Processing and characterization of aeromagnetometric data from São João Alkaline Complex - Casimiro de Abreu - Rio de Janeiro.

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Abstract

The São João massif represents an alkaline complex (São João Alkaline Complex - SJAC) composed primarily of variations of syenites, exhibiting both melanocratic and leucocratic modes of exposition. It is in the district of Barra de São João, in the county of Casimiro de Abreu, in the southeastern portion of the state of Rio de Janeiro, Brazil. The complex represents one of the contemporary Upper Cretaceous plutonic basic magmatism events within the South American plate. Generally, this basic massif exhibits a divergent magnetic signature compared to the surrounding less basic wall-rocks.

By obtaining general magnetic susceptibility data for the rocky components in the area, it is possible to infer various characteristics of the rocks and the potential spatial delimitation of the subsurface body through numerical modeling and specific mathematical inversions. This study utilizes magnetic susceptibility data obtained from airborne surveys using a cesium-based magnetometer, made available through CPRM's 1117 project. The data was processed using the Oasis Montaj Student Version application. The work includes three-dimensional modeling of the non-outcrop portion of the SJAC, magnetic susceptibility maps, and digital terrain modeling using different data treatment processes.

This study indirectly investigates the subsurface portion of the massif, focusing on the magma-generating event, utilizing inversion and data processing techniques to analyze magnetic susceptibility recorded in the region. The interpretation of magnetic properties observed in the subsurface sedimentary and rock packages aims to provide valuable insights into the composition, history, and processes that have shaped the massif and the region.

A three-dimensional model was generated using numerical inversion methods to the observed magnetic anomaly data to estimate the shape, volume, and positioning of the subsurface rocky body. In this work, the aeromagnetic data processing and three-dimensional subsurface modeling of the SJAC were carried out to shed light on questions regarding the volume, area, and disposition of the non-outcropped body portion.

This model contributes to understanding the genesis, evolution, and specific composition of the rock, as the non-traditional subsurface form of the massif exhibits significant magnetic variations that consider even the smallest possible residual compositional variations in the surrounding or similar rocks.

The interpretation of the model and the conducted processes allowed the conclusion of a subsurface portion of the complex that was not traditionally observed, with a volume of intrusive rock much larger than initially expected when analyzing the morphology of the outcropping portion. The results indicate a high thermal amplitude associated with the event that generated the rock package, enabling the understanding of the thermal maturity of hydrocarbons present in contemporary basins to this one.