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Strong crustal seismic anisotropy in the Kalahari Craton based on Receiver Functions

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Earlier seismic studies of the Kalahari Craton in southern Africa infer deformation of upper mantle by flow with fast direction of seismic anisotropy being parallel to present plate motion, and/or report anisotropy frozen into the lithospheric mantle. We present evidence for very strong seismic anisotropy in the crust of the Kalahari craton, which is 30-40% of the total anisotropy as measured by SKS splitting. Our analysis is based on calculation of receiver functions for the data from the SASE experiment which shows strong splitting between the SV and SH components. The direction of the fast axes is uniform within tectonic units and parallel to orogenic strike in the Limpopo and Cape fold belts. It is further parallel to the strike of major dyke swarms which indicates that a large part of the observed anisotropy is controlled by lithosphere fabrics and macroscopic effects. The directions of the fast axes for the crustal anisotropy are parallel to the general directions determined from SKS splitting, although the directions from our analysis of receiver functions is more homogeneous than for SKS splitting. This analysis indicates parallel fast axes in the crust and in the mantle, which suggests that the crust and lithospheric mantle may have been coupled since cratonisation. If so, the apparent match between mantle anisotropy and the present plate motion is coincidental.