New Thoughts on Improving Oil Recovery from the Minnelusa Formation, Powder River Basin, Wyoming

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Abstract

Sands within the Upper Pennsylvanian/Lower Permian portion of the Minnelusa Formation have produced in excess of 600 million barrels of oil in Wyoming from over 300 oil fields. The traps responsible for these fields formed due to the facies relationships between coastal eolian dunes, shallow marine carbonates, sabkha dolomites and anyhydrites, and overlying shallow coastal plain muds. Most Minnelusa fields have been waterflooded with varying degrees of effectiveness. Improving and enhancing recovery from these fields has proven challenging. It is difficult to optimize recovery without an understanding of reservoir architecture. Since productive Minnelusa reservoirs were deposited in a coastal dune setting along the northwestern shore of the Anadarko Sea, it is possible that eustatic sea level changes affected facies deposition as well as creating tightly cemented intervals (tight zones) within the sands as a function of the changing water table. Accordingly, a method that adapts sequence stratigraphic principles to correlations of tight zones within the upper Minnelusa has been developed that shows promise in mapping the separation of flow units within these important reservoirs. Utilizing this new method has indicated not only ways to improve oil recovery within existing fields, but has also suggested that the currently accepted theory for the evolution of the upper Minnelusa may need to be revised. Initial findings indicate a previously unrecognized unconformity within the Permian portion of the upper Minnelusa with sands above this unconformity having been deposited contemporaneously with the Opeche Shale. In addition to the potential to improve recovery through better mapping of reservoir architecture, this new method suggests there may be additional traps within the Minnelusa that have been overlooked. If this new mapping methodology is proven reasonably accurate, not only can EOR projects be undertaken with less risk, but improved mapping may result in new exploration ventures.