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Seismic Velocities and Earthquake Locations in the Central America Upper Mantle: results from the TUCAN Experiment

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The processes that govern magma generation and extraction at subduction zones are not yet well understood. Velocity tomography and earthquake locations from the TUCAN (Tomography Under Costa Rica and Nicaragua) PASSCAL experiment give insight into the geometry and structure of the Central American subduction zone, which exhibits large variations in downgoing plate roughness and dip, volcano locations, and geochemistry over a short distance along the arc. Approximately 14000 P travel times and 11000 S travel times are used in joint Vp, Vp/Vs and hypocenter inversions. The present-day slab geometry is highlighted by contrasts in dip beneath the two arc sections: a near-vertical slab dip beneath the volcanic front in Nicaragua, similar to that indicated by teleseismic hypocenters and a 30° slab dip beneath central Costa Rica, similar to that indicated by a previous local study. In both regions, the intermediate-depth seismic zone is a single layer as thin as 5 km in some areas and no more than 10 to 20 km thick overall. Tomographic images show that throughout Nicaragua and Costa Rica, the slowest mantle velocities appear directly below the volcanic front, indicating likely zones of mantle melting extending 80 to 120 km depth. This region is much larger beneath Nicaragua than beneath Costa Rica, potentially allowing a greater extent of melting. Within the downgoing plate, a low-velocity region is imaged at depths less than 150 km beneath Nicaragua and in the upper 60 km of the slab beneath Costa Rica. This feature may represent a hydrated layer at the top of the downgoing plate, similar to that seen in waveguide studies. Beneath Nicaragua, we also see evidence for a

dipping high-velocity region in the mantle wedge beneath Nicaragua extending from 20 to 100 km trenchward of the arc, consistent with results from receiver function analysis and offshore active source tomography. This high-velocity region may serve as an impediment to mantle flow and fluid migration, causing the shift in the volcanic front in Nicaragua.

7230 Seismicity and tectonics (1207, 1217, 1240, 1242)
7240 Subduction zones (1207, 1219, 1240)
7270 Tomography (6982, 8180)
8170 Subduction zone processes (1031, 3060, 3613, 8413)
8180 Tomography (6982, 7270)
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