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Submarine Channel Complex of the Barreirinhas Basin, Brazilian Equatorial Margin: Evolutionary Analysis from the Campanian to the Maastrichtian for Reservoir Prediction.

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Introduction

Brazil continues to stand out as one of the world's leading oil producers. While the Campos and Santos basins currently account for a large portion of the country's production, the Margem Equatorial Brasileira (MEB) has gained strategic prominence, driven by recent discoveries in geologically analogous regions such as the basins of French Guiana, Suriname, and the Gulf of Guinea. This context reinforces the high potential of the still underexplored MEB, particularly in areas like the Barreirinhas Basin. Geologically, the MEB results from the separation of the South American and African continents during the opening of the Equatorial Atlantic. It is characterized by mixed tectonics, with both extensional and compressional episodes driven by the activity of transform faults. Among the basins that make up the MEB, the Barreirinhas Basin shows promising prospects, although it still lacks detailed studies on its petroleum systems, especially in deep-water domains. This study focuses on seismic analysis from the Campanian to the Maastrichtian, aiming to understand the geometry of different geological features and the depositional environment.

Method and/or Theory

The seismic interpretation was conducted using a depth-migrated volume covering an area of approximately 1,000 km², with data provided by the Brazilian National Agency for Oil, Natural Gas and Biofuels (ANP). To complement the analysis, two deep-water wells were used, which provided geological data and well logs, including gamma ray, sonic, density, and neutron profiles. Additionally, seismic attributes such as RMS Amplitude and Sweetness were applied to enhance lithological contrasts and support the identification of possible unconformities or depositional boundaries.

Results and Conclusions

Well logs indicated sandstone layers associated with sedimentary cycles and stratigraphic variations showing vertical thinning toward the top. Seismic interpretation revealed the presence of an extensional-compressional system, with fault-propagation folds and structures that deformed originally parallel-layered strata; the main faults are oriented NW–SE. Based on the analysis of seismic attributes, amplitude anomalies were mapped, possibly linked to sandy intervals. To improve the characterization of these structures and assess their exploratory potential, advanced seismic attribute analyses and unsupervised machine learning techniques were applied, aiming to enhance the understanding of seismic facies and depositional boundaries in the region. Preliminary results indicate significant potential for the occurrence of reservoirs, structured within apparently confined channels, with no presence of levees, avulsions, or fans, and displaying a linear morphological pattern. Although further studies are necessary, current data reinforce the strategic importance of the Barreirinhas Basin as a promising exploratory frontier for the future of Brazil's energy sector.