Evidence of the Appalachian Front in the Lithospheric Mantle

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North America has acquired its current configuration through over a billion years of structural accretion. Part of this process was achieved through the Appalachian orogeny, when parts of Africa and Europe were joined with Laurentia (ancestral North America). The eastern continents eventually separated from North America leaving behind accreted material that makes up much of coastal New England and the Canadian Maritimes. The boundary between ancestral and accreted crust is at least 50km east of the Appalachian front (the western boundary of Appalachian deformation), since up-thrust slivers of Laurentian crust occur at this distance from the front. However, the exact location of the boundary and its expression in the lithospheric mantle is unknown. The QMII Project, which included this study, focuses on the mantle beneath New England and Quebec, because this region was influenced by the Archaean, Grenville and Appalachian orogenies and includes crustal material accreted from the Avalonian microcontinent. Though part of the larger QMIII project studying all three of these divisions, this study focused on the Appalachian front. Seismic data was obtained from all available seismometer arrays, including our own QMIII Array (a linear array specifically concentrated on the fronts). An examination of teleseismic P-wave traveltimes from a suite of 18 large (Mw > 6) earthquake events demonstrates slow compressional velocities on the eastern side of the Appalachian Front. A model of the lithospheric mantle constructed through tomographic inversion of these data displays a distinct change in velocity across the front. The shallow (~100 km deep) mantle is significantly slower (~6 %) the east of the Appalachian front, with the boundary located about 100 km east of the front in southern New England east of the, narrowing to 0-50km in the north. We hypothesize that this boundary marks the eastern extreme of the Laurentian lithosphere. Further investigations using a greater number of teleseisms will help to confirm the findings of this study and to describe the structure of the lithospheric mantle underlying the other orogenic boundaries found in eastern North America.