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Crustal Thickness Variations Beneath the Central American Arc

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Magmatism resulting from subduction is a source of continental crustal growth, for which crustal thickness is often used as a proxy. Central American subduction is of particular interest due to the extreme variations in geochemical indicators of the depth and degree of melting along the arc. The upper limit of both is crustal thickness, while crustal velocities reflect bulk composition. This study focuses primarily on crustal thickness and Vp/Vs for these reasons. Teleseisms recorded on broadband seismometers during the eighteen month PASSCAL deployment of the TUCAN network have been used to determine crustal thickness, Vp/Vs and to develop receiver function images. For each event, a single incident wavefield is deconvolved from each of the 62 P and PP teleseismic arrivals, to generate 1177 receiver functions. A moveout correction converts time to depth for the direct P-to-S conversion as well as the first two surface reflected phases. The resulting depth- corrected receiver functions are stacked for a best fit of crustal thickness and Vp/Vs for each station. Along the back arc, crustal thickness is fairly constant ranging from 29 to 34 km. Crossing the arc in Costa Rica, crustal thickness ranges from 32 to 39 km dipping from the forearc to the backarc, with the thickest crust just past the volcanic arc. The Nicaraguan transect has more variation in crustal thickness ranging from 25 to 41 km, thinning from the coast to the arc and thickening to the back arc. The thinning below the arc is opposite to what is expected, as magmatism should thicken the crust. The arc in this location follows the Nicaragua graben, so crust here may be stretched and thinned. This may result in a focusing of arc magmas to a region of thin crust. Along the forearc crustal thickness ranges from 25 km in Nicaragua to almost 50 km at the SE end of the forearc transect in Costa Rica, roughly correlating with elevation. Vp/Vs ranges from 1.62 to 2.00 with a typical uncertainty of 0.14, with the higher values near the volcanic arc. Images based on the receiver functions reveal a

NE-dipping structure between the subducting slab and the Moho beneath Nicaragua, present in both transmitted and reflected phases. While the structure may be a direct consequence of magma transport, its geometry suggests that it may be a portion of slab from a previous subduction event, partly interfering with transport of melt to the modern arc.

7205 Continental crust (1219)

7208 Mantle (1212, 1213, 8124)

7240 Subduction zones (1207, 1219, 1240)

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