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The cratonic mantle keel beneath Laurentia: New evidence for assembly by slab accretion

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Laurentia, the North American protocontinent, formed ca. 1.8 Ga by collisional assembly of several Archean cratons. The lithospheric mantle (a.k.a. tectosphere) beneath Laurentia appears as a prominent high-velocity anomaly in numerous global and regional tomographic reconstructions; it has long been recognized as a classic example of a refractory cratonic mantle keel in which the density increase related to low temperature (estimated to be 400K less than ambient conditions) is approximately offset by intrinsic buoyancy associated with strongly depleted composition. Key unresolved questions about such mantle keels concern the process(es) of formation, secular evolution and degree of present-day coupling to flow in the deeper mantle. The Hudson Bay Lithospheric Experiment (HuBLE) is an international initiative to investigate the lithospheric architecture of Laurentia using geophysical observatories deployed around the periphery of Hudson Bay. This paper focuses on the regional tectonic framework and reports some of the initial results from HuBLE, based on analysis of Rayleigh-wave dispersion and application of S-Receiver Functions. Our analysis confirms the presence of thick (up to $\sim$ 260 km), high-velocity lithosphere and suggests that the lithosphere-asthenosphere boundary (LAB) is relatively sharp. No significant differences are observed between regions of Archean and Proterozoic age. S-receiver functions indicate that shallow dipping mid-lithospheric discontinuities are common within this arc-acretionary tectonic setting, providing support for the formation of cratonic lithosphere by accretion of subducted slabs.