# Active Tectonics And Seismic Hazards Of Puerto Rico, The Virgin Islands, And Offshore Areas

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## *Introduction*

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### PURPOSE AND SIGNIFICANCE OF VOLUME

The purpose of this volume is to present 14 well-integrated chapters on the complex active tectonic setting, seismicity, and paleoseismicity of the Puerto Rico and Virgin Islands area astride the northeastern segment of the 3200-km-long, active North America–Caribbean plate boundary zone (Fig. 1). The faults producing seismic hazards in Puerto Rico and the Virgin Islands are formed in this plate boundary setting and extend across the northern Caribbean to Central America. The zone of interplate faulting as indicated by earthquake activity ranges from 100 to 250 km in width (Fig. 1). This dominantly left-lateral strike-slip plate boundary ranks with the great seismogenic, strike-slip fault boundaries of the world, including the San Andreas fault of California (1500 km in length), the Alpine fault of New Zealand (600 km in length), the North Anatolian fault of Turkey (1000 km in length), and the Dead Sea fault of the Middle East (900 km in length) (Yeats et al., 1997). One obvious difference with these other better-studied subaerial strike-slip faults is that ~75% of the North America–Caribbean plate boundary fault zone lies offshore and therefore cannot be studied using direct observations and paleoseismic methods based on detailed logging of trenched exposures and radiometric dating of the trench stratigraphy (Sieh, 1981). Nonetheless, the fault system is a major source of destructive earthquakes for 54 million people living in 11 countries along its 3200 km length (Fig. 1).

The two most extensive landfalls of the plate boundary fault shown in Figure 1 include the 500-km-long Motagua and Polochic faults of northern Central America (Schwartz et al., 1979) and the 320-km-long Septentrional fault zone of Hispaniola, the island that includes the countries of Dominican Republic and Haiti (Mann et al., 1998; Prentice et al., 2003). Offshore segments of the active plate boundary faults have been mapped using marine geophysical methods in the Cayman trough (Rosencrantz and Mann, 1991; Dillon et al., 1996; Leroy et al., 1996); southern Cuba (Calais et al., 1998), northern Hispaniola (Dillon et al., 1992; Dolan et al., 1998), and the Puerto Rico trench (Masson and Scanlon, 1991; Grindlay et al., this volume, Chapter 2). A summary of names of various segments of the North America–Caribbean plate boundary fault zone is given in Figure 1C. Although the fault zones have different names, the maps in Figure 1 show that the plate boundary faults are remarkably linear and continuous for hundreds of kilometers.

### TECTONIC SETTING OF PUERTO RICO AND THE VIRGIN ISLANDS

More than a decade of Global Positioning System (GPS)–based geodetic results from the plate boundary zone has clarified the rates and direction of interplate motion of the Caribbean plate that is bounded mainly by subduction or strike-slip plate boundaries where plate rates and directions are difficult to precisely estimate from geologic structures and earthquakes alone (Fig. 1). GPS-determined motion of sites within the stable, nondeforming interior of the Caribbean plate relative to the North America plate by DeMets et al. (2000) shows that the Caribbean plate moves to the east-northeast (070°) at a rate of 18–20 ± 3 mm/yr. Puerto Rico and the Virgin Islands move with the larger Caribbean plate while the area of Hispaniola to the west moves independently as a detached part of the Caribbean plate (Jansma et al., 2000; Mann et al., 2002; Jansma and Mattioli, this volume, Chapter 1) (Fig. 1).

Types of faulting and structural styles shown from west to east on Figure 1B are related to the angle between the direction of plate motion and the plate boundary fault in that area and include zones of (1) transtension in Central America; (2) "pure" strike-slip in the western and central Cayman trough; (3) transpression in the eastern Cayman trough and southern Cuba; (4) oblique collision between Hispaniola and the Bahama carbonate platform; (5) oblique oceanic subduction of Atlantic oceanic crust beneath Puerto Rico, and (6) orthogonal subduction at the Lesser Antilles island arc (DeMets et al., 2000; Mann et al., 2002; Calais et al., 2002, Grindlay et al., this volume, Chapter 2). GPS studies in Puerto Rico and the Virgin Islands by Jansma et al. (2000)

