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Constraining crustal structure through time: receiver function analysis in eastern Canada

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Eastern Canada comprises the Archean Superior province, the largest craton in the world, whose SE margin is flanked by the Proterozoic Grenville province and Phanerozoic Appalachian belt, remnants of collisional orogens. Furthermore, in the last ∼190-100 Ma, the area has been subjected to hot spot tectonism: the Great Meteor hot spot track cross-cuts these SW-NE trending structural boundaries. Eastern Canada is thus a natural laboratory, ideal to test whether there are systematic differences in the bulk crustal structure beneath Archean, Proterozoic and Phanerozoic domains, and the extent to which they are modified during hotspot tectonism.

To investigate bulk crustal structure across the region, we carry out P-receiver function analysis at broad-band seismograph networks in eastern Canada. Data from existing permanent and temporary stations are used in conjunction with those from a new broadband network operating from the southern tip of Hudson Bay to coastal Maine and Nova Scotia. The network crosses the major tectonic boundaries of the region, allowing comparisons of bulk crustal properties over a period spanning ∼3 billion years of Earth history.

The receiver functions are estimated via a multitaper correlation technique, and a phase-weighted H-k stacking technique is used to constrain Moho depth (H) and crustal Vp/Vs ratio (k) beneath each station. We also examine azimuthal variations in the receiver function data to investigate crustal complexity such as 3D lateral variations and intra-crustal discontinuities. We assess whether there are systematic differences in structure across the region, and interpret our results in the context of crustal formation and subsequent modification such as hotspot tectonism.