Evidences of a large tsunami in the Northern Lesser Antilles

Eric Chaumillon*[1], Stefano Fabbri , Pierre Sabatier , Louise Cordrie , Maude Biguenet , Raphaël Paris , Simon Falvard , Fabien Arnaud , Audrey Gailler , Guillaume Saint-Onge , and Nathalie Feuillet

[1]LIttoral ENvironnement et Sociétés - UMR 7266 (LIENSs) – Université de La Rochelle, Centre National de la Recherche Scientifique : UMR7266 – France

Résumé

The Lesser Antilles Arc is related to the subduction of the North American Plate under the Caribbean Plate. However, no megathrust earthquake, similar to those that occurred in Sumatra in 2004 and Japan in 2011, was reported, and few tsunamis have been identified. After three geophysical and sedimentological cruises in the lagoons and bays of the Lesser Antilles (2018, 2021, 2023), we collected growing evidence of tsunami sediment records in coastal lagoons. Two studied lagoons (in Saint-Martin and Scrubb Island-Anguilla) display spectacular sediment records of high-energy events. These records are characterized by coarse grain size, geochemical signature and fauna remains. The distinction between tsunamis and storm deposits is based on relatively classical sedimentological characteristics, such as mud drapes and rip-up clasts. X-ray computed microtomography (micro-CT) imaging is also helpful for distinguishing those deposits. The well-known tsunami triggered by the 1755 CE Lisbon earthquake is recorded in these lagoons. An older tsunami record dated to the 14-15th century (named the pre-Columbian event) displays characteristics of a very large event. Several seismic-origin tsunami scenarios were modeled, varying the location and geometry of potential source faults, with the aim of obtaining wave heights and inundations compatible with the characteristics of the observed tsunami deposit. The most convincing result is obtained with a large megathrust rupture zone (magnitude class 9 M). From our new results, it appears that damaging tsunamis likely have occurred in the past in the Lesser Antilles and consequently could occur again in the future. Therefore, examining high-energy event deposits beyond historic times is crucial for developing effective strategies to address the hazards faced by coastal communities in the Lesser Antilles and protect densely populated and touristic regions.

References

Biguenet et al., 2022. Distinguishing between tsunamis and hurricanes in the same sedimentary record using X-ray tomography. Marine Geology, 450.

Cordrie et al., 2022. A Megathrust earthquake as source of a Pre-Colombian tsunami in Lesser Antilles: Insight from sediment deposits and tsunami modeling. Earth-Science Reviews, 228.

Biguenet et al., 2021. A 1600 year-long sedimentary record of tsunamis and hurricanes in the Lesser Antilles (Scrub Island, Anguilla). Sedimentary Geology, 412.

*Intervenant

Mots-Clés: Tsunami, Sédiment, Lagune, Antilles