

Ultraheavy Oil Deposition in Burgan Reservoir: Comprehensive Study on Petroleum System Process of Origin Mechanisms and Possible Development Solution of Tarmat Reservoirs in North Kuwait

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Abstract

Burgan formation is a major oil producing reservoir in Kuwait holding several oil accumulations associated with clastic reservoirs. However heavy oil has been discovered in basal parts of Burgan sandstone in some of the fields within North Kuwait. Development of Burgan in north Kuwait began in the 1950s with oil recovery since then from Burgan channel sands. Burgan Formation is well established producer in Kuwait fields with few exceptions in the North Kuwait as samples confirmed ultra-heavy oil. The Burgan Formation is a thick clastic sequence deposited during the Early Cretaceous. Deposition of the Burgan Formation began after a significant hiatus (6-11 Ma) with sands being sourced from cratonic areas to the west. The Albian Burgan Formation was deposited during high global sea levels. Despite the high sea levels, clastic influx periodically occurred across large parts of the basin. The field is characterized by a considerable number of faults. The depositional settings of these sediments have been interpreted to include: amalgamated channels, isolated marine/estuarine channels, shoreface sandstones and marine mudstones. In Burgan, oil bearing layers could be identified in the Burgan section in upper, middle and lower Burgan layers. Burgan sands are thicker and display wider areal extent but reviews of all core data, biostratigraphic information, and geochemical and petrographic analyses and NMR logs from few wells in lower Burgan confirms localized ultra-heavy oil deposition. A comprehensive geological study was done to evaluate reservoir flow units within the field, map individual sand bodies within each stratigraphic unit for further understanding this heterogeneity and development of the reservoir. Tarmat acts as a barrier between oil pool and water aquifers, so the aquifer does not supply pressure support to the reservoir as Tarmat has zero transmissibility. Identifying origin of Tarmat can help in predicting its occurrence in the field. As of today, no production is being taken from ultra-heavy oil due to lack of appropriate technology that can made it to flow. The typical features of Tarmat include sharply defined zones of viscous or asphaltic oil in lighter oil reservoirs, commonly occurring at the base on generally high-quality reservoirs which contain around 40-50% asphaltenes. This paper analysis the various precipitation mechanisms of heavy oil including low maturity, biodegradation, water / gas washing, gravitational segregation and reservoir pressure reduction. The study suggest assumption on its origin to help in predicting its occurrence in the field and viscosity profiles, coupling with baffle and compartmentalization occurrence that can justify sweet spot pick up and field development decisions. Appropriate environment friendly technology to be developed for exploitation of tar reservoirs as huge reserve of hydrocarbon is hidden with the tar beds in North Kuwait.