Integration of airborne and ground geophysical data in support of copper mineral research between the Victor Teixeira and Capão Grande occurrences, Caçapava do Sul, RS

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Abstract

The social and technological growth experienced by contemporary society has led to the depletion of several known copper reserves, since this metal is extremely required in various sectors of industrial production and civil construction, mainly due to its technical characteristics of high electrical and thermal conductivity. The search for new deposits or the revaluation of deposits and known occurrences can be carried out by a series of direct and indirect investigation methods. Geophysics comprises an excellent alternative for indirect investigations by obtaining contrasts between the physical properties of a potentially mineralized target and the host rock. In mineral research on base metals, the geophysical methods of electrical resistivity and induced polarization, as well as time and frequency electromagnetic methods, in addition to magnetometry and gravimetry, are traditionally used. The combined use of these methods is recommended to increase the reliability of the results, reducing the common ambiguity of the methods. A region with ample potential for copper production comprises the limits of the municipality of Caçapava do Sul, located in the central portion of the state of Rio Grande do Sul, Brazil. In this region, several deposits, prospects, and occurrences preferentially associated with the metavolcanoclastic rocks of the Sul-Riograndense Shield and the volcano-sedimentary rocks of the Camaquã Basin are recognized, as is the case of the Victor Teixeira and Capão Grande occurrences, which comprise the dissemination of copper oxides, mainly malachite and azurite, with reduced presence of primary sulfides, generally constituting hydrothermal remobilizations along breccia zones. The main objective of this work was to define a geophysical-structural framework for the area that includes the cupriferous occurrences of Victor Teixeira and Capão Grande, in order to verify a supposed connection between their mineralizations, as well as to characterize new non-outcropping exploratory targets. The design of the geophysical-structural framework was carried out using enhancement techniques and source depth estimates on aeromagnetic, terrestrial magnetic and gravimetric maps. Exploratory targets were indicated from the characterization of bodies with a density equivalent to chalcocite, by the gravity modeling of the continued Bouguer anomaly, and the largest one located in the central interval of copper occurrences was detailed by the methods of electroresistivity and induced polarization. The geophysical-structural framework confirmed previously recognized structures as well as revealed others that integrate an interconnected mesh, whose depth estimated by Euler's solutions reaches down to 170 m from the subsurface. This configuration suggests a likely connection between the copper mineralizations observed in the outcrops, separated by an interval of 2,300 m on the surface. The electrical detailing of the gravimetric target revealed a correlation between a conductive body and other two polarizables located below 60 m, suggesting the presence of sulfides in the subsurface. Resistive bodies located above the polarizable bodies were attributed to silicified portions of the host rocks.