Geophysical signatures of Barra do Gameleira Intrusion, Tocantins.

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Abstract

The Gameleira Suite comprises mafic-ultramafic intrusions located in southeastern Tocantins, with the Barra do Gameleira Intrusion (IBG) being the most prominent among them. Covering an area of 8x10 square kilometers and exhibiting a rounded shape, this formation stands out due to its considerable mineralization potential. The study area is situated within the Tocantins Province, in the northern part of the Brasília Orogen. This region predominantly showcases exposed Paleoproterozoic terrains, such as the Almas-Conceição do Tocantins Terrane, characterized by TTG suites and meta-volcanosedimentary sequences known as the Riachão do Ouro Group. Geological and isotopic studies indicate that the IBG intruded the rocks represented by the TTG Suite and the Riachão do Ouro Group.

The significant contrast in chemical composition between ultramafic rocks and the neighboring units results in pronounced differences in their physical properties. The increasing maficity directly correlates with higher magnetization intensity, while inversely affecting the radiometric response of potassium (K), uranium (U), and thorium (Th). The presence of sulfide mineralizations leads to decreased resistivity and increased chargeability, whereas barren lithologies exhibit high resistivity values and low chargeability.

To characterize the entire IBG, aerogeophysical data was used, from the Tocantins Project (CPRM 2006), which included magnetic and radiometric measurements. These geophysical results were integrated with the geochemical prospecting of stream sediments and pan concentrates conducted by CPRM, along with the lithogeochemical data provided by Cooperbrita LTDA. By correlating the findings from various methods with the local geology, were defined three mineral prospecting targets: the North target, East target, and South target.

In consideration of the Ni-Cu(-Co-Au-PGE) mineralizations, terrestrial data (magnetometry, electroresistivity, and induced polarization) were acquired on the southern target. The geophysical results were then combined with soil geochemical data, leading to the development of a prospective model for this target.

Furthermore, were collected seven rock samples for microscopic analysis, petrophysical measurements, and macroscopic description. Microscopy involved both transmitted and reflected light techniques, with a focus on sulfide characterization. Petrophysical measurements included magnetic susceptibility and gamma spectrometry.

Through the integration of different methods and data, were demonstrated the efficacy of geophysics in recognizing mafic-ultramafic intrusions similar to those found in the Gameleira Suite, as well as identifying potential sulfide mineralizations. The laboratory measurements were consistent with the data inferred from aerial geophysics, thus reinforcing the obtained results. Geochemical anomalies indicated abnormal levels of Ni-Cu(-Co-Au-PGE), which correlated with anomalies of low resistivity and high chargeability, underscoring the effectiveness of the induced polarization method in identifying sulfide anomalies.