Integration of Radiogenic Heat, Thermal Conductivity, and Magnetic Susceptibility Applied to the Study of the Basement Adjacent to the Sergipe-Alagoas Basin

Dutra, A.C. (CPGG-UFBA); Costa, A. B. (CPGG-UFBA); Argollo, R. M. (DFTMA-UFBA); Sampaio, M. R. C. (IGEO-UFBA); das Flores, O. H. D. J. (IGEO/UFBA, FE/UniLúrio); Oliveira, V. A. R. (IGEO-UFBA).

Abstract

The study area is located in the basement adjacent to the western part of the Sergipe-Alagoas Basin, encompassing the states of Sergipe, Alagoas, and a portion of Pernambuco. Thermal conductivity, density, radiogenic heat, and magnetic susceptibility data were interpreted collectively with gamma-ray and magnetic spectrometry data. These were utilized to generate Potassium (K), Uranium (U), and Thorium (Th) content maps. The radiogenic heat map of the area necessitated the use of terrestrial density data. Thus, a new interpolation was conducted with U, Th, and K contents, employing the same spacing as the density data, to ensure compatibility. The same polygon was applied to the grids to maintain uniform formatting, preventing voids in the resulting map. With density values (ρ) in $kg.m^{-3}$, K in %, and Th and U in ppm, the radiogenic heat map A ($\mu W.m^{-3}$) was obtained. Subsequently, map overlays were performed to correlate different datasets and observe each individually. The objectives of this study were to comprehensively analyze the geological properties of the basement adjacent to the western part of the Sergipe-Alagoas Basin, spanning the states of Sergipe, Alagoas, and a portion of Pernambuco. Specifically, we aimed to integrate thermal conductivity, density, radiogenic heat, and magnetic susceptibility data with gamma-ray and magnetic spectrometry data. Through this integration, our goal was to produce detailed Potassium (K), Uranium (U), and Thorium (Th) content maps, crucial for understanding the geological composition of the region. To achieve this, we undertook the challenge of harmonizing the various datasets, including the incorporation of terrestrial density data for the creation of the radiogenic heat map. We conducted a meticulous interpolation of U, Th, and K contents, ensuring consistency with the density data spacing to maintain accuracy and reliability. Additionally, we applied consistent grid clipping techniques to preserve uniform formatting, thereby avoiding any potential voids in the resultant maps. The primary objective of this study was to establish correlations between radiometric and magnetic data obtained from previous investigations, thereby enhancing our understanding of the tectonic environment surrounding the Sergipe-Alagoas Basin. Our study sought to elucidate the structural features within the study area through detailed map correlations, particularly in the radiogenic heat and ternary maps, as well as the magnetic susceptibility map. These correlations yielded robust results, facilitating the delineation of key geological structures and enhancing our overall understanding of the basement adjacent to the Sergipe-Alagoas Basin. Ultimately, the successful execution of these objectives underscored the significance of integrating multidisciplinary geological data for comprehensive basin analysis. The insights gleaned from this study have contributed to a more nuanced evaluation of the geological framework surrounding the Sergipe-Alagoas Basin, thereby advancing our understanding of its geological evolution and resource potential.