Evolution and dynamics of the Lesser Antilles subduction zone: Insights from structural and sedimentary records in the back-arc domain

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The Lesser Antilles subduction zone marks the eastern boundary of the Caribbean Plate, where the North and South American plates are being subducted. The ~3000 m-deep Grenada Basin now separates the active Lesser Antilles Arc from the meridian ~1000 m-deep Aves Ridge, which corresponds to the southern part of the remnant Greater Antillean Arc, Cretaceous to Paleocene in age. Both the Aves Ridge and the Lesser Antilles underwent several phases of uplift and subsidence during the Cenozoic, presumably related to the dynamics of the subduction zone. These vertical motions have been well described for the Lesser Antilles, where islands emerge, but they remain poorly constrained for the submerged Aves Ridge. Multichannel seismic survey, wide-angle seismics and dredging performed during the GARANTI cruise in 2017 provide new constraints on the evolution of the Lesser Antilles back-arc area. Samples dredged on bathymetric highs or ridge flanks along the eastern part of the Aves Ridge attest for the development of carbonate reef platforms from Eocene to early Miocene, followed by a generalized submersion during the Miocene. The analysis of seismic lines across the Grenada Basin and the eastern Aves Ridge suggests that the Present-day basement topography was mostly established during the Eocene without significant differential motions between the Aves Ridge and the Grenada Basin since then. Seismic lines across the Grenada Basin also reveal an atypical basement geometry with a significant southeastward deepening, which possibly reflects the interaction with the South American Plate. A ~80-km wide and ~200-km long portion of the southeastern Grenada Basin appears to be floored by a 10+ km-deep oceanic crust. Further analyses will illuminate the respective contribution of thermal subsidence, tectonics and dynamic topography linked with the evolution of the Lesser Antilles subduction, the ongoing lithospheric transpression and the evolution of the STEP fault along North-Venezuela. This work is part of the GAARAnti ANR-17-CE31-0009 project.