"In Time" Estimation of GOR Using FLAIR Advanced Mud Gas Analysis

Oscar Eduardo Torres Jaimes[1], Bruno Okoh[2], Heidi Albrecht[2], Shahnawaz Khan[3], and Dariusz Strapoc[4]

[1]Schlumberger, Geoservices, 2103 Linea Del Pino St., Houston, Texas 77077

[2]Shell, FEAST Team, 150 N. Dairy Ashford Rd., Houston, Texas 77079

[3]Schlumberger, Geoservices, 300 Schlumberger Dr., Sugar Land, Texas 77478

[4]Schlumberger, Geoservices, 127 Ave. du Bois de la Pie, Paris Nord II, Roissy-en-France BP 67051, France

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ABSTRACT

The gas/oil ratio (GOR) is a very useful petroleum property for reservoir management. So, an early estimation of GOR, even while drilling, would be a valuable data for making quick decisions on collection of further downhole fluid information and/or well completion. This estimation could be done using the Advanced Mud Gas (AMG) technologies which can give data comparable to lab analysis of bottom hole fluid samples (BHS) in the range of C1 to C5. Few studies have been done to estimate this property while drilling and all of them use mathematical models based on oil equilibrium. This means that any active dynamic alteration process could be a limitation for those models. The present study used a different approach based on real downhole fluid samples from two specific Gulf of Mexico areas to obtain a calibrated GOR interpretative templates, which identify most of the secondary oil-altering processes. The available BHS data was processed through a statistical software to define fluid facies or fluid families for these areas. Then, each fluid family was subdivided into pristine (oils without any secondary gas charge) and altered oils (oils with addition of allochthonous gas). The calibrated GOR interpretative templates utilized through this study the most sensitive C1 to C5 gas ratios that define the local GOR, fluid maturity, and fluid families. This methodology allowed to draw the GOR isolines. Each fluid family showed a specific trend of the isolines, perhaps due to variability of their source rocks. AMG data from three GoM wells yielded GOR estimation within 10% uncertainty. The main limitation observed in these AMG data was the impact of drill bit metamorphism (DBM), and resulting contamination by artificial hydrocarbons generated. Hence, in moderate to high DBM-intensity intervals, the accuracy of the GOR estimations was reduced. Subsequently, AMG data from two wells out of the study area were plotted using same calibrated GOR interpretative templates, yielding repeatable accuracy of the GOR estimations (+/-10%). This potentially enables use of these calibrated graphics (fluid families and GOR) to other Gulf of Mexico basins. Nevertheless, the accuracy of these graphics would benefit from even

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larger training BHS data set. This early formation fluid evaluation helped with decision making for wireline sampling and measurements (optimizing acquisition of key detailed reservoir fluid data) and therefore impacting the reservoir fluid management.