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# Velocity-conductivity relations for cratonic lithosphere and their application: Example of Southern Africa

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Seismic velocity is a function of bulk vibrational properties of the media whereas electrical resistivity is most often a function of transport properties of an interconnected minor phase. In the absence of a minor conducting phase then the two should be inter-relatable, primarily due to their sensitivity to temperature variation. We develop linear expressions between shear wave velocity and resistivity for varying temperature, composition and water content based on knowledge from two kimberlite fields; Jagersfontein (Kaapvaal Craton) and Gibeon (Rehoboth Terrain). We test the expressions through comparison between a new high-resolution regional seismic model, derived from surface wave inversion of earthquake data from Africa and the surrounding regions, and a new electrical image from magnetotelluric (MT) data recorded in SAMTEX (Southern African Magnetotelluric Experiment). The data-defined robust linear regression between the two is found to be statistically identical to the laboratory-defined expression for 40 wt ppm water in olivine. Cluster analysis defines five clusters that are all spatially distinct and relate to (i) fast, cold and variably-wet Kaapvaal Craton, (ii) fast and wet central Botswana, (iii) slow, warm and wet Rehoboth Terrain, (iv) moderately fast, cold and very dry Angola Craton, and (v) slow, warm and somewhat dry Damara Belt. From the linear regression expression and the MT image we obtain predicted seismic velocity at 100 km and compare it with that from seismic observations. The differences between the two demonstrates that the linear relationship between Vs and resistivity is appropriate for over 80% of Southern Africa.