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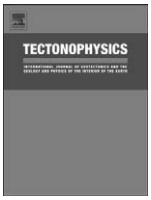

Morphostructure at the junction between the Beata ridge and the Greater Antilles island arc (offshore Hispaniola southern slope)

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ABSTRACT

Oblique convergence between the Caribbean plate's interior and the inactive Greater Antilles island arc has resulted in the collision and impingement of the thickened crust of the Beata ridge into southern Hispaniola Island. Deformation resulting from this convergence changes from a low-angle southward-verging thrust south of eastern Hispaniola, to collision and uplift in south-central Hispaniola, and to left-lateral transpression along the Southern peninsula of Haiti in western Hispaniola. Using new swath bathymetry and a dense seismic reflection grid, we mapped the morphological, structural and sedimentological elements of offshore southern Hispaniola. We have identified four morphotectonic provinces: the Dominican sub-basin, the Muertos margin, the Beata ridge and the Haiti sub-basin. The lower slope of the Muertos margin is occupied by the active Muertos thrust belt, which includes several active out-of-sequence thrust faults that, were they to rupture along their entire length, could generate large-magnitude earthquakes. The interaction of the thrust belt with the Beata ridge yields a huge recess and the imbricate system disappears. The upper slope of the Muertos margin shows thick slope deposits where the extensional tectonics and slumping processes predominate. The northern Beata ridge consists of an asymmetrically uplifted and faulted block of oceanic crust. Our results suggest that the shallower structure and morphology of the northern Beata ridge can be mainly explained by a mechanism of extensional unloading from the Upper Cretaceous onward that is still active residually along the summit of the ridge. The tectonic models for the northern Beata ridge involving active reverse strike–slip faults and transpression caused by the oblique convergence between the Beata ridge and the island arc are not supported by the structural interpretation. The eastern Bahoruco slope an old normal fault that acts as a passive tear fault accommodating the sharp along-strike transition from low-angle thrusting to collision and uplifting.

1. Introduction

The deadly 2010 Haiti earthquake has renewed the interest of the scientific community in the study of active processes in the northern Caribbean (e.g., Calais et al., 2010; Hornbach et al., 2010; McHugh et al., 2011; Mercier de Lépinay et al., 2011; Prentice et al., 2010; ten Brink et al., 2011). However, although the first order tectonic framework of the NE Caribbean is well understood, there are many under water regions where the knowledge of the tectonics remains limited. For example, the southern margin of Hispaniola Island and the northern Beata ridge were previously studied using mostly widely-spaced and low-resolution seismic reflection profiles (e.g., Byrne et al., 1985; Cooey, 1982; Driscroll and Diebold, 1998; Jany, 1989; Ladd et al., 1977, 1981; Mauffret and Leroy, 1999; Mauffret et al., 2001; Mercier de Lépinay et al., 1988). This sparse coverage complicated the understanding of the along-strike variations of tectonic structures in the region. Furthermore, the paucity of seismic activity along structures such as the Beata Ridge makes it difficult to identify possible active faulting.

This work presents new high-resolution, systematic swath bathymetry and seismic reflection data and combines them with previous swath bathymetry and re-processed single-and multi-channel reflection profiles to provide a combined interpretation of the morphotectonic features of offshore southern Hispaniola. We focus on the identification and characterization of recent tectonic features in the region and provide well-defined targets to carry out future studies for seismic and tsunamigenic hazard assessment. We use the newly-integrated data set to review previous hypotheses for the evolution of the Beata ridge and its interaction with the island arc and to discuss

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