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Optimal Cube Development Spacing in Uinta Basin Using Geochemical Fingerprinting Technology

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Abstract

An important question for operators, investors and shareholders for all basins is how drainage behavior of independently completed parent wells is different from cube-developed child wells; most importantly, how this difference will impact their investment. To answer this question a multifaceted approach is typically taken and yet the answer can often still prove elusive. In this study, we introduce a geochemistry-based methodology that provides quantitative drainage monitoring. This allows for direct comparison of drainage heights and drainage changes through time to better understand proper spacing and the impact of cube development to producing intervals. The Uinta Basin generally has smaller drainage heights than other basins in the continental US. However, Uinta is unique in that its drainage heights are not limited by reservoir height as is the case in Williston Basin, Powder River Basin and Eagle Ford producers. Whether cube-developed wells have overlapping drainage rock volumes (DRV) with adjacent wells, or if they drain notably differently than the original parent producers from which reserves have been calculated, are some crucial questions to answer for proper development. In this presentation, we present a two-part workflow using the thousands of naturally occurring hydrocarbon compounds collected from both rock (cuttings/core) and produced oil. First, for each area, bulk geochemical compound data was collected from rock samples which was used to generate a group of Reservoir Characterization Indices (RCI) to provide key reservoir properties such as permeability and oil saturation. Then, time-lapse produced oil samples were allocated back to their contributing zones using regression models based on geochemical fingerprint data of the rocks and oils to reveal the temporal and spatial variation of the effective drained DRV surrounding horizontal wells in unconventional plays. Data from both XCL Resources and the RevoChem Database, which monitor production profiles from IP to several years into the life of the monitored producing wells, demonstrate: 1) drainage heights of initial single producers is generally similar to drainage heights of recent cube development wells, regardless of the reservoir that was targeted; 2) drainage changes over time are also similar between single producing wells and their cube producing counterparts; and 3) the majority of monitored Uinta wells, no matter if independently developed or cube developed, see that drainage moves shallower through time. These findings provide concrete evidence that the current cube development strategies within the Uinta are not currently straining the producing capabilities of the Castle Peak, Uteland Butte, Wasatch and adjacent hydrocarbon bearing formations. This geochemical methodology has proven beneficial throughout the lifecycle of unconventional reservoir development, aiding in answering many important questions to obtain optimal full field development.