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# Very Broad Band Seismic Constraints on the LAB and Lithospheric Layering in the north American Craton

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Several types of geophysical observations have been used to estimate the thickness of the lithosphere in continental cratons worldwide. Heat flow measurements, geochemical analyses, magnetotelluric data and seismic tomography all concur that, in its oldest parts, the cratonic lithosphere is on average 200-250 km thick. An outstanding question is how such a thick lithosphere was formed and how it could have been maintained since Archean times. Another puzzling observation is that in many areas, receiver function (RF) studies fail to detect conversions from the lithosphere-asthenosphere boundary (LAB), and, instead, detect a sharp velocity drop at much shallower depths, that defines a mid-lithospheric discontinuity (MLD).

In the north American continent, the LAB, and an MLD (that may or may not coincide with that found in RF studies) are well defined through changes in the direction of the fast axis of azimuthal anisotropy as found from combined inversion of long period seismic waveforms and SKS splitting data (e.g. Yuan and Romanowicz, 2010). We here review how these results relate to more recent analyses that take advantage of the dense sampling of north America owing to the deployment of the USArray and other temporary or permanent broadband networks, combined with Bayesian trans-dimensional modeling of crust and upper-mantle radial and azimuthal anisotropic structure obtained locally at a representative set of stations in north America (e.g. Caló et al., 2016).

We describe evidence for the detection of the LAB and, in some cases, of several mid-lithospheric discontinuities, using a combination of constraints from long period seismic data and converted phases, which suggest formation of the cratonic lithosphere through successive under-plating by layers of different composition. We discuss the possible origin of the high shear velocities observed in North America and other cratons in the depth range 120-150 km.