

Crustal structure across the southern Appalachians using receiver functions from the SESAME array

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We used receiver functions from the SESAME flexible array and U.S. Transportable array to determine average crustal thickness (H) and V_p/V_s (k) across the accreted terranes of the southern Appalachians. The Blue Ridge, Inner Piedmont, and Carolina terranes were thrust over the North American margin during the Late Paleozoic Alleghanian orogeny, and the relationship between Alleghanian thin-skinned tectonics and inherited Grenville crustal structure remains poorly understood. In general, crustal thickness and V_p/V_s gradually increase from the Carolina terrane towards the Blue Ridge mountains, in close agreement with previous wide-angle results. P_s delay times increase from ~ 4.2 s within the Carolina terrane to ~ 7.0 s over the Blue Ridge crustal root, and then decrease to ~ 6.0 s in the Valley and Ridge (Fig. 1). Stations within the Carolina terrane (D02-D09) display strong P_s conversions and crustal reverberations (P_pP_s and $P_sP_s+P_pP_s$), and ($H-k$) stacking results indicate crustal thickness of 36-37 km and V_p/V_s of 1.69-1.73. Beneath stations D15 and D17 in the Inner Piedmont, H and k increase to 42-44 km and 1.75-1.76. Given the weak reverberations within the Blue Ridge, we used P_s delay times and an assumed range of V_p/V_s (1.73-1.78) to obtain crustal thickness estimates of 56-60 km at stations D20 and W35. The Moho shallows again to ~ 47 -50 km beneath the Valley and Ridge. The low V_p/V_s values in the vicinity of the Central Piedmont shear zone (CPSZ) are consistent with models that suggest Grenville-age crust extends beneath the Carolina terrane and possibly the Coastal Plain, whereas lower crustal accretion of the Carolina arc terrane in the vicinity of the CPSZ is less likely. The Blue Ridge crustal root appears to be correlated with topography, which implies local compensation of the mountains. Root preservation is primarily attributed to limited crustal extension beneath the Blue Ridge during Mesozoic extension compared with outboard terranes, but structural inheritance related to the Proterozoic Grenville continental collision cannot be completely ruled out.

As part of the SESAME project, we have participated in various educational programs across Georgia to promote the excitement and importance of studying geology and geophysics. We have had the opportunity to interact with >550 students from schools throughout the state, and we conducted a successful adult educational seminar for 100 participants at the Blairsville Mountain Research Center in north Georgia, where one of our broadband stations is operating.

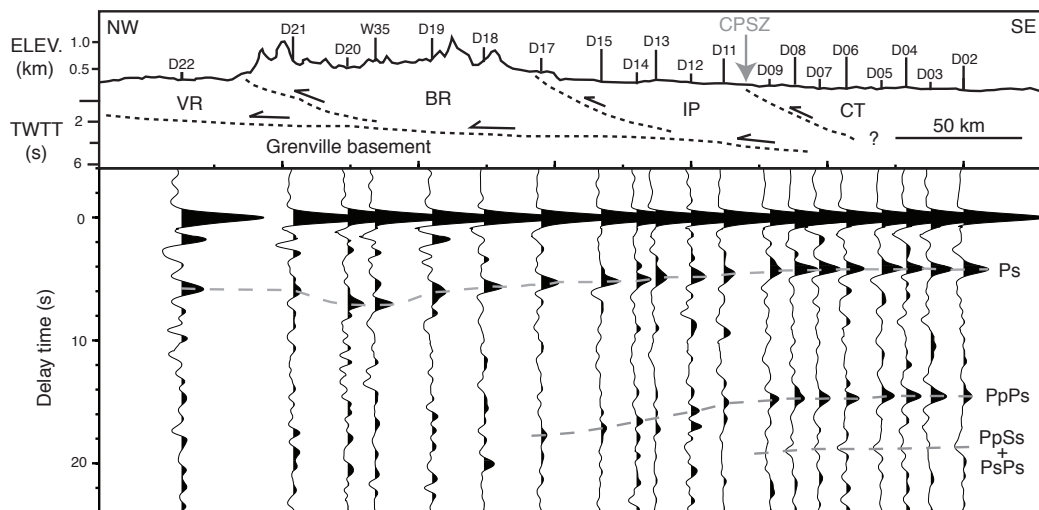


Figure 1: Stacked receiver function traces from SESAME stations along a profile oriented normal to the southern Appalachian orogen. VR: Valley and Ridge; BR: Blue Ridge; IP: Inner Piedmont; CT: Carolina terrane; CPSZ: Central Piedmont shear zone.