree from the University of Iowa and MS Geology degree from the Mackay School of Mines at the University of Nevada, Reno.