Mapping of Basement Relief and Volcanic Intrusions of Parecis Basin in Brazil Based on 3D Magnetotelluric Imaging and Potential Field Data

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Abstract

The Parecis Basin is located in central-west Brazil and covers the center north of Mato Grosso State. Together with the Amazon and Paran basins, they define the set of the Brazilian Neoproterozoic intracratonic basins. Amazonian Craton rocks constitute the basement of the basin comprising metamorphic, metasedimentary and intrusive rocks. The Basin has accumulated nearly 6000 m of sediments of the Paleozoic, Mesozoic and Cenozoic. The basin has an irregular prismatic shape with a W-E major axis and area of 355,000 km^2. Four magnetotelluric (MT) profiles proposed by the Brazilian Petroleum Agency (ANP) aimed at characterizing its geological structure and assessing the proven active petroleum systems by geochemistry survey and some gas exudations on Teles Pires River. The data include 385 MT broadband soundings spanning from 1000 Hz down to 2,000 s and 1.8 km spacing.

The MT data were processed using robust techniques and remote reference. Static shift observed in some stations were corrected based on Transient Electromagnetic (TEM) measurements at each site. 2D resistivity models were obtained and depicted the basin major geological structures including the sedimentary sequences. Dimensional analysis of MT data evidenced a 3D behavior for the region for periods over 1-10 s.

Based in the 3D inversion scheme proposed by Sirivaraporn et al (2005) a preliminary 3D resistivity inversion model was constructed on a crustal scale covering the study area. MT data from four periods per decade distributed over almost six decades were used in the 3D inversion. The mesh consisted of yyy x zzz x www nodes with two element columns for each MT sounding and cell thickness increasing progressively downward from 50 m to few kilometers up to 40 km.

The preliminary 3D resistivity model presents overall good fitting and resolves the depths to basement better than the 2D models. The basement relief seems to be controlled by regional grabens and horsts previously suggested by potential field data. The 3D model also resolves some low resistivity layers representing sedimentary sequences, intercalated at places by highly resistive horizontal and vertical bodies associated to volcanic intrusions like dikes and sills. Lower crust resistivity anomalies were also observed in the model and are informative of the tectonics involved prior to the basin formation.