Qualifying Source Rock Properties with Reservoir Fluid Geodynamics

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Abstract

The distribution of hydrocarbon fluid compounds within a reservoirs is of great interest for production. Properties and distribution of compounds and phases determine production constraints. For example, GOR defines generally the type of producible hydrocarbons and asphaltene content has a serious impact on viscosity and thus on oil flow and production rates. Within this work we model the distribution of hydrocarbons over geological time in a reservoir for two different charging scenarios. The first scenario is a rather homogeneous charging according to established compositional generation and expulsion models which are common in basin and petroleum systems modeling. The other scenario is based on charging with strongly varying reservoir influx coming from a SARA-type (Saturates, Aromatics, Resins, Asphaltenes) source rock generation and expulsion model. We assume that the hydrocarbons, which are expelled from the source, are gathered in a reservoir in a first modeling step and that the reservoir has been filled initially with a hydrocarbon column in thermodynamic dis-equilibrium. In a second step we model how the trapped hydrocarbon distribution moves towards equilibrium. This process shows a continuous cross-over of different GOR, biomarker and asphaltene gradients within the hydrocarbon column. Each gradient might be in a different state at a different time not necessarily reaching equilibration at the same time. This second step represents geologic modeling of in reservoir processes on a geological time scale. This approach is rather new and has been named "Reservoir Fluid Geodynamics"*. The evolution of the compositional distribution over geological time provides valuable input to the risk management prior to production.