More from Less: Quantitative Models to Predict Fluid Properties (GOR) from Mud Gas Compositional Data

Lara Heister[1] and Andrew Pepper[1]

[1]This !s Petroleum Systems

Abstract

Organic geochemists have expended much effort in recent decades to understanding the systematics of carbon and hydrogen isotopes in the 'gas' components of petroleum: the seven routinely measured compounds with 1- 5 carbon atoms. However, there remains relatively little direct linkage between isotope interpretations and the fluid compositional information that a reservoir engineer might find useful—i.e., GOR, formation volume factor, density, and viscosity.

In terms of composition, understanding of the proportions of these seven compounds and their relationship to reservoir fluid compositions has been largely left to the reservoir engineers' PVT study. Thus, schemes for interpretation of mud gases—gases liberated during drilling—are qualitative and date back to 1969 (Pixler) and 1985 (Haworth). Most geochemical cross-plots relegate composition to a simple 'dryness' parameter (methane content).

Using a PVT database, we studied the systematics of C1–5 hydrocarbon compositions and ratios and their relationship with GOR in nonbiodegraded reservoir fluids. We also modeled the mixing curves resulting from biogenic-thermogenic gas mixing, which is common in young, cool reservoir systems.

A series of correction factors are required to correct for the fractionations that occur during release of the heavier hydrocarbons. Using the resulting tool GC2GORTM and a series of derived nomograms, we show examples of mud gas to GOR prediction in mixed biogenic-thermogenic fluids from the Horn Mountain Field in the deepwater Gulf of Mexico Basin.