THE TRANSBRASILIANO LINEAMENT AND THE SEISMIC STRUCTURE OF THE CRUST UNDER THE EASTERN PORTION OF THE PARNAÍBA BASIN

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Abstract:

The Parnaíba Basin is a cratonic basin, circular in shape, with an area of 660.000 km² located in northeast Brazil. Its limits are the Amazonian Craton to the west, São Luis Craton to the north, São Francisco Craton and Tocantins Province to the south and the Borborema Province to the east.

In order to determine the current structure of the lithosphere and to better understand the Parnaíba Basin tectonic evolution, BP is funding the PABIP research project, which aims to integrate geophysical and geological studies involving Brazilian and British universities. In October 2015 the Lithosphere Research Lab. (LabLitos) of IG/UnB in partnership with the University of Aberdeen and the INCT for Tectonic Studies conducted a deep seismic refraction experiment crossing the Parnaíba Basin and its east and west limits. The refraction transect is approximately 1,200 km long in E-W direction and was acquired with 600 vertical seismographic stations spaced 2 km, and 36 short-period three-components seismograph stations spaced approximately 30 km from each other. During four nights 22 controlled explosions of 1.5 tons each were performed. The refraction profile followed the path of the deep reflection profile conducted in 2013. The obtained data are of high quality.

In the central-eastern portion of the basin the seismic profile crosses the Transbrasiliano Lineament (~ 5ºS), which is covered by Paleozoic sediments of the basin. This work presents an approach of the crustal structure across the lineament under the Parnaíba Basin obtained by receiver function and deep seismic refraction. The receiver function results define four domains under the seismic profile, differentiated by the behavior of the Moho discontinuity and by Vp/Vs values. The Borborema domain, where the Transbrasiliano Lineament is inserted, is characterized by Moho with depth ranging from 37 km in the west, 40 km in the central part and 35 km at the eastern end of the profile. Vp/Vs has well defined values around 1.72, featuring felsic crust. The western block presents Moho depth around 37 km and Vp/Vs values around 1.75, showing the existence of an abrupt discontinuity in the crust, probably a fossil suture region. The mantle shows velocity of 8.0 km/s. Although the Transbrasiliano Lineament is a clear aeromagnetic feature it is not well defined in the regional seismic data. It does not present any seismic response related to variation in Vp or Vp/Vs, neither to texture of the crust that would define the seismic characteristics of the lineament. It seems to be transparent to seismic data. The receiver function results, integrated with a qualitative analysis of seismic refraction data, and considering the deep reflection imaging, carried out by BP in 2013, lead to consider that the Transbrasiliano Lineament has only a shallow expression and has a minor (perhaps local) influence in the Parnaíba Basin evolution.

Keywords: RECEIVER FUNCTION, MOHO, PARNAÍBA BASIN