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# Submarine sediment record of the 2009 South Pacific Tsunami and 1960 Great Chilean Earthquake Tsunami in Tutuila (American Samoa): a new proxy for backwash deposits

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Following the 2004 Indian Ocean Tsunami and other recent events, such as the 2009 South Pacific Tsunami, a large number of studies have focused on the impacts of such catastrophic events and their onshore deposits. The offshore backwash deposits have mostly been omitted, although they are crucial for a better understanding of the hydrodynamic processes during tsunamis and they may offer a higher preservation potential for past extreme wave events. In order to shed light on this point, cores were sampled in the sheltered bays of Tutuila (American Samoa), aboard R/V Alis, during the SAMOA-SPT campaign (Sept. 2015). We present a unique sedimentary record of two historical tsunami backwash in Pago Pago Bay, a highly sheltered bay strongly impacted by the 2009 South Pacific Tsunami. Although not associated with a marked grain size change, two backwash deposits were identified and dated using high-resolution 210Pb chronology: the 2009 South Pacific Tsunami and the 1960 Great Chilean Earthquake-associated Tsunami. A high Ti/Ca ratio and a distinct mineralogical assemblage revealed the terrestrial origin of the thin event layers (2 cm thick). Thin section analysis showed micro deformations at their base, including shearing and buckling. These sediment deformations are observed and described for the first time in recent backwash deposits. They lead us to propose a new depositional model for tsunami backflow as a highly cohesive mudflow inducing shearing and buckling of the soft underlying seafloor sediment. Based on the age versus depth model, deposits corresponding to Cyclone Val (December 1991) were also identified. They also show high Ti/Ca ratio indicating a terrestrial source. However, they are much more discrete; they are only found as small dispersed mud clasts (< 5 mm) and are not associated with sediment deformation. These basal sediment deformations can serve as a criterion for the identification of other recent and ancient tsunami backwash deposits around the world, but also add a new structural signature to the proxy toolkit to distinguish tsunami and storm deposits.