CHARACTERIZING THE CRUSTAL ARCHITECTURE OF THE PARNAIBA BASIN WITH PASSIVE-SOURCE SEISMOLOGY

Lithospheric-scale processes, such as the origin and evolution of large cratonic basins, can create big footprints or signatures in the subsurface that can be observed by geophysical means. With a huge potential for natural resources, the equatorial margin of NE Brazil has motivated many geophysical investigations by the oil industry. Our study area is the Parnaíba Basin, one of the largest cratonic basins of the world. The main goal of our study is to provide new images of the crust and lithosphere under the basin and highlight seismic discontinuities within, in order to improve our understanding of its architecture and help constrain models for its origin and evolution. A total of 9 broadband seismographic stations were installed within the PBAP project, a collaboration among several universities and BP Energy do Brasil, along an approximately 500 km-long transect across the basin, with interstation spacing of around 50 km. The receiver function technique is probably one of the most successful methodologies in broadband seismology for imaging of the crust and lithospheric mantle in continental areas, and we estimated crustal thickness and Vp/Vs ratio of the Parnaíba Basin by developing P-wave receiver functions from the acquired dataset. We also developed one-dimensional velocity models calculated from the joint inversion of P-wave receiver function and Rayleigh dispersion curves. Results from HK-Stacking, receiver function migration and joint inversion indicate the Moho dips gently toward the depocenter of the basin, displaying up to three different behaviors: A flat Moho in the depocenter of the basin, which showed the thickest crust (>42 km) and Vp/Vs ratio values arround 1,75; A thinning crust towards the eastern flank (<38 km), bounding with the Borborema Province, with Vp/Vs ratio of 1,74. An almost flat Moho with thickness of 40 km and Vp/Vs ratio around 1,72 on the western border, bounding with the Araguaia Belt. We also noted some mid crustal reflections at 15-20 km depth indicating the presence of a mid-crustal discontinuity, along with the segmentation of the Parnaíba crust, suggest that limited stretching might have occurred during the development of this cratonic basin.

KEY WORDS:
BROADBAND SEISMOLOGY, PARNAIBA BASIN, CRUSTAL ARCHITECTURE