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Seismic and thermal lithospheric structure of the North American-Greenland Arctic realm

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Lateral variations in seismic velocities in the upper mantle, mapped by seismic tomography, primarily reflect variations in the temperature of the rocks at depth. Seismic tomography therefore provides a proxy for lateral changes in temperature and variations in the thickness of the lithosphere, in addition to delineating the deep boundaries between litho-tectonic blocks with different properties and ages. Our new, 3D tomographic model of the upper mantle and the crust of the Arctic region, AMISvArc, is constrained by a large global dataset of broadband waveform fits, and provides improved resolution of the lithosphere and asthenosphere. The most prominent high-velocity anomalies indicate the cold, thick, stable mantle lithosphere beneath Precambrian cratons. The boundaries of the Archean cratons and intervening Proterozoic belts mapped by tomography indicate the likely offshore extensions of major Phanerozoic sutures and deformation fronts. The northern boundaries of the Canadian Shield's and Greenland's cratonic lithosphere closely follow the coastlines. The lithospheres of Greenland and the Canadian Shield are clearly separated by the thinned lithosphere underlying the Labrador Sea and Baffin Bay. The old oceanic lithosphere of the Canada Basin is much colder and thicker than the younger lithosphere beneath adjacent Arctic Ocean Basins, and appears affiliated with the lithosphere of neighbouring Banks Island, NWT. At 150-250 km depth, the oceanic central Arctic region is underlain by a moderate low-velocity anomaly characteristic of a warm asthenosphere, similar to that beneath northern Pacific but much cooler than that beneath Iceland and northern Atlantic. We interpret these results in the context of the seismo-tectonics of Northern Canada and Greenland, in addition to their context in the wider circum Arctic.