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High-energy wave deposits at the eastern shore of Bonaire (Netherlands Antilles)

M. Engel (1), T. Willershäuser (2), A. Bolten (2), H. Brückner (1), G. Daut (3), V. Wennrich (4), D. Kelletat (5), A. Scheffers (6), S. R. Scheffers (6), and F. Schäbitz (7)

(1) Faculty of Geography, Philipps-Universität Marburg, Deutschhausstr. 10, D-35032 Marburg, Germany (max.engel@staff.uni-marburg.de), (2) Institute of Geography, Universität zu Köln, Albert-Magnus-Platz, 50923 Köln, Germany, (3) Institute of Geography, Friedrich Schiller-Universität Jena, Löbdergraben 32, 07743 Jena, Germany, (4) Institue of Geology and Mineralogy, Universität zu Köln, Albertus-Magnus-Platz, 50923 Köln, Germany, (5) Institute of Geography, Universität Duisburg-Essen, Universitätsstr. 15, 45141 Essen, Germany, (6) School of Environmental Science and Management, Southern Cross University, P.O. Box 157, Lismore NSW 2480, Australia, (7) Seminar for Geography and Education, Universität zu Köln, Gronewaldstr. 2, 50931 Köln, Germany

The island of Bonaire is part of the Leeward Netherlands Antilles and lies 90 km off the Venezuelan coast. It mainly consists of two upper cretaceous cores of basalt, andesite, and dacite, fringed by a sequence of Quaternary marine limestone terraces. These well-defined platforms formed by in-situ growth of coral reefs and deposition of coral debris during high stands of sea level and subsequent exposure due to slow tectonic uplift.
Bonaire has a semi-arid climate with an average annual precipitation of less than 500 mm, though large year-to-year variation occurs. Due to its peripheral position within the Caribbean hurricane belt the island rarely experiences severe storm events. Nevertheless, along the eastern windward coast several high-energy wave impacts of mid- to late Holocene age have created a well-diversified sedimentary record. Broad ramparts of imbricated coral rubble north of Lac Bai are 4 m high, proceed up to 400 m inland, and follow the shore over a distance of 12 km. Reef communities of the island's eastern sublittoral obviously never regenerated after their destruction during extreme wave events. Furthermore, massive boulders of up to 260 tons are distributed over the broad elevated Pleistocene reef platform deriving from the foreshore zone (Scheffers et al., 2008).
The windward nearshore morphological depressions provide excellent conditions for preserving sedimentary inputs of exceptionally large wave impacts. We carried out numerous vibracorings and gravity corings inside shallow sinkholes on the Pleistocene terrace north of Lac Bai and the landward floodplain of the Lagun embayment at Washikemba. Several vibracorings of up to 5 m below surface at Lagun show multiple interruptions of continuous sedimentation patterns by poorly-sorted shell hash within a carbonate-rich matrix of marine origin. The lowermost bioclastic unit dates back before 6000 BP. Within a superimposed layer of pure mangrove peat another cluster of shells, partly broken, is intercalated. 3.25 m below surface, an erosional surface separates the peat from a third mollusc debris facies. The high-energy impact obviously caused sustained modifications of ecological conditions and the sedimentary environment since it destroyed the local mangrove population, indicated by subsequent fine-grained terrestrial sedimentation documented in the cores.
In this contribution we present the approach of tracing high-energy deposits in onshore geoarchives of Bonaire's windward coast by implementing a broad interdisciplinary spectrum of analytical methods. It also will be discussed whether the episodic sedimentation patterns identified here are due to tsunamis or exceptionally large tropical storms.

Scheffers, S.R., Haviser, J., Browne, T., Scheffers, A. (2008) Tsunamis, hurricanes, the demise of coral reefs and shifts in prehistoric human populations in the Caribbean. Quaternary International, doi:10.1016/j.quaint.2008.07.016.