Short Note

Tsunami deposit research in Mexico compels multi-disciplinary approach, not just multi-proxy application

Reply to: Comment by Ramírez-Herrera, *et al*. *Geofísica Internacional,* 57(1), 2018. DOI: 10.19155/geofint.2018.057.1.1812

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There has been an upsurge in geological and biological characterization of tsunami deposits after the 2004 Indian Ocean tsunami with the intention to identify paleo-tsunami events in sedimentary archives (Goff *et al*., 2011). Although there is noteworthy progress in recent years, there is still no perfect recipe to identify deposits associated with paleo-tsunami. Similarity between tsunami and storm deposits in coastal regions and the lack of any global proxy to identify paleo-tsunami, continue to be some of the main limitations. Tsunami deposits from different parts exhibited variable grain size, sediment structure and mineralogy. Some contain and others lack of marine fauna and shell fragments. One approach to overcome the limitations is the characterization of known-tsunami deposits in different regions and the documentation of possible independent proxies for different parts of the world. The paper by Ocampo-Ríos *et al*. (2017) is a small step in that direction since it documented the geological characteristics (our expertise) of a known-tsunami deposit. It also compared various recent tsunami deposits from near-by sites with similar geomorphological and geological settings in order to uncover a local proxy for the southwestern Mexico. Only the erosive base was useful among the entire observed characteristics.

Contrary to the critics' comments, Ocampo-Ríos *et al*. (2017) presented geological characteristics of sediments deposited by the 1985 tsunami at margins of the El Potosí estuary (up to 15-70 cm depth) at distances of >600 m from the shore. It is quite possible that inundation continued beyond 700 m and that far away sites also host tsunami deposits. Hydrological roughness was calculated from the inundation limit and the estimated roughness (for lagoons) was helpful in testing the eyewitness account. Geological proxies were not used to identify any paleo-tsunami deposit and the inundation limit was never estimated from the Manning's number. Similarly, the comparable chemical compositions of tsunami as well as non-tsunami deposits were a consequence of the geology of southwestern Mexico and its mineralogical composition. Considering the proximity of the Middle American Trench and the southwestern coast of Mexico, it is most probable that sediments transported by fluvial activity into the Pacific Ocean were reworked from the continental shelf by the tsunami waves and deposited in the estuary. The absence of higher Na_2O and Br in sediments deposited during a tsunami that occurred more than two decades before the sampling expedition were due to the lack of preservation or dissolution of highly soluble Na and Br-bearing salt minerals (deposited by sea water) in the sedimentary archive by several years of pluvial/fluvial activity (Chagué-Goff, 2010). Oxides of Si (quartz and feldspars) and Ti (mafic and heavy minerals) represent the mineralogical composition and they cannot be used as proxies to differentiate between continental and marine sources. In this particular case, minerals eroded from the Guerrero Composite Terrain (Centeno-García *et al*., 2011) were reworked from the Pacific

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Ocean into the estuary. However, we appreciate the comments since they provided a platform to discuss if simple multi-proxy application is sufficient, or the tsunami sediment research in Mexico compels a multi-disciplinary approach with the participation of experts from different disciplines.

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