Geophysical Research Abstracts
Vol. 12, EGU2010-8927-1, 2010
EGU General Assembly 2010

A note on the onshore preservation potential of siliciclastic tsunami deposits - examples from coastal Peru

Michaela Spiske (1), Jens Piepenbreier (1), Heinrich Bahlburg (1), and Carlos Benavente (2)

(1) Westfälische Wilhelms-Universität, Institut für Geologie und Paläontologie, Corrensstrasse 24, 48149 Münster, Germany (spiske@uni-muenster.de), (2) Instituto Geológico, Minero y Metalúrgico INGEMMET, Av. Canadá 1470, Lima, Peru

Numerous tsunami during the last decade document that they are frequent events. Applying the number of recent and historical tsunami to the geological past, the onshore record should be numerous. This is not the case. Hence, the lack of historical or paleo-tsunami deposits implies that (1) either not all tsunami are capable of eroding and depositing sediments and/or (2) tsunami sediments have limited preservation potential.

We re-surveyed locations of the three most recent regional tsunami events in Peru, in order to determine the preservation potential of texturally diverse fine gained, siliciclastic tsunami deposits in different coastal environments. We re-visited the areas affected by the Chimbote-Tsunami (1996), by the Camana-Tsunami (2001) and by the Pisco-Paracas-Tsunami (2007).

The three events deposited sediments in form of (1) (graded) layers of coarse sand, some including shell fragments or rock fragments, (2) (imbricated) shell layers, (3) heavy mineral accumulations, (4) mud caps and (5) muddy rip-up clasts. Directional structures like imbricated shells gave information of both the presence of runup and backwash deposits.

In coastal Peru, where an arid climate is prevailing, aeolian erosion and transport are the most important coast shaping processes. Fine grained tsunami sediments will be mobilized and re-deposited, and sedimentary structures or grain size trends will be lost soon after an event. This is proved by the fact that all sediments deposited by the Chimbote-Tsunami and about half of the sediments of the Camana-Tsunami were already eroded, eleven and six years, respectively, after the event. There are no seasonal rain falls along the Peruvian coast. In case of the Chimbote and Camana-Tsunami, increased water discharge of periodic rivers after the annual snow melt or in the former case also during the El Niño event of 1997/98, additionally may have eroded large volumes of coastal sediments into the sea.

The re-survey of the Camana-Tsunami shows that muddy deposits like rip-up clasts and mud caps have a higher preservation potential than sandy sediments. This is caused by the cohesion of the mud particles that makes the deposits less susceptible to aeolian processes due to the fast hardening of the mud layers in the dry Peruvian climate.

Furthermore, examples of both the Camana and Pisco-Paracas-tsunami show that backwash deposits are preserved more frequently than runup sediments, probably because the latter will (partly) be eroded by the subsequent backwash.

In case of the Chimbote-Tsunami, local co-seismic uplift was recorded at Puerto Santa, where the coastline was shifted about 60 m in seaward direction. Co-seismic tectonic movements generally cause a disequilibrium that might locally entail increased rates of erosion or deposition. At Puerto Santa, no tsunami sediments were preserved, but the subsequent post-seismic subsidence led to a shift in the depositional facies and an increase in the normal post-tsunami sedimentation rate.

For recent events, as observed after the Pisco-Paracas-Tsunami, human activity, such as the use of beach and tsunami sand for rebuilding coastal structures, and the use of wood or sea grass deposited in swash lines as combustible, is an additional limiting preservation factor of these tsunami indicators.

Consequently, fine grained siliciclastic onshore tsunami deposits generally seem to have a lower preservation potential compared to normal coastal sediments.