

SEISMIC INTERPRETATION OF IGNEOUS INTRUSIONS AND THEIR IMPLICATIONS FOR THE ATYPICAL PETROLEUM SYSTEM IN SE PARNAIBA BASIN, BRAZIL

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After almost two decades of few exploratory efforts in the Parnaíba basin, recent gas discoveries have revived the economic interest in this region. A new exploratory play was successfully tested, confirming the efficiency of the igneous sills triggering the thermal effect on source rocks maturation, and also playing an important role as unconventional trap and seal. Parnaíba Basin was affected by two Mesozoic magmatic events: the Mosquito Formation (Lower Jurassic) and the Sardinha Formation (Lower Cretaceous), both characterized by basic magmatic rocks. Around 2900km of 2D seismic reflection data in the southeastern region of Parnaíba Basin were interpreted in order to identify and describe the diabase sill's geometry, suggesting its implications for the atypical petroleum system. The main sill geometry identified in the area was the saucer-shaped sill, a fundamental geometry broadly interpreted in sedimentary basins worldwide. Many other sill shapes were also interpreted in the seismic data, showing the variety and importance of sill emplacement for the structural framework of the poorly deformed intracratonic Parnaíba basin. The identified sills were classified in three types: A, B, and C, according to their main geometries and the stratigraphic position of their host rocks. From base to top, Type A sills intrude the Pre-Silurian Sequence, that fills in graben structures of the basement aligned to the Transbrasiliiano Lineament. They have short lateral continuity and saucer-shaped geometry. Type B sills intrude mainly the Silurian Sequence and have a very long lateral continuity when intruding the shales of Tianguá Formation, in which they are horizontal tabular. Type C sills intrude the top of the Devonian Sequence and have two main geometries: saucer-shaped and horizontal tabular. By correlation to the surface geology of the area, Type C sills are interpreted as part of the Sardinha Formation (Lower Cretaceous). Considering the atypical hydrocarbon play of the basin, some potential trap features, associated with sill geometry, were identified, using as an analogue the recent successfully tested plays in the basin. These traps are associated to a specific sill geometry, called here as "inverted saucer-shaped sill". This geometry consists into a horizontal sill, placed on the top of a potential reservoir formation, limited on their two tips by two steeper sills, that may be connected to a lower horizontal sill, normally intruding a deeper potential source rock. The emplacement mechanism controls responsible for this geometry are still unclear. Therefore, it is necessary to improve the researches about igneous sill's emplacement in the Brazilian cratonic basins, especially in the Parnaíba basin, for an exploratory purpose.

KEYWORDS: PARNAIBA BASIN; SAUCER-SHAPED SILLS; ATYPICAL PETROLEUM SYSTEM