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Collisional zones in Puerto Rico

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Collisional events along the North American-Caribbean plate boundary are complex and not completely understood. Structures and metamorphism in rocks exposed in Cuba, Hispaniola, and Puerto Rico suggest that the margin has undergone at least three main contractional events in the Early Cretaceous, Late Cretaceous, and in the Late Eocene. The Eocene event is more evident in the transpressional structures preserved in Eocene rocks and may be related to the oblique collision of the northern margin of the Caribbean Plate with continental crust of the Bahamas in the North American Plate. In Puerto Rico, the Late Eocene collisional event is best exposed in the Northern Puerto Rico Fault Zone (NPRFZ) and the Southern Puerto Rico Fault Zone (SPRFZ). These fault zones show transpression in Eocene rocks that suggest contraction and left-lateral shear. The NPRFZ is the boundary between the Northeast and Southwest blocks. Its main fault is the Cerro Mula Fault, a WNW-ESE striking left-lateral fault. The SPRFZ separates the Central and Southwest blocks and strikes NW-SE in the western part of the island.

The origin and extent of the Early Cretaceous and Late Cretaceous events are less clear. Recent structural and stratigraphic studies in the Southwest block of Puerto Rico suggest that deformation of Late Cretaceous folded and faulted sedimentary and volcanic rocks, and thrust emplacement of mantle rocks (serpentinized-peridotite) onto the crust are related to Maastrichtian to Paleocene contraction along the plate boundary. In Puerto Rico, there is no metamorphism associated to this event. This deformation constitutes a Late Cretaceous collisional event that is also recognized in Hispaniola and Cuba. Late Cretaceous-Paleocene serpentinite emplacement is attributed to the collision of the subduction zone with the hypothesized Caribeana submerged platform to the north. In Puerto Rico there is a volcanic hiatus in Early Paleocene that may be related to the proposed collision. Reactivation of these structures occurred during Late Eocene-Early Oligocene. The Early Cretaceous tectonic event in Puerto Rico is deduced from stratigraphic relationships of the serpentinite and Late Cretaceous rocks. Early contraction in Cuba and Hispaniola may be related to increased convergence along a subduction zone. However, the characteristics of the tectonic event are not understood. In spite of the temporal similarities of deformation in the northern Caribbean, there are noted differences in the type of deformation that may be related to variations in shape and orientation of pre-existing zones of weaknesses and geographic locations along the Caribbean-North American plate boundary.