Aerogeophysical Data Analysis for Generating Insights on the NW Tectonic Framework of the Gurupi Belt and Adjacent Sedimentary Basins

André Sena de Oliveira[1], Elton Luiz Dantas[2], Roberta Mary Vidotti[2], Alvaro Penteado Crósta[1]
[1] Universidade Estadual de Campinas - UNICAMP
[2] Universidade de Brasília - UnB

Abstract

The gradual advances in geophysical interpretation in hard-to-reach terrains, due to the substantial improvement in data acquisition, allows for a better characterization of geological environments that were previously hidden under sedimentary covers. In this way, unveiling the tectonic framework in various geotectonic environments (e.g., sedimentary basins, cratonic environments, mobile belts, rifts, etc.) has become increasingly routine. This work focused on the tectonic framework of the northwestern portion of the Bragantina Platform, specifically where the Neoproterozoic basement known as the Gurupi Belt is exposed. This is a difficult-to-access location with limited geological and structural information, and poorly detailed geological mapping. We employed aerogeophysical data from the Gurupi Aerogeophysical Project, conducted by the Geological Survey of Brazil (CPRM), that were interpoleted using the bidirectional method for magnetometry data. This was followed by the application of filters in the magnetic anomalies: i) Matched-filter (MF) to separate the geophysical response in the frequency domain into spectral bands and enable the analysis of the underlying architecture at depths of 22 km, 5.7 km, and 0.53 km; ii) Total Horizontal Gradient (THG) for detecting magnetic domains, structural trends, and the geometry of magnetic sources; iii) Tilt Derivative of Total Horizontal Gradient (TDR-THG) to identify lateral boundaries and lineaments associated with magnetic anomalies sources; and iv) Euler solutions to estimate the depth of the magnetic source. The results showed that subsurface structures, generally oriented along E-W and NE-SW, follow overall trends at depths of up to 22 km, representing older structures reactivated by NW-SE shear zones associated with the Tentugal Shear Zone. Euler solutions indicate that the magnetic source of E-W and NE-SW lineaments, in general, does not exceed 1300 meters in depth, while NW-SE structures associated with shear zones indicate magnetic sources at depths greater than 1300 meters. Existing regional geological maps were used for correlation with magnetic domains interpreted and, in general, showed good match. However, there is a need for more detailed geological mapping to achieve a better correspondence with the studied magnetic anomalies, which exhibit characteristics that are not evident in the geological maps. The results of this study provided a new overall characterization of the basement in the study area. A new perspective of the tectonic framework of the Gurupi Belt and the adjacent Sedimentary Basins was presented. The geophysical products indicated magnetic heterogeneity in the sedimentary basement of the Bragantina Platform. Magneto-structural domains attributed to the edge of the São Luís Craton, reworked by oblique shear zones of the Gurupi Belt, were recognized. Additionally, the magnetic sources related to the shear zones of the Gurupi Belt indicated significant depths of penetration along the edge of the São Luís Craton.

Keywords: Orogenic Belt, Gurupi Belt, São Luís Craton, airborne magnetometry