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The mantle and crust record of convergent margin deposits – Preliminary results of the MT Brazil Project

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Introduction

The lithospheric evolution of the Goiás Magmatic Arc (GMA) occurred between ca. 900 and 600 Ma as part of the Brasiliano Orogeny. Its geological complexity results from the superposition of multiple stages, including island and continental arc magmatism, collision among three cratonic blocks, post-collisional magmatism, and subsequent cratonization processes. Airborne magnetic and radiometric data have been employed to distinguish these stages and delineate areas with potential for mineral exploration. However, uncertainties remain regarding the presence of mantle and lower crustal records, as well as the deep fluid pathways associated with major mineral systems, due to the overprinting by successive tectonic events.

Furthermore, the scarcity of significant porphyry Cu-Au deposits in the continental magmatic rocks raises questions about their fertility or whether the processes of accumulation and preservation of mineralization in deformed Neoproterozoic arcs are not yet fully understood.

Identifying lithospheric conductors has proven to be a crucial vector of mineralization, particularly in modern convergent tectonic settings (e.g., the North and South American Cordilleras). Robust statistical analyses demonstrate that mantle conductors serve as primary targets for porphyry copper deposits, while lower crustal conductors delineate fertile regions for orogenic gold deposits.

Methods

In order to solve the posed problem, we acquired long-period Magnetotelluric (MT) data across the Mara Rosa Domain, using a regular spacing of 50 km between sites. Each site recorded data for approximately 20 to 30 days with a sampling frequency of 1 Hz, enabling the capture periods of up to 10,000 seconds. We processed the data using multivariate statistical techniques, with most sites analyzed in remote reference mode. We modeled lithospheric resistivity using the Non-Linear Conjugate Gradient method. Additionaly, our MT results were integrated with airborne magnetic and radiometric data, ground gravity measurements, as well as geochronological and structural constraints.

Results

Our 3D resistivity model reveals variations of up to three orders of magnitude, revealing the complexity of the GMA. We identified strong correlation between deep conductive zones, structural discontinuties, and known mineral deposits. These findings iluminate the deep crustal roots associated with the formation and preservation of porphyry Cu-Au systems in deformed Neoproterozoic magmatic arcs.