Recognizing Bypassed Production and Oil Properties from Cuttings and Core Extracts of the Sihil Oil Field, Campeche, Mexico

Jeremy E. Dahl¹, J. Michael Moldowan¹, Marcio R. Mello², Francisco Fuentes³, Mario Limon³, Alfredo Vera⁴

¹Department of Geological and Environmental Sciences, Stanford University, Stanford, CA 94305-2115, USA, and Biomarker Technology, 2501 Blucher Valley Road, Sebastopol, CA 95472 USA. E-mail: jeremydahl@yahoo.com, ²Analytical Solutions, Rua Professor Saldanha, 115, Jardim Botanico, Rio de Janeiro, RJ, Brasil, ³PEMEX, Villahermosa, Mexico, ⁴PEMEX, Cd. de Carmen, Mexico

Biomarker analysis of extracts from side-wall core from Sihil reveals the location of missed pay zones within the reservoir, shows the gravity distribution of oil throughout the well, indicates the location of seals and barriers to migration, demonstrates reservoir compartmentalization along these discontinuities, and reveals why oil gravity differences exist in the reservoir. Cuttings and core samples from reservoir rock from two Sihil production wells, Cantarel Wells 418D and 3068, were extracted and biomarkers analyzed quantitatively. Based on ppm of various biomarkers it was apparent which horizons within the reservoir contained the most oil. Biomarker ratios were correlated to API gravity in produced oils to determine the vertical API gravity distribution of oil in the reservoir from biomarker ratios in the extracts. Oil gravity was then plotted along with abundance for the two wells to determine all producible zones. As a result, many producible zones, which have been bypassed (assuming sufficient porosity and permeability exist) are clearly visible. Furthermore, it is quite apparent that producible oil extends to a depth greater than that of the wells suggesting deeper drilling should result in new production (again assuming appropriate porosity and permeability).

An abrupt shift in biomarker ratios occurring over a very short vertical distance suggests that the Tithonian-Kimmeridgian boundary is a barrier to migration in the Cantarel 3068 Well (see figure below). Heavier oil is found above this seal and lighter oil below it. Biomarker ratios indicate that both source and maturity account for differences in oil gravities in the reservoirs. This in turn suggests different migration pathways for oils above and below this barrier to flow.