A Sharp Edge of the Cratonic Lithosphere of North America

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Using teleseismic travel time delays, we develop a tomographic model of the lithosphere beneath northeastern North America, from the shore of James Bay in Quebec to the Atlantic coast of New England and to a depth of 300 km. Three major terranes lie within this cratonic margin: the 2.7 Ga Superior province, the 1 Ga Grenville orogenic belt and the 0.3-0.4 Ga Appalachian terranes, which are bounded by the Grenville Front (GF) and Appalachian Front (AF), respectively. Additionally, the 0.8 Ga Avalon terrain was accreted to coastal New England by strike-slip faulting during the Appalachian orogeny. Our tomographic model uses earthquake seismograms recorded by permanent US and Canadian stations, the Transportable Array and the temporary QMI\textsuperscript{3} deployment. All data were corrected for instrument response and record sections were examined visually to identify gross errors in response and timing. Differential arrival times of P and PKP waves were determined by cross-correlation and have a maximum amplitude of about \pm 1 second. In our model, lithospheric boundaries do not correlate well with geological boundaries, nor do they strike parallel to them. The seismically-fast (by 5\% relative to AK135) cratonic lithosphere of North America is much thicker than that of the younger terranes, extending to 200 km or more depth but with a sharp east-dipping eastern edge located (at Moho depths) 100-250 km northwest of the GF. The lithosphere beneath the Grenville and Appalachian terranes, which were affected by subduction during the Grenville and Appalachian orogenies, is slower (by 4\%). A sliver of seismically-fast lithosphere, extending to \sim 150 km depth, occurs along the Atlantic coast and is interpreted as the Avalonian lithosphere.