Submission code: R9PLD0X49Q

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MAGNETOTELLURIC TRANSECT OF SOUTHEASTERN CEARÁ

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Introduction

The magnetotelluric (MT) method is a passive geophysical technique that has been widely used since the 1950s to investigate the geoelectrical properties of the subsurface, based on the interaction between telluric currents and subsurface materials. Its main applications include mineral and petroleum exploration in sedimentary basins, the study of cratonic regions, and the identification of large-scale geological discontinuities in the Earth's crust. Due to its ability to reveal electrical resistivity contrasts at depth, MT has become an essential tool for characterizing geologically complex settings, such as the Borborema Province. Located in northeastern Brazil, this province represents a tectonic mosaic formed by the amalgamation of several crustal blocks during the Brasiliano Cycle (900–490 Ma), and is structured by extensive regional- to continental-scale shear zones.

Method and/or Theory

In this context, the present magnetotelluric study focuses on investigating a transect that crosses units of the Jaguaribeano Domain: the Orós-Jaguaribe Belt (Statherian period, 1.8–1.6 Ga), located between the Aiuaba and Jaguaribe shear zones; the basement to the west, represented by the Acopiara Complex, and to the east, by the Jaguaretama Complex (both Rhyacian in age, 2.3–2.05 Ga); as well as the Pereiro Batholith (Neoproterozoic, 600 Ma).With the aim of investigating and delineating deep geological structures based on natural variations in the Earth's electric and magnetic fields.

This research integrates magnetotelluric geophysical data collected at six stations along a 65 km transect, with a spacing of 10 to 12 km between stations. The average recording duration was 20 hours, targeting depths of approximately 50 km. Data analysis will include the application of filters to remove harmonic noise, the determination of the impedance tensor, and a dimensionality analysis to define a 2D model representative of the main geological blocks and units.

Results and Conclusions

The data exhibited good quality responses across most of the spectrum, however there was noise concentrated around the harmonics of 60 Hz, 120 Hz, and 180 Hz. To eliminate these signals, a FIR (Finite Impulse Response) notch filter was applied. Following this filtering process, the data were evaluated in terms of apparent resistivity and phase as a function of frequency. Subsequently, pseudosections and 2D models are generated, which will aid in interpreting the subsurface structures in the study area. The final model was crucial for distinguishing the geological contacts and tectonic domains observed between the Orós and Jaguaribe belts, as well as identifying the most resistive and conductive structures at depth.