

Five Kilometers of Paleozoic Sediments Beneath the Pre-Salt of Santos Basin

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Abstract

The Early Cretaceous Syn- to Post-Rift Pre-Salt petroleum system of the Santos and Campos Basin in Southeastern Brazil is already one of the most prolific petroleum systems of the world. In only ten years after the first discovery of light oil in the uncommon microbialite reservoirs 10 fields are already producing over 875,000 bopd and 34.3 MMm³/d of gas, for a total of 1,090,700 boepd from only 52 wells. Some wells produce slightly over 36,000 bopd (ANP Oil and Natural Gas Production Bulletin, December 2015). Circa 40-50 Gboep have been discovered by Petrobras and statistical extrapolations point to yet-to-find-oil resources between 120-217 Gbor. Three super-giant fields are known in the Santos Basin: Lula/Tupi, Buzios/Franco and Libra. Several other giant fields such as Guará/Sapinhoá, Carioca/Lapa, Iara, Iracema/Cernambi, Carcará, Sagitário, Pão de Açúcar and the pre-salt accumulation under the Cretaceous/Palaeogene sandstone reservoirs of the Whales Park; these last two in the Campos Basin, complete the scenario of this prolific petroleum province.

What if, beneath this rich and prolific petroleum system in the Santos Basin, a whole new exploratory play(s) existed? What if a large chunk of a previously continuous and enormous Paleozoic Basin remained trapped below the Early Cretaceous rifts as an underlying Pre-Rift Supersequence? What if this Pre-Rift basin contained the entire stratigraphic section known in the nearby Paleozoic onshore Paraná Basin with thicknesses of up to 5 km? What if in this Paleozoic section an extremely rich source rock is known to exist? What if most of the structural traps of the rift section are mirrored in the underlying Pre-Rift section?

The economic implications of this hypothesis are outstanding. If proved true, another potentially rich petroleum system would exist underneath the mighty Pre-Salt petroleum system. This petroleum system would be sourced by the organic-rich shales of the Irati Formation. Light oil, condensate and gas should be expected to occur in the Botucatu and Pirambóia eolian sandstones, right underneath the Serra Geral/Camboriú basalts. The traps would be the same structures already known in the Pre-Salt system. Faulted blocks, rotated or not, hold the majority of the reserves of the Pre-Salt petroleum system. These same structures could hold additional reserves in the deeper Irati-Botucatu/Pirambóia petroleum system; provided that mapping indicates the existence of this deep reflective tabular section.

The best way to prove or not this hypothesis would be the drilling of an exploratory well, or the deepening of an appraisal well, in the highest structural position of the Lula/Tupi structure (see Figure 5). There, the Pirambóia and Botucatu sandstones could be reached by a well less than 6000 m deep, after crossing circa 500 – 600 m of the Camboriú lavas.