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Petroleum Migration Patterns in Faulted Traps Deduced from Geochemical and Fault-Seal Studies, Columbus Basin, Offshore Trinidad

Integrated geochemistry and fault-seal studies offer a greater understanding of the petroleum filling histories and product distributions in Plio-Pleistocene shelf deposits of the Columbus basin. The SE. Galeota (SEG) complex is a low-relief, faulted anticline containing stacked gas ± oil accumulations distributed across fault blocks separated by normal faults. Geochemical data show a systematic pattern of decreasing maturity and increasing biogenic gas fraction laterally from NE to SW within the same stratigraphic interval, but less systematic patterns in a vertical sense. Combined with fault-seal observations, these results imply that filling occurred by lateral migration and fill-spill along sand carrier beds with faults creating trapping geometries, acting as flow barriers, and limiting cross-stratal communication between sands. Samaan oil field is a high-relief anticline where stacked shelf sands are dissected by a network of conjugate extensional faults that compartmentalize oil and gas accumulations. Geochemical data show both vertical and lateral compositional variations and the highest maturity petroleum in shallow reservoirs. These patterns can be explained by horizon-based migration from the NE in a system where the source rock is undergoing differential uplift and carrier beds of variable regional extent capture different fractions of the total petroleum charge. Although both fields were charged by horizon-based migration, the end results are dramatically different. In the SEG area, the low-relief nature of the structure allows different maturity products to be geographically segregated from one another in separate fault blocks. In contrast, the high-relief Samaan structure captured the entire charge into the same 4-way closure.