ELECTROMAGNETIC STUDIES IN THE PARNAIBA BASIN: STRUCTURAL CHARACTERIZATION BY MT IMAGING

Solon, F.F.[1]; Fontes, S.L.[1]; La Terra, E.F.[1]
[1]Observatório Nacional/MCTI

ABSTRACT: A magnetotelluric profile (MT) of approximately 1430 km long, EW direction, crossing the Parnaíba Basin was conducted in order to characterize the main structural features that can be enhanced through the electromagnetic imaging. This profile is coincident with a seismic reflection profile acquired by BP Energy do Brasil, and it is included in a multidisciplinary study which is being conducted in the Parnaíba Basin between Observatório Nacional/MCTI, University of Oxford and BP Energy. The study aims to review the evolution models of the Parnaiba basin and to provide an exploratory context. The MT study comprises 220 broadband MT stations and 57 long-period MT stations along the profile. The investigation depth varies from a couple of hundred meters to approximately 50 km, allowing the characterization of deep structures of the crust. Data were processed using a robust processing routine including remote reference. Such processing routine is based on the estimation of the impedance tensor elements by least squares method. Some attributes such as phase tensor and induction vectors were also analyzed in order to characterize preferential geoelectric strike directions (directions of electric currents) and dimensionality of the MT data. Induction vectors, for instance, are vector representations of the complex ratio (i.e., containing real and imaginary parts) between the vertical and horizontal components of the magnetic field. They are often used to infer the presence or absence of lateral variations in conductivity. The phase tensor, given by the relationship between the real and the imaginary parts of the impedance tensor, provides information about both the dimensionality and directionality of the structures in the subsurface. Through it we may identify regions of the basin that are mainly 1D, 2D or even 3D. The analysis of these two attributes pointed to the presence of a conductive body at great the lower crust. This body was first defined as a mid-crustal reflector in the seismic reflection section, and it is characterized by a high amplitude seismic reflector, which occurs at the lower crust. This reflector, however, does not extend throughout the entire seismic section, being located only in the central region of the Parnaíba basin in an acoustically inexpressive block of the crust. Modeling and inversion routines are being applied to better understand the relation between conductor bodies in the crust and the midcrustal reflector. The modelling and the analysis of the induction vectors suggests the presence of anomalous conductivity concentrations in the crust region, while the phase sensor confirms the hypothesis of a conductive body with three-dimensional morphology on a portion under the MT profile in the Parnaíba Basin, which may extend throughout the entire study region.

KEYWORDS: PARNAIBA BASIN, MAGNETOTELLURIC METHOD, CRUST