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Geophysical characterization of Chapada deposit based on magnetic and gamma-ray spectrometry data

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Introduction

The Goias Magmatic Arc is located north of Brasilia Belt and was formed during the collision of São Francisco-Congo, Amazonian and Paranapanema cratons. The Brasilia Belt is a tectonic zone composed of metasedimentary rocks, mafic-ultramafic complexes, and volcano-sedimentary sequences. The Chapada deposit, located within the Goias Arc Magmatic, is an important example of porphyry-type copper-gold deposit, where the mineralization is hosted by biotite-rich schists and gneisses. Magnetic and gamma-ray spectrometric airborne data enable the identification of tectonic structures and support the understanding of the genesis, location and dimensions of the bodies. In this context, this study aimed to characterize and describe magnetic and gamma spectrometric signatures of Chapada deposit, and to correlate these signatures with adjacent ore bodies using 3D magnetic data modelling to obtain information on their dimensions, magnetic susceptibility, and geometry.

Method and/or Theory

This study used airborne gamma spectrometry and magnetometry data Goias State airborne geophysical survey, available by the Geological Survey of Brazil. Magnetic and gamma-ray grids were generated using the Oasis Montaj software. For the magnetic data, an area of approximately 6000 km² was selected which contains Chapada, Zacarias and Posse deposits. The following products were generated for this área: magnetic anomaly, analytic signal, first vertical derivative, tilt derivative and total horizontal gradient grids. For gamma-ray spectrometry data, a smaller 5 km x 5km area centered on the deposits was defined to improve visualization. The following products were generated: total count, K, eTh, eU, ternary image, eTh/K, eU/K and eU/K ratios. 3D magnetic data modelling was performed using Voxi tool (Oasis Montaj software) to estimate the magnetic susceptibility of subsurface bodies.

Results and Conclusions

The analysis of magnetometric products allowed the identification of several features NE/SW-oriented features, including faults, shear zones and folds in the western part of the study area. Structures potentially associated with intrusive bodies were also identified. A preliminary analysis of gamma-ray products revealed K, eTh and eU anomalies near the Chapada deposit, and the 3D model indicated the presence of bodies at depth. The integration of magnetometric and gamma spectrometric data provided a better understanding of the deposit area, location and dimension of ore bodies.