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Crustal Structure Of The Pantanal Basin From Joint Inversion Of Receiver Functions And Rayleigh-Wave Dispersion

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Abstract

The understanding of the origin and evolution of the Pantanal basin, and its relationship to adjacent foreland basins and flexure of the South American plate, is still poorly understood due to the paucity of seismic data. To fill this gap, USP is leading a FAPESP-funded international, multi-institutional effort to investigate the deep structure under the Paraná, Pantanal, and Chaco basins with seismic data. Here, we analyze Moho P-to-S conversions in receiver functions for 41 stations in and around the Pantanal basin to determine crustal thickness and bulk Vp/Vs ratio, and jointly invert receiver functions with surface wave dispersion curves to develop S-wave velocity-depth profiles for the crust and uppermost mantle. We find average Moho depths of 36.1±1.8 km and average Vp/Vs ratios of 1.69±0.06 in the Pantanal basin, lower than those in adjacent areas; S-wave velocity models confirm the crust is thin under the Pantanal region and reveal a lower-crust with S-velocities ∼3.8 km/s, slower than in nearby regions. Existing geodynamic models suggest that the Pantanal basin formed at the top of a flexural bulge induced by the weight of the Andes on the western edge of the South American plate, causing extensional stresses in the upper crust of the bulge and reactivating pre-existing faults. We show that the Pantanal basin formed over a structurally weak stretch of the South American bulge characterized by thin and slow crust. We propose that crustal (and lithospheric) thinning facilitated the basin formation by stress concentration during the passage of the flexural bulge, while thicker crust prevented the formation of similar basins in other parts along the bulge. Projection of the Transbrasiliano Lineament (TBL) in the SW direction suggests it may extend under the Pantanal basin. If collisional processes triggered delamination that led to the TBL formation, we postulate that asthenospheric flow must have kept the lithosphere thin under the TBL after its formation.

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