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Seismic Structure of Southern African Cratons: A study based on teleseismic receiver functions and finite-frequency tomography

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Cratons are extremely stable continental crustal areas above thick depleted lithosphere. These regions have remained largely unchanged for more than 2.5 Ga. This study presents a new seismic model of the seismic structure of the crust and lithospheric mantle constrained by seismic receiver functions and finite-frequency tomography based on data from the South Africa Seismic Experiment (SASE). Combining the two methods provides high vertical and lateral resolution.

The main results obtained are (1) the presence of a highly heterogeneous crustal structure, in terms of thickness, composition (as shown by estimated Vp/Vs), and sharpness of the discontinuities, (2) observation of an unexpectedly strong crustal azimuthal anisotropy, and (3) a fast lithospheric keel of the Kaapvaal Craton which reaches depths of 300-350 km and relatively slow anomalies beneath both the paleo-orogenic Limpopo Belt and modified Bushveld Complex down to depth of $\sim$250 km and $\sim$150 km, respectively.