

ABSTRACT

Tobago and Earthquakes

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On 1997/04/22 at 09:31 UTC, an earthquake of magnitude, M_t , 6.1 occurred about 10 km south of Tobago. It was the strongest near Tobago earthquake in modern times and caused damage in excess of TT\$18M. Two people were injured and six houses collapsed in south-west Tobago. There was a dramatic coseismic increase in groundwater discharge, in some instances sufficient to threaten building foundations. The evidence suggests that the discharged groundwater was squeezed out by a narrowing of the fracture network associated with the boundaries of the large-scale lithological units, particularly the Bacolet Formation. This earthquake followed one of magnitude, M_t , 5.6, which had occurred, just three weeks earlier, on 1997/04/02. It was located off the west coast of Tobago and had also caused damage. The seismic activity occurring during the weeks following the first event, when subjected to a b -value analysis, revealed indicators of the imminence of a stronger event than had already occurred. The 1997 earthquakes along with the other significant earthquakes near Tobago in 1982 and 1958, plus pre-instrumental events dating back to 1922, appear to have been triggered by strong-major earthquakes occurring on the Vema Fracture Transform, which offsets the mid-Atlantic ridge near 11°N latitude, about 20° directly east of Tobago. It is proposed that earthquakes on this transform excite stress waves, which travel through the asthenosphere at a velocity of approximately 632 km/yr, triggering earthquakes near Tobago with a delay of 38 ± 4 months. Published focal mechanism solutions in both zones reveal right-lateral-strike-slip motion. This together with the observed triggering phenomenon appears consistent with an interpretation that the earthquake correlation in the two zones arises from the presence of the boundary between the North American and South American plates in the area. For the instrumental era, the main shock magnitude has increased with each successive sequence and the magnitude of the mainshock of the next significant near Tobago is projected to lie in the range 6.6-7.0. The implications for the earthquake hazard in Tobago are serious.

Keywords: Joan Lynfa Latchman; Tobago; 1997 Tobago earthquakes; earthquake forecasting; b -value; Vema Fracture Transform; stress wave; earthquake triggering; earthquake induced groundwater discharge; tsunami