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Deep structure of the central Lesser Antilles Island Arc South of Guadeloupe

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The central Lesser Antilles arc around 16°N has been the site of a number of previous experiments, which have mainly focused on the accretionary complex and backstop geometry. However, no seismic profile has been acquired traversing the central island arc itself, leaving the arc geometry and basement as well as Moho depth here undetermined. We present the results of a 280 km long regional wide-angle seismic profile conducted south of Guadeloupe between 15.5°N and 16.5°N, trending approximately perpendicular to the deformation front/parallel to convergence. The profile initiates in the Grenada Basin, crosses the active island arc and extends onto the Barbados Ridge accretionary complex, where it terminates approximately 80 km west of the deformation front. On the incoming plate, the wide-angle results reveal an eight km thick oceanic crust below the accretionary prism. Underneath the island arc crust the slab dips at an angle of $\sim$14.5°, steadily increasing underneath the island arc. Velocities of the incoming oceanic crust rise from 5.5 km/s at the oceanic basement to 7.3 km/s above the crust-mantle boundary. A distinction between oceanic layers 2 and 3 is not imaged. A décollement and subduction channel is resolved in the reflection profile as well as on selected wide-angle record sections and is characterized by low seismic velocities ($\sim$3.6 km/s) and a thickness of approximately 1200 m. Due to the thick accumulation of sediment on top of the incoming North American oceanic crust, seismic energy penetration along our profile is not sufficient to resolve the velocity structure of the oceanic mantle. The structure and seismic velocities of the incoming oceanic crust show typical values for mature, unaltered oceanic crust. We speculate that upper mantle velocities follow this trend and are in the range of 7.9-8.1 km/s associated with an anhydrous condition of peridotite in the upper mantle. As inferred from low seismic velocities of < 3.0 km/s, the island arc is covered by a sediment layer increasing in thickness from a few hundred meters to 1100 m at the transition to the Grenada Basin. Approximately 1900 m of sediment are trapped in the Grenada Basin, however, the basin's eastern margin is only covered by four seismic stations and resolution beyond the instrument layout is limited due to lower ray coverage. Two distinct crustal layers are resolved: an upper crustal layer with a velocity gradient of 0.28 s-1 and a lower crustal layer with a gradient of 0.038 s-1. The crust-mantle boundary is found at an average depth of 27 km. Upper mantle velocities of 8 km/s are well constrained by reverse shots along the central portion of the island arc beneath the volcanic front.