

First published online February 27, 2017, doi: 10.1130/2017.2526(06)

GSA Special Papers , v. 526,

First published online February 27, 2017, doi: 10.1130/2017.2526(06)

GSA Special Papers , v. 526,

Crust-mantle boundary in eastern North America, from the (oldest) craton to the (youngest) rift

Vadim Levin¹, Andrea Servali¹, Jill VanTongeren¹, William Menke² and Fiona Darbyshire³

+ Author Affiliations

+ Author Affiliations

Abstract

The North American continent consists of a set of Archean cratons, Proterozoic orogenic belts, and a sequence of Phanerozoic accreted terranes. We present an ~1250-km-long seismological profile that crosses the Superior craton, Grenville Province, and Appalachian domains, with the goal of documenting the thickness, internal properties, and the nature of the lower boundary of the North American crust using uniform procedures for data selection, preparation, and analysis to ensure compatibility of the constraints we derive. Crustal properties show systematic differences between the three major tectonic domains. The Archean Superior Province is characterized by thin crust, sharp Moho, and low values of Vp/Vs ratio. The Proterozoic Grenville Province has some crustal thickness variation, near-uniform values of Vp/Vs, and consistently small values of Moho thickness. Of the three tectonic domains in the region, the Grenville Province has the thickest crust. Vp/Vs ratios are systematically higher than in the Superior Province. Within the Paleozoic Appalachian orogen, all parameters (crustal thickness, Moho thickness, Vp/Vs ratio) vary broadly over distances of 100 km or less, both across the strike and along it. Internal tectonic boundaries of the Appalachians do not appear to have clear signatures in crustal properties.

Of the three major tectonic boundaries crossed by our transect, two have clear manifestations in the crustal structure. The Grenville front is associated with a change in crustal thickness and crustal composition (as reflected in Vp/Vs ratios). The Norumbega fault zone is at the apex of the regional thinning of the Appalachian crust. The Appalachian front is not associated with a major change in crustal properties; rather, it coincides with a zone of complex structure resulting from prior tectonic episodes, and thus presents a clear example of tectonic inheritance over successive Wilson cycles.

Accepted 12 October 2016.

