Project Summary This is a proposal to assemble a new data set on the structure of the lithosphere and the underlying asthenosphere at the passive margin of eastern North America, and to use these data to gain new insights into both the process of accretion of the continent and its subsequent modification by delamination, rifting and hotspot magmatism. The target is primarily the upper mantle (as contrasted to the crust). Our motivation is that structure and fabric of the mantle are key to understanding these processes, but that relevant data currently are lacking, especially at the characteristic length scales of 250 km and less. We will focus on the following three issues: Can unambiguous **lithospheric thinning** be detected, and related to delamination, rifting or hotspot magmatism? Are **lithospheric discontinuities**, such as the Hales (a.k.a. 80−km) discontinuity, present, and do they have properties that are consistent with their being related to any of the well−known tectonic events? What is the origin of the **New England Anomaly**, a prominent margin−perpendicular shear wave velocity anomaly, and in particular, is that origin connected with the passage of the Cretaceous−aged New England (or Monteregian) plume? The propose research has both a data collection and a data analysis and interpretation effort. A key part of the data set assembly effort is a temporary deployment of six broadband stations that will "bridge" existing US and Canadian stations and the soon−to−be−installed Canadian POLARIS array. The combination of these three groups of stations will "illuminate" a wide swath of the continental margin, from craton to shore, and allow us to address the fundamental issues of its evolution. The data analysis will be performed concurrently with the new data collection, starting with already−archived data from existing stations, and will be extended to the new data as it arrives. The following "seismological products" will be prepared: **Receiver functions** (both radial and transverse) for all stations; **shear wave splitting** measurements (under both 1−layer and multilayer assumptions) for all stations; **Surface wave tomography;** and **Body wave** velocity and attenuation tomography; In addition, we will perform specialized analysis of Love−Rayleigh coupling, polarization, etc. as is warranted by features in the data.