

## **Tectonics, Basin Evolution and Sediment Distribution within the Collision to Subduction Transition of the Southeastern Caribbean Plate Boundary Zone in Offshore Trinidad**

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### **Abstract**

Convergence and oblique collision between the Caribbean and South American plates exert a dominant control on the timing and location of depositional centers and sediment pathways along this transitional plate boundary margin. We use ~10,000 km of 2D seismic reflection lines that are recorded to depths >12 seconds TWT and well data to interpret the distribution and continuity of tectono-stratigraphic sequences and to identify and constrain the timing of activity of key structural features.

The thick (4.5seconds) northward-dipping, passive margin Cretaceous strata document the relatively quiescent conditions that existed prior to deformation heralding the arrival of the Caribbean plate. The transition to active subduction and collision by the middle Miocene is recorded by the Barbados accretionary prism (BAP); composed of thrust and deformed Palaeogene to recent sediments, and the plate boundary deformation zone which includes the uplifted, thrust and folded structures that form an ~200-km-wide zone composed of southward-verging thrust packages of Cretaceous to middle Miocene sediments, and the metasediments of the Northern Range and Tobago High. Uplift of these structures was accompanied by the progressive subdivision of what was previously a broad offshore basin into segmented depocenters of Pliocene–Holocene sedimentary successions: 1) the broad Columbus foreland basin formed as a result of northward flexure of the South American crust beneath the Caribbean plate with up to 12 km of Pliocene–Holocene sediment; 2) the narrow Darien sub-basin formed between the uplifted structures of the Darien Ridge and the most proximal thrusts of the accretionary prism with an 8 km thick Pliocene–Holocene sedimentary succession; 3) the Barbados Basin; the largest piggyback basin of the BAP that contains up to ~4 km of Pliocene–Holocene sediments; 4) a series of small piggyback basins filled with thin Pliocene–Holocene stratigraphy; and 5) the North Coast Basin, formed within the plate boundary suture zone above Caribbean and exhumed allochthonous metamorphic basements with ~3.5 km of Pliocene–Holocene stratigraphy.

Sediments sourced from the Orinoco River and Guyana current to the south are distributed through sediment pathways which connect through the Columbus Basin. There is a dominant eastward sediment pathway from the Columbus Basin shelf to slope and out to the piggyback basins of the inner BAP via narrow pathways; formed along the footwall of uplifted thrust faults, and which step towards the south through time. We also determine a volumetrically-significant northward movement of Pleistocene sediments from the Columbus Basin through the Darien and southern Barbados sub-basins to the North Coast and other Caribbean Basins. The petroleum system varies across and along the margin as a consequence of differences in the dominant structural style depositional setting, facies associations and burial history associated with the respective basins.