

## Application of multiple proxies in Mexican tropical coasts to prove evidence of tsunami deposits

**Comment To:** Ocampo-Rios, *et al.*, *Geofísica Internacional*, 56(1), 2017. DOI: 10.19155/geofint.2017.056.1.4

María Teresa Ramírez-Herrera\*, Avto Goguitchaichvili, Francisco Bautista, Patricia Quintana, Ana-Carolina Ruiz-Fernández, Néstor Corona, Violeta Rangel, Marcelo Lagos, Vladimir Kostoglodov, María Luisa Machain, Daniel Aguilar Treviño, Rocío Castillo-Aja and Krzysztof Gaidzik

Received: August 17, 2017; accepted: October 06, 2017; published on line: January 01, 2018

The study of tsunami deposits has significantly advanced since the Chilean 2010 and Tohoku 2011 tsunamis providing opportunities to analyze tsunami deposits and their characteristics (Rubin *et al.*, 2017). In tropical environments, the combination of multiple proxies has demonstrated to be a necessity to prove evidence of ancient earthquakes and tsunamis (Ramírez-Herrera *et al.*, 2012, 2016; Williams *et al.*, 2011). Challenges faced in the study of tsunami deposits in tropical areas frequently affected by hurricanes, lead to problems of differentiation between tsunami and storm deposits, and misinterpretations of climate/seasonal changes.

Ocampo-Ríos *et al.* (2017) attempted to study the geologic evidence of the 1985 tsunami in Barra de Potosí, México. Their assertion that an "erosive base" is the only tool to prove the existence of tsunami deposits is not correct. (1) Our previous work in the Barra de Potosí area (field and survey-based interviews to witnesses of the 1985 tsunami) indicate that the area around the village has been intervened by human activity, thus surficial sediments are not reliable. (2) Beaches are very dynamic, and are located where normally tsunami erosion occur, thus, this type of environments are not suitable for tsunami deposits preservation. (3)

---

M.T. Ramírez-Herrera\*  
V. Rangel  
Laboratorio Universitario de Geofísica Ambiental  
Instituto de Geografía  
Universidad Nacional Autónoma de México  
\*Corresponding author: tramirez@igg.unam.mx

A. Goguitchaichvili  
Laboratorio Universitario de Geofísica Ambiental  
Instituto de Geofísica  
Universidad Nacional Autónoma de México  
Unidad Michoacán, UNAM-Campus Morelia, México

F. Bautista  
Laboratorio Universitario de Geofísica Ambiental  
Centro de Investigaciones en Geografía Ambiental  
Universidad Nacional Autónoma de México  
Campus Morelia, Morelia, México

P. Quintana  
D. Aguilar Treviño  
Centro de Investigaciones y Estudios Avanzados,  
Unidad Mérida, Yucatán, México

A.C. Ruiz-Fernández  
Instituto de Ciencias del Mar y Limnología  
Universidad Nacional Autónoma de México  
Unidad Académica Mazatlán, Mazatlán, México

N. Corona  
Centro de Estudios en Geografía Humana  
El Colegio de Michoacán A.C., Michoacán, México

M. Lagos  
Instituto de Geografía, Laboratorio de Tsunamis  
Pontificia Universidad Católica de Chile  
Santiago, Chile

V. Kostoglodov  
Instituto de Geofísica  
Universidad Nacional Autónoma de México  
Ciudad de México, México

M.L. Machain  
Instituto de Ciencias del Mar y Limnología  
Universidad Nacional Autónoma de México  
Ciudad Universitaria, Ciudad de México, México

R. Castillo-Aja  
Posgrado en Geografía  
Universidad Nacional Autónoma de México  
Ciudad Universitaria, Ciudad de México, México

