Geophysical Research Abstracts
Vol. 16, EGU2014-6134, 2014
EGU General Assembly 2014

Patterns of changes in oil properties in complex constructions for carbonate reservoirs

Vladimir P. Morozov, Irina N. Plotnikova, Fidania F. Nosova, Nikita V. Pronin, and Julia G. Nosova
Kazan Federal University, Kazan, Russian Federation (irena-2005@rambler.ru, +7 843 2337983)

The objects of this research are carbonate reservoirs with non-uniform lithology and filtration-volumetric parameters. The oil under study is heavy (0.924 g/cm3).
Our research methods include the following: studying of filtration-volumetric parameters in rock samples, performing the thermal and geochemical studies of fluids .
Thermal and geochemical studies performed on core samples and on fluids extracted from sediments of Bashkirian sub-panel of a 1985 well in Akansky field showed that oil properties (namely its group composition) are not constant and uniform throughout the deposit but depend on the structure of the pore space, on the porosity, and the size of pore channels. In particular, we found out that oil that saturates large pores and cavities contains less oil fractions and more resins and asphaltenes. The fine pores of the rock matrix are saturated with lighter petroleum hydrocarbons, which predominantly have oils while the percentage of asphaltenes decreases.
These patterns can be explained by the process of chromatography (separation) of oil during its migration and filtration through some porous environments while filling up the collector and forming deposits. Assuming that petroleum is a colloidal solution where light hydrocarbons serve as solvents, and resin- asphaltene colloidal particles are the dissolved part, the process of filling the pores can be represented as follows. Under the influence of external forces and as a result of spreading in a porous environment, oil, when entering the collector, is subjected chromatography – the lightest and easily movable hydrocarbons (solvents) penetrate into finer pore channels (including the thinnest pores and micro cracks of the rock matrix), while the resinous asphaltene part dissolved in oil remains in the large pores and cavities. Thus, the distribution of oil in carbonate reservoir of Bashkirian sub-panel is as follows: rock matrix and its low porosity layers are filled with lighter oil, while heavier and viscous oil is accumulated in large pores and cavities.
A similar pattern in the distribution of oil properties in a reservoir is due to the character of the wettability (wet affinity) of the pore surface of the reservoir.
We must clearly understand the process of oil upheaval by water in non-uniform reservoirs with different porosity and size of filtration channels in order to develop recommendations for increasing efficiency of oil upheaval of water in carbonate reservoirs. Given the fact that the carbonate reservoir is mostly hydrophobic, its fine pores will be filled with light oil, which can be displaced only with the help of countercurrent and concurrent-countercurrent impregnation. This influences on the selection of EOR processes and oil from the formation and on petroleum engineering. This should be considered when selecting the technology of water injection.