

Northern Pelotas Basin: Stratigraphy and Basin Development

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Introduction

The underexplored region of the northern Pelotas Basin, Southeast Brazil is gaining attention due to a series of discoveries on the African margin. Conjugate discoveries to the Southern Pelotas region have translated to renewed interest in the greater area. The area of Northern Pelotas sits south of the Santos Basin salt province containing a mix of features between the two depositional settings. Newly acquired 3D seismic data reveal volcanic basement structure and complex overlying stratigraphy. In this study, we assess the correlation of regional events leading to the crustal deformation and evaluate the hydrocarbon prospectivity of the stratigraphic overburden units using available well data points and seismic facies.

Method and/or Theory

For this analysis we use locally dense, 2D and 3D seismic data totaling 115,000 km and 17,450 km² respectively. A collection of structural-enhancing seismic attributes was calculated to identify fault trends within the economic basement and the sedimentary packages. Additionally, instantaneous seismic attributes were also calculated to identify prospective reservoir units in the basin. Publicly available exploration well results were used to constrain the key geologic ages of sedimentary units.

Results and Conclusions

The South Atlantic volcanic margin development occurred in the Early Cretaceous, from south to north. The greater Pelotas Basin developed as a magma-rich margin setting via wide zones of Seaward Dipping Reflectors (SDRs). The 133-113 Ma accretion of SDRs continued until the magmatic supply waned and the onset of oceanic crust production began. By placing the study area in a regional context, the observed Early Cretaceous basement attenuation can be linked to the Abimael Propagator, a failed spreading ridge previously documented in the southern Santos Basin, but, less documented in this area of interest. Confirmed by wells on the paleo-shelf margin and localized highs, packages of Albian carbonates accumulated in shallow marine settings while the margin was still thermally buoyant. Attribute extraction from the shelf-positioned Albian carbonate interval reveals shoaling of the internal seismic facies that are analogous to the oncolithic-rich reservoirs of the nearby Santos Basin. Once thermal subsidence was underway, the deposition of clastic sedimentary deposits occurred. Cretaceous channel facies, mass transport units (MTCs), Tertiary channel complexes and turbidites have been mapped across the shallow and deep-water domains. These reservoir facies are complemented by the recorded evidence of three organic-rich source rocks in the basin, with total organic content (TOC) as high as 4.8%.

Integration of 2D and high-resolution 3D seismic data have revealed the extent of early SDR deformation related to the Abimael failed rift event with a northern termination in the Santos Basin. Calculated seismic attributes on reservoir facies, conjugate data points, and well analysis indicate an elevated level of prospectivity in the region. The insights gained from these analyses are integral for assessing potential plays and understanding the basin's tectonostratigraphic history.