New geophysical data motivate a re-examination of tectonic models for Appalachian terrane accretion in western New England. For example, a recent study used ~70 km spaced Earthscope seismic observatories to identify a ~15 km “step” in crustal thickness in New England that was interpreted as evidence of multi-stage tectonic steepening of the Grenville-Appalachian suture.

Using a technique based on P to SV converted waves from distant earthquakes, we constructed vertical probes of seismic impedance (velocity x density) at locations spaced ~10 km apart to provide a more detailed view of this feature in northwestern Massachusetts.

We identified boundaries between the crust and the sub-crustal mantle that are vertically juxtaposed (Fig. 1). We find a single boundary at ~40km beneath sites on Grenville basement, and, similarly, a single boundary at ~30 km beneath the western-most Gondwanan-derived terrane. Observations for both boundaries are consistent with abrupt changes of impedance, implying sharp crust-mantle transitions. However, several seismic sites that straddle the Grenville-Appalachian suture zone show both crust-mantle boundaries, suggesting that they overlap over a horizontal distance of ~30 km.

These overlapping crust-mantle boundaries suggest a model for the Laurentian-Gondwanan collision that likely involved slab breakoff of the east-dipping Laurentian lithosphere, but does not require a later episode of deformation to steepen the resulting crust-mantle offset. As more data arrive from dense seismic arrays of the New England Seismic Transect (NEST) project, we will be able to apply more advanced seismological analysis and get a closer look at the lithospheric structure within the Grenville-Appalachian suture zone, constraining existing problems, and likely identifying new ones.

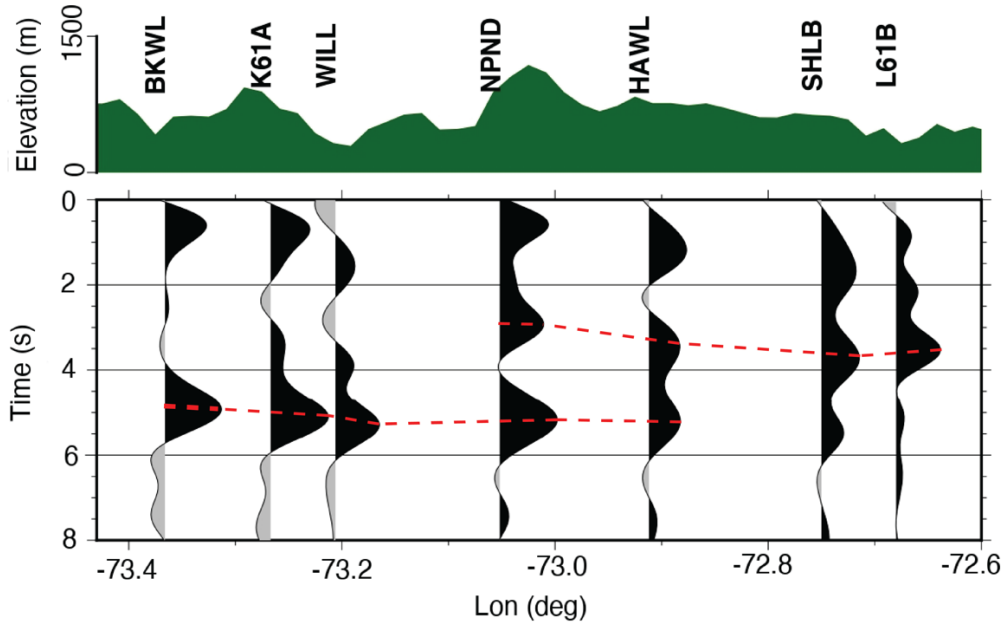

Fig. 1. Interpretation of the waves arrivals as crustal-mantle boundaries.