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Electrical and seismic anisotropy properties over Southern Africa

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The SAMTEX experiment (Southern African MagnetoTelluric EXperiment) is the largest land-based magnetotelluric (MT) experiment of its kind providing an excellent opportunity to compare the electrical and seismic properties over a large region. The seismic results obtained from the previously conducted Southern African Seismic Experiment (SASE), along with the fine geochemical and petrological information, can now also be reconciled with the electrical properties over the region. The depth information inherent in the MT method may be used to place bounds on the depth of the SKS and SKKS seismic shear-wave splitting anisotropy, which has no inherent depth information, thereby making for a complimentary study.

The MT data were analysed using an impedance tensor decomposition method, which provides us with an indication of the geoelectric directionality of the region. Each site was analysed twice, once for a decade of data representative of the crust, and once for a decade of data representative of the lithospheric mantle. The strike directionality is plotted as a vector indicating the most conductive direction. Shear-wave splitting observations, from SKS analyses, have been conducted on the SASE data, where the delay times appeared to exhibit geological control, and the fast axis directions were attributed to the lattice preferred orientation (LPO) of olivine frozen into the lithospheric root during the formation of the region in the Archean.

The MT most conductive directions for the mantle and the fast axis directions of the

shear-wave splitting analysis exhibit far more complexity than have been previously observed in other studies of a similar nature. The crustal MT results are strongly controlled by surface geological structure as would be expected. There are three possible explanations for our lithospheric mantle results; either our mantle results are being affected by large-scale 2-D structure that is overwhelming the response due to LPO of olivine; the LPO of olivine is not producing a significant electrical response in the southern African region and the electrical response is caused by another source; or the seismic anisotropy is located at a greater depth than that which we are probing.