Correlation of facies, porosity and permeability of the Santos Basin's Pre-Salt and implications on the quality of reservoirs

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Abstract

The Pre-Salt integrates a sequence of sedimentary rock's layers of silty-clayish and carbonate character that were formed during the Aptian (125-113 Ma), being later covered by evaporitic rocks at the beginning of the Albian (113-114 Ma) as a result of the breakup process of the supercontinent Gondwana. The specific geological configuration resulted in an excellent quality of the stratigraphic trap, which currently extends from the Santos Basin's central part to the Campos Basin's northern portion. The Santos Basin is located on the east coast of Brazil. It has an area of approximately 350,000 km², which subtends the coasts from Florianópolis-SC to Cabo Frio-RJ, advancing about 600 km towards the Atlantic Ocean. With oil reserves in the order of 100 billion barrels, the Santos Basin is currently one of the country's most important oil and natural gas provinces. Located about 4 km below the seabed, the carbonate rocks of the Barra Velha Formation of the Santos Basin contain a large amount of oil, whose disposition and quality in the reservoir vary according to the structural control of the porous medium in the sedimentary facies. Understanding the Barra Velha Formation carbonates is a great challenge for geoscientists due to its complex depositional configuration and diagenetic history, in which the lithotypes' texture and composition differ from any other analogous reservoir-rock already described. In order to understand the quality standards of Pre-Salt hydrocarbon reservoirs, this Scientific Initiation work seeks to correlate facies with the ordering of porosity and permeability of carbonate rocks from the Barra Velha Formation through quantitative and qualitative descriptions of rock samples, thin-sections and well-logs data (cores, gamma rays, resistivity, *etc.*) from the Tupi Field in the Santos Basin, obtained from the Exploration and Production Database (BDEP/ANP) under the ANP public data availability regime. In this sense, out of the integration of petrographic descriptions data, the objective is to elaborate on the Petrel™ software a 3D model of facies and distribution of porosity and permeability for the Pre-Salt carbonate reservoirs in the Santos Basin so that one can infer the portions with the better oil and gas storage conditions.