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Local Earthquake Tomography of the Southern Puna Plateau

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The Puna Plateau is a part of the Andean Plateau, which has been formed by the subduction of the oceanic Nazca plate beneath the South American continental plate. The southern Puna Plateau is anomalous with respect of the rest of the Andean Plateau in having a distinct magmatic and structural history. It has a large deficit in crustal shortening compared to its elevation and an underlying slab with a transitional dip between a steeper segment to the north and a flat slab to the south. Additionally, the continental lithosphere in the southern Puna Plateau is much thinner than the northern Puna Plateau. Mainly based on geochemical and geological observations, a model of lithospheric delamination was proposed to explain these distinct features, which predicts melting in the crust and mantle lithosphere. Here we show new results from local earthquake tomography within this region, which we can use to test the delamination hypothesis as a working model for the subduction and orogenic processes.

Our results are derived from seismic data recorded by a 74 station seismic network, which has been operated from 2007 to 2009 in Argentina and Chile, covering a major area of the southern Puna Plateau. We performed the seismic tomography using both P-wave and S-wave traveltimes from local earthquakes recorded by the seismic network and obtained 3D velocity models for P-wave velocity and Vp/Vs ratio. More than 1000 events and 30 thousand P and S first arrival picks are analyzed and weighted automatically during the inversion procedure based on the misfit between the calculated and real travel time. We apply damped-least-squares full matrix inversion for 3-D velocity structure which is described as over 3000 grids. The tomography images show a low P-wave velocity anomaly in the crust in the center of the study region, which coincides with the location of the Central Volcanic Zone. In the southeastern part of the region beneath north Pampas, a high P-wave velocity block in crust and uppermost mantle is observed, which can possibly be interpreted as the evidence of the delaminated lithospheric block.