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Terrestrial Gravimetry Applied to the Characterization of the Crustal Structure of the Serra da Lua Region, Roraima: Preliminary Insights within the Guiana Shield of the Amazonian Craton

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Introduction

Serra da Lua, located in the south-central region of Roraima State, lies within the southern sector of the Guiana Shield—one of the least studied geological provinces in northern Brazil. The area comprises migmatitic orthogneisses, deformed granites, charnockites, and mafic-ultramafic intrusions, associated with the Rio Urubu Belt, a structure linked to the Akawaí orogenic evolution (ca. 1.96–1.91 Ga). These lithologies display intense heterogeneous deformation, characterized by NE–NW-trending ductile shear zones interspersed with domains that preserve magmatic and structural features of reworked continental crust. The complex crustal architecture of Serra da Lua, combined with the limited availability of geophysical data, presents a major challenge to advancing geotectonic understanding of the region. In this context, potential field methods — such as terrestrial gravimetry — are essential, as they allow indirect imaging of subsurface crustal structures. Gravity field variations reflect density contrasts in the crust and can reveal deep features like faults, crustal blocks, and zones of crustal thickening or thinning. This study presents preliminary results from a terrestrial gravity survey conducted in the Serra da Lua region, focusing on the characterization of the regional structural framework and the identification of crustal heterogeneities. The integration of gravity and geological data offers new insights into the tectonic evolution of southern Roraima and supports mineral exploration in underexplored areas.

Methodology

The gravity survey was conducted using a Scintrex CG-5 digital gravimeter. Measurements were corrected for instrumental drift, Earth tides, latitude, free-air effect, and Bouguer anomaly, adopting a standard rock density of 2.67 g/cm³. Corrected data were interpolated using kriging and separated into regional and residual components through low-order polynomial fitting and upward continuation. Signal enhancement techniques, such as vertical derivatives and horizontal gradients, were applied to highlight structural features at different crustal depths.

Results

The gravity data revealed anomaly patterns consistent with the regional tectonic framework of Serra da Lua. The spatial distribution of anomalies indicated lateral variations in crustal density and the presence of significant structural features. The separation of regional and residual components, combined with enhancement techniques, allowed the identification of gravity contrast zones that may correspond to geological contacts, fault systems, and crustal heterogeneities. These results reinforce the applicability of terrestrial gravimetry as an effective tool for investigating deep crustal architecture and provide valuable input for integrated geological studies in the region.