



**THE 4<sup>TH</sup> GEOLOGICAL CONFERENCE  
OF  
THE GEOLOGICAL SOCIETY OF TRINIDAD AND TOBAGO**  
June 17-22, 2007, Hilton Trinidad & Conference Centre  
Port-of-Spain, Trinidad and Tobago

**“Caribbean Exploration – Planning for the Future”**

**ABSTRACT**

**GEOMORPHOLOGY AND QUATERNARY GEOLOGY OF THE NORTHERN RANGE,  
TRINIDAD AND PARIA PENINSULA, VENEZUELA: RECORDING QUATERNARY  
SUBSIDENCE AND UPLIFT ASSOCIATED WITH A PULL-APART BASIN**

**RITTER, John B.**

*Wittenberg University, PO Box 720, Springfield, OH 45501-0720 USA,  
jritter@wittenberg.edu and WEBER, John C., Grand Valley State University, 1 Campus  
Dr, Allendale, MI 49401-9401 USA*

A suite of geomorphic features along the Northern Range of Trinidad and the Paria Peninsula of Venezuela are used to constrain long-term ( $10^3$ - $10^5$  years) vertical tectonics in the region in response to formation of the Gulf of Paria. The gulf represents a pull-apart basin resulting from dextral wrenching along the El Pilar Fault in Venezuela stepping across the gulf to the Central Range Fault in Trinidad. North of the Central Range Fault on Trinidad, the Northern Range, the range-bounding Arima Fault, and the Northern Basin form a quasi-rigid block sinking westward into the Gulf of Paria pull-apart basin. The Paria Peninsula is its mirrored western counterpart, sinking eastward into the Gulf.

Eleven adjacent drainage basins in the Northern Range and 23 drainage basins on the Paria Peninsula, of roughly similar size and orientation and underlain by uniform geology in their respective areas, form the basis of this analysis. Drainage basins and stream networks were delineated and basin morphometric properties were derived from 30-m SRTM data using RiverTools™ and ArcGIS™ Spatial Analyst tools. Trends in drainage basin morphometric properties, including mean elevation, relief, slope, and basin shape, are symmetrical about the Gulf of Paria and reflect subsidence towards the Gulf and relative uplift away from the Gulf. Mean elevation of the basins increases away from the Gulf to as much as 600 m, while elevation of the basin outlets, defined topographically by the mountainfront, increases from sea level near the Gulf to as much as 85 m along the westernmost basins in the Northern Range and 200 m along the westernmost basins on the Paria Peninsula. Valley bottoms in drainage basins nearest the Gulf on Trinidad are buried by as much as 110 m of sediment, with wide (> 1 km), flat valley floors, and the basin outlets on both sides nearest the Gulf are drowned as evidenced by their embayed nature. On Trinidad, these basins exhibit slight asymmetry, with steeper east-facing slopes. More distal basins are characterized by inset valley fills (with cumulative thicknesses of 100 m) and more constricted valley floor widths, while the drainage basins farthest from the Gulf have v-shaped, bedrock valleys essentially free of alluvial units. Mountainfront sinuosity decreases slightly but consistently away from the Gulf.

This is consistent with a block subsiding into the Gulf and rebounding upward away from the Gulf. Values for basin shape show slight elongation in the middle of the study transects, perhaps suggesting flexure about a fulcrum between the subsiding and rebounding parts of the block.