Precambrian tectonics in northernmost Hudson Bay: Insights from joint inversion of receiver functions and surface waves

Amy Gilligan (Imperial College London), Ian Bastow (Imperial College London), Fiona Darbyshire (Université du Québec à Montréal), Mike Kendall (University of Bristol)

How tectonic processes operated and changed through the Precambrian remains a matter of debate: when did plate tectonics as we observe on Earth today begin, and did different processes occur on the younger, hotter Earth? The Canadian shield is one of the largest exposures of Precambrian rocks on Earth, with the geology of northernmost Hudson Bay spanning more than 2 billion years of Earth history, from 3.9-1.8Ga. It is therefore an ideal locality for trying to understand the processes that operated on the early Earth.

Previous geophysical work has shown interesting variations in crustal properties, appearing to relate to differences in tectonic/crustal formation processes over time. To explore this further, and to understand better the 1.8Ga Trans Hudson Orogen, we use data from broadband seismic stations in northernmost Hudson Bay to obtain new shear velocity models for the crust and upper mantle. We jointly invert P receiver functions and surface wave dispersion measurements. These models are used to estimate crustal thicknesses within this region. Variations in crustal thickness and shear velocity structure show that Archean crust is thin and structurally simple, with a sharp Moho. Variations in crustal seismic velocity are readily attributed to post-formation tectonic events. On the strength of Moho character, present-day crustal thickness, and metamorphic grade, we propose that southern Baffin experienced uplift of a similar magnitude and length-scale to the Himalayas during the Paleoproterozoic Trans-Hudson Orogeny.