



SBGf Conference

18-20 NOV | Rio'25

Sustainable Geophysics at the Service of Society

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Submission code: RGYXNY5WV6

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Regional geophysical signatures related to lode gold deposits in the Borborema Province (NE-Brazil)

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Introduction

In the Borborema Province (NE-Brazil), deposits of lode Au occur, mainly controlled by regional strike-slip shear zones developed during the Brasiliano Orogeny. The mineralized veins host metavolcano-sedimentary rocks of the Neoproterozoic folded belts. This study shows the results of the use of magnetic, gamma-ray spectrometry and gravity data to investigate the regional controls by shear zones, granitic intrusions and potassium hydrothermalism in the formation of lode Au deposits. Were analyzed three of them: i) São Francisco mine (RN) in the Seridó belt; ii) Itapetim mine (PE) in the Alto Pajeú belt; and iii) Serrita-Salgueiro “*garimpos*” (PE) in the Piancó-Alto Brígida belt.

Methods

Aerogeophysical projects contracted by the Geological Survey of Brazil (SGB) surveyed magnetic and gamma-ray spectrometry data with flight lines at a height of 100 m, spaced 500 m apart in the N-S direction. The SGB surveyed gravity data referenced to the Brazilian Fundamental Gravity Network. The calculation of the Bouguer anomalies in relation to the geoid considered a rock layer with a density of 2.67 g/cm³. To support the interpretations, 2.5D and 3D quantitative modeling of the geophysical data implemented direct modeling, magnetic vector inversion (MVI), 3D Euler deconvolution and Werner deconvolution methods.

Results and Conclusions

The São Francisco Au mine is located in the metasediments of the Seridó Group, close to magnetic lineaments and granitic intrusions anomalously enriched in K. The results of the Euler deconvolution of the magnetic data revealed along the mineralized zone the existence of an elongated magnetic body in the NE-SW direction (width between 100 and 500 m and maximum depth of 190 m), connecting the Au occurrences with the negative Bouguer gravity anomaly of the Serra Verde pluton. In addition, as evidence of potassium hydrothermalism and fluid source, K anomalies occur in the mine pit and the magnetic Serra Verde pluton.

The Itapetim Shear Zone (ISZ) control Au deposits hosted in the rocks of the São Caetano Complex. The interpretation of the NE-SW magnetic lineaments revealed a complex tectonic structuring, in which the main branch of the ISZ spreads into ramifications at its northeast and southwest ends. Also notable is the existence of NW-SE lineaments, possibly related to a ductile-brittle deformation, intersecting at a high angle the ISZ. The 3D modeling (MVI) of the shear zone plane and adjacent intrusions suggest the contribution of fluids from granitic intrusions in the formation of Au mineralization.

The metasediments of the Salgueiro Complex host Au mineralized quartz veins in the Serrita-Salgueiro country, close to granitic intrusions anomalously enriched in K, which are the source of negative Bouguer anomalies with amplitudes of up to -12 mGal. The interpretation of the magnetic data shows the existence of lineaments in the E-W, NE-SW, NNE-SSW, NNW-SSE and WNW-ESE directions correlated with shear zones that controlled the emplacement of the quartz veins. In the 3D model (MVI), the distribution of magnetic susceptibility confirms the genetic relationship between the granitic intrusions and the mineralizations evidenced in the geological mapping.