K. Gaidzik  
Department of Fundamental Geology  
University of Silesia, Poland

Ramírez-Herrera *et al.* (2012) research results come from sites in the Ixtapa estuary and not from Zihuatanejo Bay, i.e. a completely different geomorphic setting that consequently changes the tsunami impact and distribution of tsunami deposits. Thus, comparison by Ocampo-Ríos *et al.* (2017) with their sites is inadequate. (4) Ocampo-Ríos *et al.* (2017) hydraulic roughness calculation (0.02) to determine the inundation limit shows inaccuracies. Values from 0.011 to 0.02 apply to flood plains with very irregular shape which is not the case for Ixtapa estuary studied by Ramírez-Herrera *et al.* (2012) nor is the Zihuatanejo Bay. The calculation of Manning's values for the specific location (using the local topography, vegetation density, presence of barriers, etc.) is more appropriate than using standardized Manning's values. We reassessed here the tsunami flooding area interpreted by Ocampo-Ríos *et al.* (2017) using their data and demonstrate that their results are not correct, the inundation continues beyond 700 m in both Zihuatanejo and Barra de Potosí areas. (5) . Mineral content and assemblages are source-dependent and therefore, they are not a useful tool alone to identify tsunami deposits (Jagodzinski *et al.*, 2012). (6) Except for the Br concentration values, Ocampo-Ríos *et al.* (2017) do not show significant differences in the elemental composition of the "pre-tsunami" and "tsunami deposits". The explanation provided on the low concentrations of Na, Cl and Br is not plausible. These elements have been widely used to identify marine provenance on sediment paleorecords along coastal areas. Br concentrations on soils can vary from 5 to 40 ppm, while on marine sediments they can reach up to 300 ppm (e.g. Ruiz-Fernández *et al.*, 2016). The oxides used to demonstrate tsunami origin of the Barra de Potosí sediments named "tsunami deposits", i.e. SiO<sub>2</sub> and TiO<sub>2</sub>, if there was in fact any significant difference in values, would prove terrigenous characteristics and origin, and not marine. In summary, multiple proxies are required to prove evidence of tsunami deposits.

## References

- Jagodziński R., Sternala B., Szczuciński W., Chagué-Goff C., Sugawara D., 2012, Heavy minerals in the 2011 Tohoku-oki tsunami deposits-insights into sediment sources and hydrodynamics. DOI:10.1016/j.sedgeo.2012.07.015
- Ocampo-Ríos B.G., D. Roy P., Macías M.C., Jonathan M.P., Lozano-Santacruz R., 2017, Tsunami deposits of September 21st 1985 in Barra de Potosí: comparison with other studies and evaluation of some geological proxies for southwestern Mexico. DOI:10.19155/geofint.2017.056.1.4
- Ramírez-Herrera M-T., Lagos M., Hutchinson I., Kostoglodov V., Machain M.L., Caballero M., Goguitchaichvili A., Aguilar B., Chagué-Goff C., Goff J., Ruiz-Fernández A.-C., Ortiz M., Nava H., Bautista F., López G.I., Quintana P., Extreme wave deposits on the Pacific coast of Mexico: Tsunamis or storms? — A multi-proxy approach. 2012. DOI:10.1016/j.geomorph.2011.11.002
- Ramírez-Herrera M.T., Bógalo M.-F., Černý J., Goguitchaichvili A., Corona N., Machain M.L., Carranza Edwards A., Sosa S., 2016, Historic and ancient tsunamis uncovered on the Jalisco-Colima Pacific coast, the Mexican subduction zone. *Geomorphology*, Elsevier, 2016, roč. 259, April. DOI:1016/j.geomorph.2016.02.011
- Ruiz-Fernández A.C., Sánchez-Cabeza J.-A., Serrato de la Peña J.L., Pérez-Bernal L.H., Cearreta A., Flores-Verdugo F., Machain-Castillo M.L., Chamizo E., García-Tenorio R., Queralt I., Dunbar R., Mucciarone D., Díaz-Asencio M., 2016, Accretion rates in coastal wetlands of the southeastern Gulf of California and their relationship with sea-level rise. DOI:10.1177/0959683616632882
- Rubín C.M., P. Horton B., Sieh K., Pilarczyk J.E., Daly P., Ismail N., Parnell A.C., 2017, Highly variable recurrence of tsunamis in the 7,400 years before the 2004 Indian Ocean tsunami. DOI:10.1038/ncomms16019.
- Williams S., Prasetya G., Chagué-Goff C., Goff J., Fai Cheung K., Davies T., Wilson T., 2011, Characterising diagnostic proxies for identifying palaeotsunamis in a tropical climatic regime, Samoan Islands. DOI:10.23919/OCEANS.2011.6107137