



SBGf Conference

18-20 NOV | Rio'25

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Submission code: PQ5N79Z040

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Influence of Salt Tectonics on the Geomorphology of the Central-Southern São Paulo Plateau, Santos Basin (Brazil)

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Introduction

The Santos Basin is considered one of the most important sedimentary basins in Brazil due to its proximity to the country's most populous regions, as well as to major ports, tourism hubs, and oil and gas exploration areas. Despite advances in research, primarily driven by the discovery of pre-salt reservoirs, the region still lacks detailed geomorphological mapping, especially in its deeper sectors. Within this context, the São Paulo Plateau stands out due to its broad extent, geomorphological and environmental diversity, and the presence of hydrocarbon exploration activities. In this sector, the Tupinambá High emerges as a prominent morphological feature, characterized as an elongated structural uplift that exerts control over the geological organization and geomorphological expression of the overlying units. The recent acquisition of high-resolution multibeam bathymetric data from the central-southern portion of the plateau presents an opportunity to advance the understanding of seafloor morphology associated with salt tectonics. Accordingly, this study aims to characterize the morphological features of this sector and to analyze the influence of salt tectonics on the submarine geomorphology of the central-southern São Paulo Plateau.

Method and/or Theory

For this purpose, unpublished multibeam bathymetric data (15 m resolution), provided by TGS Brazil through a cooperation agreement with the Fluminense Federal University, were used. Geomorphometric analyses—such as slope, aspect, and roughness—were performed using geoprocessing tools. In addition, 2D seismic data from the Brazilian National Agency for Oil, Natural Gas and Biofuels (ANP) were used to verify subsurface features such as faults and salt diapirs, which influence the overlying submarine morphology. Furthermore, regional gravity data were incorporated to enhance the interpretation of subsurface structural variations and to better constrain the salt tectonic framework affecting the study area.

Results and Conclusions

The results reveal a set of morphological features, including minibasins, ridges, crests, and fault scarps, whose distribution and geometry reflect the dominant role of halokinetic processes associated with the underlying evaporitic sequence. Halokinesis is identified as the primary structuring agent of the landscape in this sector of the São Paulo Plateau. Within this framework, the Tupinambá High stands out as a structural elevation that significantly controls local salt tectonics. Resulting from basement uplift, this structure directly influences the mobility of salt from the Ariri Formation, acting as a key morphological control on the seafloor relief. Its development conditions the formation of domes, depressions, and elongated undulations on the seafloor, reflecting the interaction between halokinesis and post-salt sedimentation. These analyses expand the understanding of seafloor features influenced by salt dynamics and provide valuable insights into the geomorphological configuration of the São Paulo Plateau.