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CONFERENCE 2022 OF THE GEOLOGICAL SOCIETY OF TRINIDAD & TOBAGO
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Constraints on Tectonic Processes and Crustal Deformation within the Subduction to Strike Slip Transition at the Southeastern Caribbean Plate Boundary Zone

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Theme: CG: Structure and tectonics around the Caribbean margin
Key Words: Southeastern Caribbean, STEP fault, Contractional tectonics, transitional plate boundary

The southeastern Caribbean margin is a location where active subduction and strike-slip tectonic styles transition along a strongly curved and seismogenic plate boundary. We use an integrated dataset which comprises 2-D seismic reflection, well, seismic tomographic, gravity, magnetic, earthquake focal mechanisms, and global positioning system (GPS) data to analyze the transitions of geologic structures and sedimentary basins at the subduction to strike-slip transition.

The evolution of the margin includes oblique collision between the arcuate southeastern margin of the Caribbean plate and the South American margin; propagation of the Subduction-Transform-Edge-Propagator fault; and north-to-northwest flexure of transitional South American lithosphere to the south of the west-dipping segment of the slab that sinks into the mantle beneath the Caribbean plate.
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Pre-existing structures such as northwest–southeast-oriented Atlantic oceanic fracture zones and lithospheric transitional boundaries are a significant control on the evolution of the margin including the location and orientations of STEP faults, slab rollback, detachment, and tearing. Lithospheric deformation associated with STEP tearing and slab detachment influences the position, orientation, and evolution of crustal plate boundary structures and sedimentary basins.

The multiphase deformational history that includes oblique collision, Subduction-Transform-Edge-Propagator faulting, and subducted slab dynamics, influence the spatially and temporally complex uplift and subsidence patterns observed in sedimentary basins and structures within the southeastern Caribbean subduction-to-strike-slip transition.