Geomorphologic and stratigraphic investigations on historic and pre-historic tsunami in Northwestern Puerto Rico: Implications for long term coastal evolution.

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Abstract
In 1918 an earthquake of magnitude **M**7.3 affected the northwestern portion of Puerto Rico. This earthquake was generated on the Mona Passage and produced an important tsunami. The event was associated with the rupture of the Mona Canyon Fault, which according to its Seismic Moment (***Mo***) had a rupture of about 3.5 meters of vertical displacement with an approximate length of 70 km. The waves generated by the tsunami reached up to 27 ft along the Puerto Rican coast. Descriptions from survivors and historic records led us to reconstruct the occurrence of this event. Some stratigraphic and geomorphologic investigations were conducted following the reconstruction of this tsunami.

Field investigations searched for the location of the historic observations and descriptions of eyewitnesses in different areas in the swamps, the dune areas at the beach and along the cliffs of Aguada and Aguadilla. The geomorphologic analysis included the search of tsunami impacts along the coast, which consist of a series of different flat, swampy and low lands beaches, separated by prominent cliffs. Based on the information collected, eight cores were collected on the swamps of northwestern Puerto Rico looking for historic and pre-historic evidence of tsunami. Also, a trench was opened a hundred meters from the beach.

The stratigraphic and sedimentologic record observed ion the cores show some layers appearing as parallel cross bedding laminations at different depths. These layers are sedimentologically different from the massive deposition defined above and below, which consist mainly of massive layers of white and gray calcareous and quartz fine sand. These laminations appear to be related to single and sudden events that cut-crossed the massive layers being deposited previously. Since there is no evidence of big seawater flooding in some of the sampled areas in the last 100 years, the sediments have been interpreted as generated by the 1918 tsunami. The upper layers located between .30 .50 meters deep in almost all the pipes showed the tsunami layers. Some records showed similar layers suggesting events prior to the 1918 tsunami. Preliminary interpretation concluded that the laminations found in the swamps were positively associated with tsunami deposition. Two radiocarbon dates were obtained from these laminations. The dates showed two pre-historic events dated 1270-1410 AD, and a second event dated 820-400 BC. Finally, the data suggests that tsunami events combined with Neotectonic deformation of active normal faults have been very important in the morphologic evolution of northwestern Puerto Rico.

Keywords: Caribbean, coastal geomorphology, paleoseismology, Puerto Rico, tsunami.