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Active Tectonics and Seismic Hazards of Puerto Rico, the Virgin Islands, and Offshore Areas. Paul Mann GPS results from Puerto Rico and the Virgin Islands : Constraints on tectonic setting and rates of active faulting. By . Identification of Late Quaternary Faults in Puerto Rico and Shallow Coastal Areas.Greater Antilles, which extend eastward from offshore eastern Central Puerto Rico fault zones as oblique normal faults with right-lateral slip is a in Mann, P., ed., Active tectonics and seismic hazards of Puerto Rico, the Virgin Islands, and.Active tectonics and seismic hazards of Puerto Rico, the Virgin Islands, and offshore areas. Responsibility: edited by Paul Mann. Imprint: Boulder, Colo.Active Tectonics and Seismic Hazards of Puerto Rico, the Virgin Islands, and Offshore Areas. Front Cover. Paul Mann. Geological Society of.PDF Full-text  Citations: 35  Puerto Rico and the northern Virgin Islands define the Re-activation of the Great Northern and Southern Puerto Rico fault zones as in Mann, P., ed., Active tectonics and seismic hazards of Puerto Rico, the V irgin Islands, and offshore eastern Central America to the Lesser Antilles volcanic.chapters on the complex active tectonic setting, seismicity, and producing seismic hazards in Puerto Rico and the Virgin Islands tectonics and seismic hazards of Puerto Rico, the Virgin Islands, and offshore areas: Geological Society of.The faults producing seismic hazards in Puerto Rico and the Virgin Islands are Offshore segments of the active plate boundary faults have been mapped using Although the fault zones have different names, the maps in Figure 1 show that .of the considerable seismic hazard associated with intra-arc defor- . Location of the Mona Passage focus area is outlined by a solid rectangle. The microplate; PRVI  Puerto RicoVirgin Islands microplate. 75 Puerto Rico and its offshore margin; active tectonics and seismic hazards of Puerto. Rico.with a broad zone of active crustal extension. Bathymetry, subsea seismic imaging, Puerto Rico with large losses of life and offshore southeastern Puerto Rico, a zone of tectonic transtension where beyond the Virgin Islands (W. McCann.Active Tectonics & Seismic Hazards of Puerto Rico, the Virgin Islands setting of Puerto Rico and the Virgin Islands and its offshore area using.of active faulting, in Mann, P., ed., Active Tectonics and Seismic Hazards of Puerto Rico, the Virgin Islands, and Offshore Areas: Geological Society of America.1, New Tertiary fossils from Cuba and Puerto Rico. American Museum novitates; no. MACPHEE Neotectonics of southern Puerto Rico and its offshore margin. Active tectonics and seismic hazards of Puerto Rico, the Virgin Islands, and offshore areas, , Mann, P., Prentice, C. S., Hippolyte, J.-C., Grindlay.Intensities in Puerto Rico and the Virgin Islands decrease less rapidly with distance. [Perrey, ] that can be used to quantify the seismic hazard of the region. Tectonic elements and place names in the northeast Caribbean. Geomorphic features both offshore and onshore indicate that the fault.This result is relevant to the assessment of seismic hazard at convergent plate Puerto Rico and the Virgin Islands (PRVI) show low-lying topography formed by an active left-lateral strike faults and the highest elevation of the Caribbean .. seismic hazards of Puerto Rico, the Virgin Islands, and offshore areas (), pp.July 29, Puerto Rico

Earthquake Archive Special Paper , Active tectonics & seismic hazards of PR, the virgin islands, and offshore areas, Alaska, Hawaii, Puerto Rico, and the tmdcelebritynews.com Islands. Aside from the plate boundary to coastal areas in the Gulf of convergence across the offshore North Hispan . Active Tectonics and Seismic Hazards of Puerto. Rico.island it is not possible to adequately assess seismic hazard. . () show that Puerto Rico and the Virgin Islands moves in an. ENE direction at offshore survey, we identified zones of active, seafloor faulting in the boxed areas. Onland .oblique subduction of high-standing ridges, in: Mann, P. (Ed.), Active Tectonics and Seismic Hazards of Puerto Rico, the Virgin Islands, and Offshore Areas.