Using Pore System Characterization to Subdivide the Burgeoning Uteland Butte Play, Green River Formation, Uinta Basin, Utah

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Abstract

Over 240 horizontal wells with highly variable production results have been drilled in the Uteland Butte member (UBm) of the lower Green River Formation in the Uinta Basin, Utah. The best wells have each produced more than 300,000 barrels of oil in the first 12 months of production, with conservative EURs above a million barrels. Conversely, the poorest UBm wells have initial production rates of less than 10,000 barrels of oil in the first year and will never recoup their drilling costs. Pore pressure, oil viscosity, and frac size are recognized as important controls on well productivity. Less understood, but of equal importance, is the variability in reservoir types across the UBm play. The UBm can be divided into sub- plays by district using the dominant pore systems in each area. We defined four distinct sub-plays within the Uinta Basin: 1) intergranular-dominated porosity, 2) intercrystalline-pore-dominated dolomite, 3) mixed intercrystalline-organic porosity, and 4) organic porosity. Reservoirs in the intergranular- dominated porosity sub-play are mostly present in the form of nearshore siliciclastic and carbonate bars, such as ooid and ostracod shoals, fluvial mouth bars, and nearshore siliciclastic bars. The normal pressure and charge in these reservoirs are due to hydrocarbon migration out of the deeper basin.

Source rocks in this sub-play have an average maturity too low for mainstage oil generation for these lacustrine shales, which produce highly viscous black wax with very low GORs. To date, horizontal wells drilled in this sub-play have not been economically successful. The intercrystalline-pore-dominated sub- play consists of thin, laterally continuous, high-porosity dolomites that act as the best reservoirs. This sub-play has an average VRo of 0.6 to 0.8, still too low for mainstage oil generation in these rocks and produces a migrated black wax with low GORs. The mixed intercrystalline-organic porosity sub-play is largely self-sourced and significantly overpressured. Maturities in this sub-play ranges from 0.8 to 1.0 VRo. This sub-play produces a yellow to gray wax with moderate GORs. Finally, the organic-porosity-dominated sub-play is highly overpressured and completely self-sourced. There is relatively little reservoir-quality dolomite, the limestones are more argillaceous, and the organic-rich carbonate shales are thicker. The productive reservoir in this sub-play consists of organic porosity largely contained in bitumen that has been expelled at lower maturity, then continued to thermally degrade with higher maturity, converting to zones of interconnected organic porosity. Maturities range from 1.0 to 1.2 VRo and the hydrocarbons produced are a bright yellow wax with relatively high GORs. By recognizing the important differences these pore systems exert on best development practices and then accurately mapping them across the basin, operators, interest owners, and regulatory agencies can more efficiently plan operations.

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