

The Demerara Rise, Offshore Suriname: Seismic Evidence for Early-Rift Volcanism, Transpression and Deepwater Exploration Targets

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ABSTRACT

The Jurassic opening of the southern Central Atlantic Ocean was accompanied by extensive magmatism at the rifted margins of Suriname/Guinea Bissau and Southern Florida. This style of continental rupture resulted in westwardly divergent and offlapping, convex-upward seaward dipping reflector (SDR) packages beneath the Demerara Rise carbonate platform, offshore Suriname. Gravity modeling and modern seismic analogues were used to identify these high-density, steeply-dipping (~20 degrees), 21 km-thick, igneous strata that underlie the Demerara Rise. West of the Rise, the Deep Guyana Basin contains excessively-thick oceanic crust recording the presence of a waning magmatic source during continued plate divergence. We infer that this Jurassic volcanic margin continued into the Guinea Plateau of West Africa and the conjugate margin of Southern Florida/Great Bahama Bank.

The presence of a Late Jurassic-Early Cretaceous (and possibly older) carbonate section indicates that the early volcanism produced a shallow marine substrate (photic zone) upon which the overlying carbonate bank developed. After initial carbonate platform deposition, the Equatorial Atlantic began to open, and the North Demerara Transform between northern West Africa and northern South America was a key structure in this second phase of ocean opening. An Aptian plate vector adjustment resulted in the formation of ~NW-SE compressive structures, related to dextral transpression along the Transform, and to the peneplanation of a broad zone across the Demerara Rise.

This compression and uplift probably also triggered the gravitational collapse of the west-facing flank of the upper Demerara Rise onto the adjacent basin floor below, by Albian time. Evidence of the transpressional event is also observed in structured oceanic crust and the overlying Late Jurassic/Early Cretaceous sediments in the Deep Guyana Basin. The framework of stratigraphic successions on the Suriname margin and the Deep Guyana Basin were controlled by fluctuating accommodation and sedimentary supply. Extensive networks of north- and westward-flowing channel complexes, base of slope fans, and turbidite deposits extend into deep water. These features are prospective hydrocarbon conduits of clean reservoir sandstones potentially charged by Cretaceous source rocks.