In-Situ Wireline-Log-Derived Indices for Miscible Light-Hydrocarbon-Injection Recovery in Bakken Petroleum System

Hao Li[1] and Dr. Siddharth Misra[1]

[1]University of Oklahoma

ABSTRACT

Bakken Petroleum System (BPS) has a great potential for enhanced oil recovery (EOR) because of the high original oil-in-place estimates accompanied by low primary recovery potential. BPS is composed of both conventional and unconventional units exhibiting significant variations in lithology, rock texture, clay content, porosity, and total organic carbon. Two wireline-log-derived EOR-efficiency indices are generated for a 200-feet depth interval in the BPS to identify flow units suitable for EOR using light, miscible hydrocarbon injection. The Microscopic Displacement (MD) Index exhibits higher resolution compared to the Ranking (R) Index. MD index relies on a novel method to calculate the miscible free-oil volume from subsurface NMR T2-distribution logs by accounting for alteration in MMP due to pore confinement effect. At a resolution of 1-foot depth interval, several flow units were successfully identified in the Middle Bakken formation that exhibit high miscible-gas-injection recovery potential.

In-situ wireline-log-derived EOR indices provide an economical screening method to identify flow units in the Bakken Petroleum System suitable for light, miscible hydrocarbon injection. In addition, factor analysis was performed on NMR T2 distribution to estimate free-water-filled and bound-fluid-filled porosities. The indices predict that 50% and 20% of the Middle Bakken formation should exhibit high and intermediate recovery potentials, respectively, for miscible, light hydrocarbon injection. Indices show that the recovery potentials of the Upper and Lower Bakken formations are approximately 60% lower than that of the Middle Bakken.