



## Multi-proxy analysis of an enigmatic sand layer in Pololu Valley, Hawaii: tsunami or storm deposit?

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The Hawaiian Islands have been affected by many locally and distantly-generated tsunamis. Their location in the middle of the Pacific means that they act as natural tsunami “barometers” for circum-Pacific countries. The coastal wetland system in Pololu Valley, Hawaii, has formed behind a 30 m high sand dune that constricts the outflow of Pololu Stream to the sea and also prevents major tidal seawater incursions. This is a unique setting in the Hawaiian Islands because it has been inundated by documented historical tsunamis in 1946, 1957 and 1960, with maximum runup heights of approximately 17 m, 10 m and 3 m, respectively. Photographs from 1946 provide clear evidence of the effects of tsunami inundation before, during and after the event, and indicate significant scouring of the dune system. The northeast side of the island of Hawaii has however, also been affected by hurricanes and severe storms in the recent past, many of which have also struck the Pololu coastline (e.g. 1871, 1903, 2003).

A gouge auger survey of Pololu wetland carried out in 2008 revealed a sand layer approximately 20 cm below the surface about 250 m inland from the shoreline. The most seaward auger site was adjacent to an old Second World War landing craft, which is believed to have been transported inland by the 1946 tsunami. The sand layer could be traced 100 m further inland, as it thinned from 35 cm to 2.5 cm thick. While it is possible that the thinning inland sand sheet was deposited by the 1946 tsunami, only a detailed multi-proxy analysis can provide enough robust information about its age and the depositional processes involved. Interpretation of these multi-proxy analyses will help to determine whether these sediments were laid down by a tsunami or a major storm. The data will also provide chronological information to help determine the age of the event.

Five short cores were collected at an increasing distance from the shoreline, and samples were analysed using a multi-proxy approach, including radiometric dating, geochemical, sedimentological, pollen, diatom and foraminifera analysis. Pb-210 dating suggests that a record of two 20th century events might have been preserved in the upper part of the sedimentary sequence.

A preliminary survey of a deeper sedimentary sequence in the valley showed that a long-term record of multiple events might also be preserved here. Although it does not form part of this project, it rather serves to indicate that there is considerable potential to extend the record of past storms and tsunamis further back in time.