



## Laboratory geophysical measurements of pre-salt rock samples from Tupi Field, Santos Basin

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This paper was prepared for presentation during the 18<sup>th</sup> International Congress of the Brazilian Geophysical Society held in Rio de Janeiro, Brazil, 16-19 October 2023.

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### Abstract

The carbonate reservoirs of the Brazilian pre-salt have been the subject of several reservoir characterization studies in the last decades, due to their high geological complexity and unique features when compared to other world carbonate reservoirs. In this work, we performed a geophysical characterization of ninety rock samples from the Tupi Field, Santos Basin, including measurements of three geophysical parameters: magnetic susceptibility, radiometric concentrations from gamma-ray spectrometry, and ultrasonic velocities. The rock samples are cylindrical plugs extracted from a single well and they represent the carbonate rocks from different pre-salt facies. Magnetic susceptibility measurements were obtained from a portable equipment with the goal of understanding the ferromagnesian composition of the rocks, as well as discussing their origin using the geological knowledge of the Basin evolution. The gamma-ray spectrometry provided the concentrations of K (%), U (ppm) and Th (ppm), from the count of gamma-ray radiation counts per second in different ranges of the sensor's energy spectrum. A portable gamma-ray spectrometer with a bismuth germanate sensor was employed in this study. The results contributed to the discussion of the association of certain minerals present in samples. The ultrasonic velocity measurements are being carried out using an experimental apparatus that includes a confinement cell where the samples are pressurized to the levels expected in pre-salt depths. These velocities are used to estimate elastic parameters that contribute to the description of the different carbonate facies and allows a geomechanical analysis to be carried out. The pre-salt geological facies established for the samples are: Mudstone, Muddy spherulitestone, Packstone, Wackstone, Grainstone (Grainstone/Rudstone) and Spherulitic shrubstone/mudstone. A statistical and correlation analysis of the geophysical data with respect to the carbonate facies allowed to establish patterns for each one of them. So far, significantly different Th and U values have been identified in the Wackstones samples when compared to the other facies. It was also noted that the coarser granulometry facies, such as Grainstone and Packstone, are associated with higher U and K values, with the exception of Wackstones. The measurements of ultrasonic velocities have a great potential to contribute to the characterization of the facies in terms of elastic and geomechanical parameters. Considering the distribution of the plugs in depth, this work provides interpretations that could be extended along the wells where plugs are not available.