

Petroleum Charge History of a Stacked Reservoir Offshore Brazil as Inferred from the Distribution and Geochemistry of Petroleum Inclusions

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The Peroba-3 well contains a shallow, biodegraded producible oil zone underlain by an intermediate oil show (slightly biodegraded) and a deep oil show (unbiodegraded). The objective of this study was to screen for the presence of petroleum inclusions (PI), use this information for determining the extent of paleo-oil zones, and compare their geochemistry to oils, oil shows and rock extracts. A Grains with Oil Inclusions (GOITM) value of 5.3% in the producible oil zone is moderate but PIs are small (< 5 µm) and there are few within grains.

Lower GOI values (0.7-2.0%) in the intermediate oil show interval are evidence for migration and possibly accumulation of oil. In the deep oil show PIs occur more frequently (GOI = 9.6-19%), are larger and are more abundant within grains. Their geochemical signature is similar to the oil show in terms of secondary alteration (nonbiodegraded), maturity (peak oil window) and source signature (clay-rich, probably Cretaceous or younger, carbonate-poor, suboxic marine shales).

It does not correlate with the less mature and lacustrine-influenced producible oil or the intermediate oil show, nor does it correlate with the significantly less mature marine mudstones in the well. Similar peak oil window maturities are indicated by parameters calculated from a wide boiling range of compounds, so PIs probably trapped oil from a single charge event. Both paleo- and current oil in the deep oil show interval differ from the upper producible oil and we infer that they were generated from a deeper source and migrated vertically.