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Different Types of Traps in the Pre-Salt of Campos Basin: Jaspe Block Case Study

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Introduction

Following the 2010 discovery of the Pão de Açúcar prospect in the pre-salt of the Campos Basin, a paradigm shift occurred regarding the types of hydrocarbon traps recognized within this play. This discovery revealed high-quality gas and condensate accumulations within an unconventional four-way dip closure (4WC), which was not structurally sealed by the contour of the base-salt unconformity, but rather by lateral facies variations of high- and low-energy carbonates. This exploratory milestone significantly increased industry interest in similar pre-salt plays. As a result, the Brazilian National Petroleum Agency (ANP) has delineated new blocks based on analogous structural characteristics — one such example being the Jaspe Block, located in deep waters of Campos Basin and covered by modern 3D seismic data processed with advanced Full Waveform Inversion (FWI) techniques.

Method and/or Theory

Initially, the mapped horizons comprised the top and base salt unconformities, delineating a four-way dip closure (4WC), within the block's main structure. However, as observed in the Pão de Açúcar case, the potential for an alternative trap mechanism within the Jaspe structure was identified — one governed by lateral facies variations within carbonate platforms, as proposed by Viera de Luca (2017). To aid in horizon mapping and facies discrimination, various seismic attributes such as sweetness, RMS amplitude, instantaneous amplitude, and TecVA were applied.

Results and Conclusions

Attribute extraction and mapping enabled a clearer identification of distinct seismic facies within the structure. In this study, two main seismic facies were identified. The first is characterized by internally chaotic and high-amplitude geometries, typically associated with carbonate build-ups and platform environments and commonly indicative of reservoir intervals. The second exhibits more continuous, parallel to sub-parallel reflectors, which are characteristic of non-reservoir facies, such as shales, limestones and mudstones. The interpretation of these seismic facies also allowed paleoenvironmental interpretations, even in the absence of well data. Typical reservoir facies were deposited over basement highs, exhibiting significant thicknesses and seismic geometries characteristic of carbonate platform or build-ups in elevated areas. In contrast, non-reservoir seismic facies drapes and onlaps the basement highs and the build-up facies, indicating possible onlap termination against higher structural relief, suggesting a deeper portion of the paleo-lake (limestones and mudstones deposits).

These interpretations contribute to a more precise subsurface characterization, refining the geometry and definition of pre-salt prospects. The resolution and quality of seismic data remain key, especially for identifying facies at greater depths. The recognition of new trapping mechanisms has the potential to revitalize exploration in the mature Santos and Campos basins, unlocking new opportunities and redefining the exploratory frontier of Brazil's pre-salt province.