



## Properties of Thermogenic and Microbial Hydrocarbon Mixtures at Gunflint Oil Field and Implications for Exploration in the Gulf of Mexico

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### ABSTRACT

The Gunflint oil field in Mississippi Canyon blocks 948 and 992 in the deepwater U.S. Gulf of Mexico is comprised of stacked middle Miocene turbidite reservoirs charged with hydrocarbon mixtures of thermogenic oil and microbial (“biogenic”) gas. The discovery well, MC948-2, proved reservoir fluids of both liquid and vapor phases with varying PVT properties distributed in a seemingly random trend with depth. This study seeks to bring order to this distribution by integrating carbon isotope and biomarker geochemical analyses of mud gas and downhole reservoir fluid samples with filtrate contamination-corrected PVT analysis results. This integrated study indicates that the thermogenic oil component of the reservoir fluids is low GOR, low API, and very low maturity that increases slightly with depth. The varying microbial gas fraction in the hydrocarbon mixtures is the key control on fluid properties: the greater the microbial gas fraction, the higher the GOR and the lower the in-situ viscosity of the overall mixture. However, there is little, if any, correlation between API gravity and GOR, viscosity, or microbial gas fraction; this may be due to increased gravity segregation of resins and asphaltenes when a larger, destabilizing microbial gas fraction is present in the hydrocarbon mixture. Lastly, this study explores the relationship between reservoir age and carbon isotopic ratios to determine the source beds for the microbial gas, the generation timing, and extent of vertical migration in the stacked accumulations.