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To Deepwater Sergipe Basin and Beyond: Q&A from Integrated Geoscience Investigations of Oils From Recent Wells

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Abstract:

Although deepwater Sergipe Basin has giant potential from discoveries between 2011 (Barra) through 2015 (Poco Verde-4), the petroleum system had not been described. We addressed this lack by consideration of source (type, physical and age distribution and maturity), hydrocarbon migration (distances, conduits and barriers), and tectono- sedimentary controls (crustal type and distribution, thermal inputs, and influences on source, seal and reservoir). Starting with a recently-enhanced group of oils plus cuttings analyses, we re-evaluated older piston cores placing our point data in context with potential fields and structural maps, all referenced to published material which largely discussed onshore / shallow-water regions.

Proven source intervals Coqueiro Seco and Barra de Itiuba extend from onshore basin limits nearly to the base of continental slope in a region of well-defined rifting with alternating coast-parallel horsts and graben that strongly influence source deposition. Outboard of the shelf break, rift architecture wanes towards the continental-oceanic crust boundary. The mainly drift-age outboard section is punctuated by Eocene intrusives and cross-cut by the Japaratuba, Piranhas and (Rio) Sao Francisco channel and canyon systems. Deepwater exploration targets are turbidite / MTDs with structural enhancement related to Eocene volcanism and related post-depositional thermal sag. The relatively unfaulted, mud-dominated system may be charged via sills and dikes that enhanced migration into the turbidite reservoir targets.

Deepwater discovery oils are geochemically similar to near-shore oils sourced from the syn-rift. Maturity inboard is from source burial depth whereas outboard (where overburden thins), maturity is reached with thermal input from Eocene volcanism. Sole evidence for a younger (presumed marine C-T) source is likely a contaminant: oleanane, seen in two wells directly updip from dikes. Volcanic heating locally has matured the younger oleanane-containing source while fracturing associated with diking provided a migration path into the adjacent turbidite reservoir.

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