Seismic surface wave imaging of the crust and shallow upper mantle of the Central and Eastern United States

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The geologic structure of the Central and Eastern United States (CEUS) includes Proterozoic igneous provinces, failed Proterozoic to Cambrian and Triassic rifts, two collisional zones (the ~1.3-1.0 Ga Grenville Province and the ~490-260 Ma Appalachain mountain belt), the Piedmont, and the Coastal Plain. The intraplate region and passive margin continue to deform, as attested to by intraplate seismicity and the M5.8 2011 Mineral, Virginia earthquake.

Using Rayleigh waves of periods 18 to 125 sec recorded with Earthscope's Transportable Array, we apply surface-wave imaging (Pollitz and Snoke, 2010) to determine phase velocity distributions and 3D seismic shear velocity in the crust and uppermost mantle. Our surface-wave imaging complements the body wave and 5 to 40 sec Rayleigh-wave imaging of Schmandt and Lin (2014) and helps resolve the details of the relatively shallow seismic structure.

While most failed rifts have only a shallow expression in the crust (e.g., Mid-Continent Rift), the Reelfoot Rift is underlain by low-velocity mantle extending unresolvably deep. From the Central Plains to the Atlantic coastal region, high-velocity shallow upper mantle domains associated with the Mazatzal Province, Granite-Ryolite Province, and Coastal Plain are separated by lower-velocity mantle associated with the Reelfoot Rift, the Blue Ridge of the Southern Appalachians, and Triassic rifts. Deep low-velocity mantle is associated with the ~86-68 Ma Travis and Uvalde volcanic fields in central Texas, the ~48 MaVirginia/West Virginia volcanic zone (Mazza et al., 2014) and a broad Eastern New York-Vermont-New Hampshire zone. Hotspot tracks may be associated with all of these low-velocity zones, and the central Texas and New England zones are further located at the former rifted Laurentia margin.