Role of faults as migration pathways: insights from 2D basin modeling in Recôncavo Basin, Brazil

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The Recôncavo Basin is a Late Jurassic-Early Cretaceous asymmetric rift in Northeastern Brazil. Its sedimentary column can be divided in (1) a fluvial-eolian-lacustrine pre-rift sequence and (2) a syn-rift sequence with lacustrine, deltaic and fluvial shales and sandstones. The lacustrine shales of the Neocomian Candeias Fm. have been recognized as the most important source rocks.

Given its importance for the comprehension of petroleum systems, the role of faults during secondary migration has long been debated. Aiming to better understand the migration pathways in the Recôncavo Basin, one dip cross-section has been modeled with the Temispack 2D basin modeling software. Petrophysical properties were attributed to the normal fault zones in order to model petroleum accumulations. Two major migration pathways were successfully modeled. In the first one, petroleum from the Candeias Fm. migrates downwards to the pre-rift carrier beds of the Água Grande Fm., and then updip through a series of faulted blocks until reaching structural highs. Migration modeling suggests that the normal faults segmenting the pre-rift section acted as conduits, allowing petroleum to pass from carrier beds in the footwall to those in the hangingwall block, particularly to the major reservoir (Sergi Fm.), which is stratigraphically below the Água Grande Fm. In the second migration system, petroleum moves updip in the Candeias Fm., filling intercalated turbidites. Modeling results indicate that migration through the lacustrine shales above the Candeias Fm. to the deltaic reservoirs was facilitated by faults that cut most of the sedimentary column.