Evaluating Mobile Oil Saturation in Unpreserved Core by Low-Temperature Hydrous Pyrolysis, Wolfbone Field, Permian Basin, Texas

Tim Ruble[1], Michael Lewan[2], Derrick Whiting[1], David Bastian[1]
[1]Stratum Reservoir; [2]Lewan GeoConsulting Corporation

9.29.2020 - 10.1.2020 – AAPG Annual Convention and Exhibition 2020, Online/Virtual

Abstract

In the Permian Basin, the Wolfbone is an established target for unconventional hydrocarbon exploration. Assessing the quantity and quality of potential mobile oil saturation within these strata has traditionally been undertaken using a variety of laboratory experimental approaches. These typically include programmed pyrolysis and retort methods that quantify the volatilized oil fraction as well as Dean-Stark methods that utilize solvent extraction. In this study we have undertaken a comparison of these methods to low-temperature hydrous pyrolysis (LTHP) as an alternative technique for evaluating mobile oil saturations. Unpreserved core material was selected to assess the utility and limitations of using such samples for LTHP experiments in tight rock reservoirs. LTHP was conducted at 300°C for 24 h using 550 g of 8- to 20-mesh-size material in a one-liter Hastelloy-C276 reactor. Sufficient water was added to maintain a liquid water phase throughout the experiment. The released oil that accumulated on the water surface of the reactor was quantified (83 bbl/a-ft) and its composition was compared to oil produced from the same well. The quantities of oil released by LTHP are 1.2 times greater than those determined by programmed pyrolysis (68 bbl/a-ft), even when comparing unpreserved core to as-received material. In contrast, the quantities of oil released by LTHP are significantly less than those calculated by Dean-Stark (234 bbl/a-ft), suggesting that solvent based saturations are overestimating quantities of mobile oil by extracting substantial amounts of non-mobile

polar-rich bitumen. Evaluation of the post-LTHP rock material has been undertaken to better assess the composition of this retained immobile organic phase, which may offer new insights for enhanced oil recovery techniques. The detailed molecular composition of the oil released by LTHP has been compared with the production oil from the same well using gas chromatography to evaluate the utility of using LTHP oils as potential end-members for production allocation. Despite almost seven years of unpreserved core storage, the recovered 35° API gravity LTHP oil had well preserved mid-chain hydrocarbons (> C12) that would appear to be suitable for undertaking statistical evaluation in production allocation.