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Modes of active deformation in Eastern Hispaniola

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Eastern Hispaniola and the Puerto Rico Island are the emerged part of a doubly vergent thrust wedge formed by oblique arc-continent collision with subduction and underthrusting of the North America Plate in the Puerto Rico trench and underthrusting of the Caribbean crust in The Muertos trough (Dolan et al. 1998, Mann et al., 2002, ten Brink et al. 2010). In the relatively small area of Eastern Hispaniola several types of active crustal deformation have been recognized:

1) At the prowedge of the orogene, the rear of the accretionary prism is cut by the strike-slip Septentrional Fault, bounding a sliver plate (Mann et al, 2002). Recent detailed mapping and aeromagnetic surveys in the onshore part of the prism (Samaná Peninsula and Septentrional Cordillera, Sysmin Team) revealed that the internal structure of the sliver is made of parallel bands of sigmoidal, left-lateral, NW-SE thrust splays, bounded by steep strike-slip faults. We interpreted these structures as transpressional strike-slip duplex. It is worth to note the similarity between the strike and dip of the thrust splays and the 303, 62, 74 focal mechanism calculated by Russo and Villaseñor (1995) for the thrust event of the August 4, 1946 Hispaniola earthquake.

2) The uplifted core of the orogen extends between the accretionary prism and the beginning of the Muertos retrowedge. Half of this area is occupied by the Oriental Cordillera, a recent uplift of cretaceous island-arc rocks arching the Late Neogene reef. The rest of the territory is the Caribbean Coastal Plain modelled on the Late Neogene reef. The Oriental Cordillera is made of two en echelon left-stepping uplifts: the domal-shaped Haitises and the rhombohedral-shaped Seibo (García-Senz et al, 2007); the latter share structural similarities and scaling relations with the 90º neutral stepover model of McClay and Bonora (2001). Therefore we interpret it as a restraining stepover developed over a blind splay of the Septentrional Fault, and the main active fault at surface, the Yabón fault, as a trans pop-up strike-slip fault.

3) The contractive faults and folds that form the Oriental Cordillera disappear to the east replaced by a field of NW-SE to WNW-ESE trending normal faults with fresh scarps up to 75 m high depressing the Late Neogene reef (Punta Cana extended area). In plan form, the faults show multiple relays and transverse ramps at the overlaps. A NE-SW section coast to coast across the Punta Cana area show the Late Neogene reef gently arched and cut by normal faults bounding half-grabens, with the main throw directed to the NE. The amount of extension exceeds 3 km (5% of stretching). A very similar system of normal faults has been documented in seismic lines across the Mona Passage (eg. van Gestel et al., 1998, Mondziel, 2007, Chaytor and ten Brink, 2010) and onshore western Puerto Rico (Hippolyte et al., 2005), which are interpreted by a pinning extension model (Dolan et al., 1998, Mann et al., 2002) or by oblique extension (Chaytor and ten Brink, 2010). Whatever the tectonic model may be, our data places an onshore boundary between transpressional and extensional domains.

4) The retrowedge at the southern margin of Hispaniola form an imbricate of E-W segmented thrusts overriding the Muertos trough (ten Brink et al., 2010). These authors suggest that the transport direction within the Muertos thrust system is southward perpendicular to the regional trend of the belt.

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