Thickened crust observed beneath the eastern edge of the Rio Grande Rift

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The Rio Grande Rift (RGR) marks the western edge of the stable North American craton in the southern United States. The La Ristra experiment (1999-2006), a linear array of seismographs deployed across the Rift, imaged a narrow high-velocity anomaly in the mantle beneath the eastern edge of the Rift (Gao, et al. 2004). Wilson et al. (2005), using receiver function analysis, found thicker crust in the region directly above the downwelling, suggesting a connection between the downwelling and the surface.

In August 2008 a 2D array of broadband seismographs (SIEDCAR) was deployed on the eastern flank of the Rift to confirm and constrain quantitatively features that might be associated with edge-driven convection at the boundary between a rift and a stable craton. SIEDCAR (Seismic Investigation of Edge Driven Convection Associated with the Rio Grande Rift) deployed a total of 71 stations interspersed with 25 Transportable Array stations. Our aim is to determine the seismic structure and thickness of the continental crust, as well as the upper mantle structure beneath the eastern edge of the Rio Grande Rift.

We present here results from P to S conversion receiver functions that enables us to address fundamental questions about the role of crustal and mantle lithospheric delamination in the evolution of the continental crust in general. Our results show variable crustal thickness through the region with an average thickness of 45 km to the east of the Rift. Particularly, the crust achieves its maximum thickness at 105W longitude, between 33.5N and 32.2N latitude. This observation confirms previous receiver function results from Wilson et al, 2005. Meanwhile, results from travel time tomography (Rockett, et al. 2011) using the same data show a mantle downwelling closely associated with the thickened crust. We believe that the thickened crust might be due to lower crustal flow associated with mantle downward flow or possibly mantle delamination.