2000 Fall American Geophysical Union Meeting, San Francisco, CA, USA

Reference: Fouch, M.J., D.E. James, J.C. VanDecar, S. van der Lee, and the Kaapvaal Seismic Group, Mantle seismic structure beneath Southern Africa, *Eos Trans. AGU Suppl., 81*, F834, 2000.

Mantle Seismic Structure Beneath Southern Africa

Matthew J. Fouch[1], David E. James[1], John C. VanDecar[1], Suzan van der Lee[2], and the Kaapvaal Seismic Group[3]

[1]Department of Terrestrial Magnetism, Carnegie Institution of Washington, Washington, DC 20015; email: matt@dtm.ciw.edu

[2]Institute of Geophysics, ETH, Honggerberg, Zurich CH-8093, Switzerland

[3] URL: http://www.ciw.edu/kaapvaal

Our primary objectives in this study are twofold. First, we wish to examine correlations between surface geology and the deeper tectosphere beneath southern Africa, and evaluate their relationship to the tectonic evolution of this region. Second, we desire to probe lower mantle seismic structure in the area with improved resolution from previous studies. To these ends, we performed tomographic analyses of P- and S-wave relative delay times to obtain high-resolution images of seismic velocity structure for a large region beneath southern Africa. Data from this experiment were recorded by the Southern Africa Seismic Experiment, a two-year deployment of 55 broadband seismic stations installed at 82 sites in South Africa, Zimbabwe, and Botswana. The complete array has a footprint of ~1 million km^2, and was one component of a multidisciplinary project conducted by the Carnegie Institution of Washington, MIT, and several southern African academic institutions and industry collaborators.

The seismic data display variations in P-wave velocities of ~±1%, and variations in S-wave velocities of ~±1.7% that generally mimic patterns of P-wave velocities. The images reveal high velocity mantle keels that extend to depths up to 300 km in regions beneath the undisturbed Archean Kaapvaal and Zimbabwe cratons; the most prominent keel structures generally exist near diamondiferous regions. Beneath post-Archean terranes, we do not observe analogous keel structures. Beneath the 2.05 Ga Bushveld magmatic event, seismic velocities are resolvably lower than for areas beneath Kaapvaal cratonic mantle, suggesting that significant cratonic disruption occurred during the development of the Bushveld. Regions beneath the Limpopo Belt, an Archean suture zone sandwiched between the Kaapvaal and Zimbabwe cratons, appear to possess a normal cratonic signature. Toward the southern coast of Africa, upper mantle velocities are greatly reduced, and there is little evidence for resolvable lithospheric mantle beneath the Cape Fold Belt. In addition, a significant lower mantle low-velocity region emerges below ~700 km; however, it is unclear if this feature is well-resolved and requires further examination. We will perform additional resolution tests to place tighter constraints on the most robust upper and lower mantle features of the tomographic models.