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Magnetic and Gravity Modeling of the Internal Architecture of the Potiguar Basin, calibrated by well and seismic data.

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Introduction

The Potiguar Basin, located on the Brazilian equatorial margin, is one of the main onshore oil-producing provinces in Brazil with significant economic and scientific importance. Understanding its internal architecture is essential to improving geological models and optimizing hydrocarbon exploration strategies. This study deals with a joint 2D magnetic and gravity modeling along strike and dip profiles to investigate the internal architecture and crystalline basement of the Potiguar Basin. The modeling were calibrated by well data and composite seismic sections, allowing a geologically consistent interpretation of the architectural structures. Our results include the delimitation of crustal domains, the identification of deep faults and the mapping of internal basin areas with potential for hydrocarbon exploration.

Method

The investigation of the internal architecture of the Potiguar Basin was conducted based on the integration of magnetic and gravity data, with geological and geophysical information from wells and 2D seismic lines. The adopted methodological approach consists of processing gravity and magnetic data obtained from regional surveys, constructing 2D geophysical models along the dip and strike transects and across the Potiguar Rift and surrounding depositional platforms modeling them using the GMSYS plugin of the Oasis Montaj software.

The internal geometry of the basin was interpreted in the seismic sections. The acoustic basement top was converted from time to depth based on seismic velocity models, constrained by well data. In addition, intra-basement magnetic susceptibility and density variations were estimated using an inversion method applied to juxtaposed vertical prisms. This approach allows the mapping of geological domains beneath the basin.

Results

The integration of magnetic, gravity, seismic and well data in the 2D modeling of the Potiguar Basin provided a detailed overview of its internal structure. Mapping of deep structures, such as crustal faults and shear zones, shed light on the tectonic inheritance of the Precambrian fabric in the rift basin onset in the Early Cretaceous. Joined magnetic and gravity inversion was able to characterizing the crystalline basement, differentiating domains with distinct physical and geological properties. The final 2D models were constrained by and validated by well and seismic. The basin architecture derived from our geophysical approach is an important contribution to the tectonic-sedimentary evolution of the Potiguar Basin in the NE sector of the Brazilian Equatorial Margin.