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Deep megadeposits as paleoseismic indicators in the Lesser Antilles subduction zone

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Megadeposits such as Homogenite-Turbidite complexes (HmTu) are often retrieved in the deepest part of confined seas (Mediterranean, Marmara), in fjords or in lakes. Megadeposits are generally triggered by earthquakes and tsunamis but other factors such as climatic or volcanic events remain possible. Only few studies mention such deposits in subduction zones as the Lesser Antilles, where the convergence rate between the subducting American and overriding Caribbean plates is low (2 cm/a).
In order to carry out a paleoseismological investigation of the Lesser Antilles, sedimentary cores and geophysical data (backscatter, bathymetry, sub-bottom profiler) were collected during the CASEIS cruise (DOI: 10.17600/16001800) on board the R/V "Pourquoi Pas ?". This study focuses on the oblique (∼50°) northern segment (Barbuda-Anegada), where 7 Calypso piston cores were collected in isolated forearc basins. Megadeposits and thinner turbidites were identified in all the cores using CT scan, grain size (D50), petrophysical parameters (MS, d, Pw), echofacies characterization, spectrocolorimetry (L*) and XRF data.
Megadeposits are overall 2 to 6 m-thick HmTu complexes with a carbonate-rich base, a homogenous top (homogenite) and sometimes a gradual transition. The base might be either single or multipulsed and highlighted by alternating plane and oblique laminations, high Pw, D50, MS, L* and log[Ca/(Fe+Ti)], carbonate-rich clasts (foraminifera, shells, pteropods…), high amplitude reflectors visible in sub-bottom profiles and sometimes siliciclastic minerals (quartz, biotite, amphibole). The lower units of the megadeposits are amalgamated, and reveal therefore several sources of turbidity currents emplaced within a very short time span, and may consist of deposits from different sedimentary pathways and/or triggered by aftershocks.
Homogenites present very few variations in petrophysical parameters, D50 and geochemical ratios, show scarce structures and bioturbation and appear as transparent echofacies in sub-bottom profiles. Homogenites differ from hemipelagites by the high Ca-content. Due to the depth of the deepest cores (>5800 m), hemipelagites are carbonate-depleted except for the two shallowest cores (<5200 m). Homogenites would correspond to the end-member of large gravity-driven events or reworked sediment by tsunami. The distinct Ca-Sr pattern in core CAS16-36PC suggests that homogenites have at least two different sources which could be Anguilla Bank or Antigua Bank.
In 3 cores (35PC-36PC-40PC), the succession of at least 3 megadeposits can be correlated, implying an important potential for paleoseismic reconstructions in the northern segment forearc. Based on preliminary age models, the recurrence of megadeposits varies around 14ka, with the two youngest occurring at ∼8ka and ∼23ka cal BP. Our data suggest an exceptional ∼90ka-long record of extreme events. Their very low recurrence is in accordance with the low convergence rate. The striking difference between megadeposits and thin turbidites could be explained by the occurrence of a megathrust earthquake followed by an important tsunami in the first case, while thinner turbidites would be related to local, upper-plate or low-magnitude megathrust earthquakes without an associated tsunami.