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## **Mantle Seismic Structure Beneath Southern Africa**

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In this study, we examine mantle seismic structure for a broad region beneath southern Africa. The goal of this work is to provide detailed constraints regarding the relationship between surface geology and tectospheric structure beneath southern Africa and their implications for craton formation and evolution. We also characterize deeper mantle structure beneath the region to provide new constraints on structural variations between the tectosphere and mid-mantle. Waveform data for this analysis were recorded on an 82-station broadband seismic array located in South Africa, Zimbabwe, and Botswana. The complete array has a footprint of  $\sim 1$  million km<sup>2</sup>, and was one component of the multidisciplinary Kaapvaal Project conducted by the Carnegie Institution of Washington, MIT, and several southern African academic institutions and industry collaborators.

We present results of body wave tomography for both P- and S-waves using a nonlinear inversion technique that determines relative velocity perturbations across the study region. Our results indicate P-wave velocity variations of  $\sim \pm 1.2\%$ , and S-wave velocity variations of  $\sim \pm 1.6\%$  that are similar in lateral and depth distribution to P-wave velocity variations. The tomographic images provide clear evidence of mantle structures that mimic the dominant surface geology features across southern Africa. Specifically, a thick ( $\sim 250$ - $300$  km) mantle keel exists beneath the Kaapvaal craton; a slightly thinner ( $\sim 225$ - $250$  km) keel exists beneath the Zimbabwe craton and parts of the Limpopo mobile belt. No subtectospheric low velocity zone exists across the region. These results are consistent with previous surface wave analyses for the region [Ritsema and van Heijst, *Geology*, 2000], as well as more recent surface wave analyses using data from the Kaapvaal Project seismic waveform dataset [A. Li, pers. comm.]. Additionally, lower than average cratonic mantle velocities exist at smaller scales beneath the surface expression of the Bushveld Complex, a 2.05 Ga layered mafic intrusion. These reduced velocities may be due to mantle refertilization during the Bushveld intrusion, or they may be caused by a thermal perturbation of more recent origin, perhaps related to the Karoo magmatic event. Finally, we observe a well-resolved, concentrated zone of anomalously lower than average velocities at  $\sim 1000$  km and deeper beneath the Kaapvaal craton. We suggest that this region is likely related to previously observed low velocity deep mantle associated with the South African superplume.