

Channelized metasomatism inferred from lithospheric electrical anisotropy in the western Superior Craton

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SUMMARY

A dataset consisting of 376 broadband and long-period MT measurements from Metal Earth, Lithoprobe, and USArray surveys was used to generate the first ever large-scale isotropic and anisotropic 3D resistivity models of the western Superior Craton, Canada. At crustal depths, the modelled isotropic resistivity structure reveals curvilinear low resistivity zones which trend sub-parallel to major terrane boundaries. The modelled resistivity structures are compared with coincident seismic reflection data and interpreted within the context of the late stages of crustal growth and cratonization of the region. Lithospheric depths are characterized by alternating bands of high and low resistivity suggestive of electrical anisotropy, which is supported by phase tensor analysis of the corresponding data. Subsequently, a 3D tri-axial anisotropic inversion was performed using the crustal portion of the isotropic inversion result as a starting model. The resulting anisotropic model reveals a layer of substantial electrical anisotropy at depths of 100–200 km with a north-south conductive axis and anisotropic ratios of 10–100, inferred to represent phlogopite-bearing metasomatic channels emplaced during Proterozoic tectono-magmatic activity. The results have implications on our understanding of the modification of cratonic lithosphere by large-scale geodynamic processes, as well as on the interpretation of their cryptic preserved geophysical signatures.

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