Submission code: 70BB5N8J0R

See this and other abstracts on our website: https://home.sbgf.org.br/Pages/resumos.php

Magnetotelluric investigation of deep structural controls on the genesis and distribution of critical minerals in the polymetallic Serido Belt, NE Brazil

Gabriel Nogueira (Observatório Nacional), Maxwell Meju (Lulea University of Technology), Maria Helena B.M. Hollanda (Universidade de São Paulo), Sergio Fontes (National Observatory (Brazil))

Magnetotelluric investigation of deep structural controls on the genesis and distribution of critical minerals in the polymetallic Seridó Belt, NE Brazil

Please, do not insert author names in your submission PDF file

Introduction (Font: Arial Bold, 10).

This study investigates the structural composition of the crust in the polymetallic Seridó Belt (Borborema Province, Brazil), its relationship with regional tectonism, and the enrichment of host rocks in economically strategic metals—including gold, copper, lithium, tantalum, tungsten, and rare earth elements—based on subsurface resistivity distribution. The Seridó Belt is a metal-enriched zone within the Rio Piranhas-Seridó Domain in the central region of the Borborema Province. The literature describes, on a continental scale, the shear zones that crosscut this belt, which exhibit a NE-trending orientation. These faults and shear zones developed during the Brasiliano/Pan-African orogeny at approximately 600 Ma. This zone was deformed by a dextral transpressional tectonic regime under high-temperature and low-pressure (HT-LP) conditions, at approximately 4–5 kbar and 650 °C.

Method and/or Theory

The workflow of this study encompassed several stages: field campaign planning, data acquisition, processing, inversion, and interpretation. We deployed a total of 22 new broadband magnetotelluric (MT) stations with 5–10 km spacing along two NW-SE profiles, complemented by 6 pre-existing broadband stations and 1 long-period station. The data were processed using a robust estimation technique and subsequently inverted with ModEM-ON to derive the 3D subsurface resistivity distribution.

Results and Conclusions

The resistivity model reveals a highly resistive layer (>6000 Ω·m) intruded by conductive anomalies (<10 Ω·m) beginning at 3 km depth. These anomalies increase in size with depth, extending beyond the Moho discontinuity (32 km). At shallow depths (down to 13 km), the anomalies exhibit thin, parallel geometries aligned with NE-SW shear zones. Below this depth, they merge or detach and reorient into NW-SE and E-W trends. Initial observations suggest that this may be a unique structure with intrusion points in the weakened zones of the resistive layer. Another perspective is that this conductive anomaly, irregular in depth, was filled by materials (sediment deposition and metamorphism) that form the resistive layers, thus exhibiting differences in the horizontal slices. A structural control is noticeable; in some side views, the conductive anomalies suggest a possible southward dip of the southern layer beneath the more northern layer. The origin of these anomalies is explored; current literature suggests they may represent a Rhyacian suture zone and/or Neoproterozoic migmatitic domes. The conductive composition—potentially linked to graphite or interconnected grain networks - is also discussed. Geochemical studies confirm enrichment in metals critical for the energy transition throughout the Seridó Belt, with few exploitation points. This research aims to identify and delineate zones with potential for critical mineral exploration in the Seridó Belt, central Borborema Province.