Tectonostratigtraphic Evolution of the Nicaraguan Rise Based on Integration of 2D Seismic and Potential Fields Data: Implications for Frontier Exploration in the Western Caribbean

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ABSTRACT

The Nicaraguan Rise in the western Caribbean Sea is an underexplored Late Cretaceous to Recent modern carbonate platform with surrounding deeper-water basins covering an offshore area of ~500,000 km2 within the maritime zones of Honduras, Nicaragua, Jamaica, and Colombia. This mega-regional study integrates ~30,000 kilometers of 2D seismic reflection data and 70 wells from both academia and industry sources with gravity modeling and preexisting seismic refraction data. The main objective of the study is to define the underlying crustal structure of the study area to reconstruct the complex tectonic events that shaped the crustal structure. We identify three terranes that include the 1) the offshore extension of the Precambrian-Mesozoic continental Chortis block of Honduras; 2) the offshore extension of the Late Cretaceous to Paleocene arc rocks of the Great Arc of the Caribbean (GAC) known from outcrops in Nicaragua and Jamaica; and 3) the offshore extension of the Late Cretaceous Caribbean large igneous province (CLIP) known from outcrops in Jamaica, southern Haiti, and southern Central America.

The tectonic evolution of the Nicaraguan Rise can be described by four tectonic phases that include 1) Late Cretaceous to Paleocene collision of the Great Arc with the Chortis block; this event juxtaposed the GAC and CLIP with the Chortis block and folded the south-facing, passive margin of southern Chortis block; folds can be mapped in the subsurface up to 150 km to the northeast of Honduras beneath the Tertiary carbonate cap; 2) east-west Paleocene to Eocene rifting related to the transition from northward-verging, Late Cretaceous collision to east-northeast migration of the Caribbean plate; these rifts affected the Chortis block, GAC and CLIP and are present beneath the Nicaraguan Rise and exposed onland in Jamaica where they were inverted from late Miocene to the present; and 3) a borderlands province parallel to the Cayman trough that resulted in continued subsidence of the northern Nicaraguan Rise. Known petroleum systems based on type II/III source rocks are associated with Paleogene rift and sag basins, and unproven type II petroleum systems may be linked to late Cretaceous deepwater shaly limestone.