The Conductive Characteristics of the Lithospheric Region Under the Serra do Mar Plateau

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Magnetotelluric (MT) studies have been carried out in the southeastern coastal region of Brazil, longitudinally from the NE to the SW between Rio de Janeiro and São Paulo, and latitudinally from the Serra do Mar, to the east, to the Serra da Mantiqueira, to the west. The objective of the study is to obtain a better knowledge of the lithospheric structures and tectonics of the area. MT soundings probe the conductive/resistive crustal and upper mantle structures, complementing the shortcomings of other geophysical methods. A greater emphasis in the investigation is directed towards the identification of crustal conductive layers that might be associated with some of the geological features observed at the surface.

The study area comprises a long but narrow coastal zone, slightly arcuate, that has been intermittently active at least since the Paleocene. Distinguished geological features are the NE-SW alignments of several surface expressions of grabens, faults, dikes, folds and lineaments. The braided and amalgamated fault systems and elongated sedimentary-filled depressions (Taubaté, Resende, Volta Redonda, São Paulo) have been developed within a precambrian terrain remobilized during the Brasiliano tectogenesis. An important point of discussion upon which MT studies can make an important contribution is whether these sedimentary troughs were either created essentially by extensional forces, related to an incipient or aborted continental rift, or predominantly by transpressional shear systems, linked to the continental westward drift forces. Many MT studies carried out in regions subjected to major tectonic events (as rift systems) have detected the presence of a zone of enhanced conductivity with conductances of hundreds of Siemens at typical depths of 10 to 30 km. Such anomalously high conductance has been interpreted as related to a residual thermal pulse.

Previous MT soundings over the sediments of the Taubaté Basin (Padilha et al., 1991) have shown that below an upper conductive layer associated with the sedimentary sequence there is a resistive crystalline basement and no clear evidence of a deeper conductive layer in the crust. In the same article, the authors have theoretically demonstrated that, despite the screening

effects of the highly conductive surficial sediments, it should be plausible to detect a layer of very high conductance similar to the one observed elsewhere under rift systems.

In the present work, a MT survey was carried out in a NW-SE profile, transversal to the structural precambrian direction. The MT equipment consists of a commercial single-station system with the five electromagnetic field components being sampled in the period range of 0.0006 to 2048 s. Preliminary 1-D inversions of these recent MT soundings over the crystalline terrains of the Serra do Mar Plateau suggest the presence of a layer with a conductance of about 20 S at depths around 10 km. In the MT soundings over the sedimentary package of the Taubaté Basin, this low conductance layer was not detected probably because of the screening effects of the highly conductive layers of sediments at the surface (conductance of hundreds of Siemens). However, conductive layers of relatively low conductance (tens of Siemens) at the middle-to-lower crust has also been observed elsewhere beneath stable regions but the causes of their presence has yet to be unravelled. Therefore, preliminary interpretation of these additional MT soundings also does not give any support to the presence of a characteristic rift-related high conductance layer at the crust under the Serra do Mar Plateau, thus confirming the previous conclusion of Padilha et al. (1991).

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