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Gravimetric Survey in the Pirapetinga Graben (Resende-RJ): Estimating Sedimentary Thickness and Subsurface Density Variation

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Introduction

The Pirapetinga graben is located in the northwestern sector of the Pirapetinga River hydrographic basin, in Resende (RJ). Morphostructural evidence indicates that this graben may have formed during the Quaternary, as a result of neotectonic reactivations. However, recent studies based on numerical modeling suggest its initial formation may date back to the Paleogene. This tectonic structure is associated with prominent morphotectonic features, such as colluvial fans, paleochannels, and fluvial terraces. The area's morphostructural configuration, together with drainage asymmetry and straight river segments aligned with NE–SW lineaments, supports the hypothesis of recent tectonic activity. In this context, the present study proposes the acquisition of gravimetric data over the Pirapetinga graben to characterize its subsurface sedimentary fill. The estimated sedimentary thickness will help determine the possible existence of a new sedimentary basin belonging to the Central Segment of the Southeastern Brazil Continental Rift (RCSB), as well as contribute to the understanding of the graben's tectono-sedimentary evolution and the timing of its opening.

Method and/or Theory

The methodological approach is based on the acquisition of gravity data along one profile parallel to the Pirapetinga graben axis. The gravity method is particularly effective in detecting density contrasts between basement blocks and sedimentary fill, being especially suitable for delineating rift structures, which are typically associated with negative Bouguer anomalies due to the accumulation of low-density deposits. Gravity stations will be positioned using dual-frequency GNSS receivers to ensure altimetric precision for the complete Bouguer anomaly calculation. The acquired data will undergo standard corrections (instrumental drift, tidal, and terrain corrections) and will be interpreted using two-dimensional (2D) forward modeling, supported by previously mapped geological and structural data. The integration of gravimetric models with morphotectonic evidence aims to refine the structural interpretation of the graben and assist in distinguishing between Tertiary and Quaternary tectonic events.

Results and Conclusions

At this moment, the acquisition and processing of the gravimetric data have been successfully completed. The dataset is currently in the modeling phase, in which profiles will be extracted from the database. On these profiles, two-dimensional (2D) forward modeling techniques will be applied, with the objective of generating representative sections of the subsurface density variation along the acquired profile. This modeling will allow the estimation of the thickness of the sedimentary deposits and the identification of density variations that may be related to internal structures of the Pirapetinga graben.