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Subduction in the Southern Caribbean

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The southern Caribbean is bounded at either end by subduction zones: In the east at the Lesser Antilles subduction zone the Atlantic part of the South American plate subducts beneath the Caribbean. In the north and west under the Southern Caribbean Deformed Belt accretionary prism, the Caribbean subducts under South America. In a manner of speaking, the two plates subduct beneath each other. Finite-frequency teleseismic P-wave tomography confirms this, imaging the Atlantic and the Caribbean subducting steeply in opposite directions to transition zone depths under northern South America (Bezada et al, 2010).

The two subduction zones are connected by the El Pilar-San Sebastian strike-slip fault system, a San Andreas scale system. A variety of seismic probes identify where the two plates tear as they begin to subduct (Niu et al, 2007; Clark et al., 2008; Miller et al. 2009; Masy et al, 2009). The El Pilar system forms at the southeastern corner of the Antilles subduction zone by the Atlantic tearing from South America. The deforming plate edges control mountain building and basin formation at the eastern end of the strike-slip system.

In northwestern South America the Caribbean plate tears, its southernmost element subducting at shallow angles under northernmost Colombia and then rapidly descending to transition zone depths under Lake Maracaibo (Bezada et al., 2010). We believe that the flat slab produces the Merida Andes, the Perija, and the Santa Marta ranges. The southern edge of the nonsubducting Caribbean plate underthrusts northern Venezuela to about the width of the coastal mountains (Miller et al., 2009). We infer that the underthrust Caribbean plate supports the coastal mountains, and controls continuing deformation.