Geophysical Research Abstracts
Vol. 18, EGU2016-6633, 2016
EGU General Assembly 2016
© Author(s) 2016. CC Attribution 3.0 License.

Multiple dating approach (14C, U/Th and 36Cl) of tsunami-transported reef-top megaclasts on Bonaire (Leeward Antilles) – potential and current limitations

Gilles Rixhon (1), Simon Matthias May (1), Max Engel (1), Silke Mechernich (2), Rebecca Keulertz (2), Andrea Schroeder-Ritzrau (3), Jens Fohlmeister (3), Norbert Frank (3), Tibor Dunai (2), and Helmut Brueckner (1)

(1) Institute of Geography, University of Cologne, Cologne, Germany , (2) Institute of Geology, University of Cologne, Cologne, Germany , (3) Institute of Environmental Physics, University of Heidelberg, Germany

Coastal hazard assessment depends on reliable information on the magnitude and frequency of past high-energy wave events (EWE: tsunamis, storms). For this purpose onshore sedimentary records represent promising geo-archives for the mid- and late-Holocene EWE history. In comparison to fine-grained sediments which have been extensively studied in the recent past, supralittoral megaclasts are less investigated, essentially due to the difficulties related to the dating of corresponding depositional events, and thus their limited value for inferring the timing of major events. On Bonaire (Leeward Antilles, Caribbean), supratidal coarse-clast deposits form prominent landforms all around the island. Fields of large boulders (up to 150 t) are among the best-studied reef-top megaclasts worldwide. Transport by Holocene tsunamis is assumed at least for the largest boulders (Engel and May, 2012). Although a large dataset of 14C and electron spin resonance (ESR) ages is available for major coral rubble ridges and ramparts, showing some age clusters during the Late Holocene, it is still debated whether these data reflect the timing of major depositional/transport event(s), and how these data sets are biased by reworking of coral fragments. In addition, different processes may be responsible for the deposition of the coral rubble ridges and ramparts (storm) and the solitary megaclasts (tsunami).

As an attempt to overcome the current challenges for dating the dislocation of the megaclasts, three distinct dating methods were implemented: (i) 14C dating of boring bivalves (Lithophaga) attached to the boulders; (ii) uranium-series (U/Th) dating of post-depositional, secondary calcitic flowstone at the underside of the boulders; and (iii) surface exposure dating of overturned boulders via 36Cl concentration measurements in corals. The three 14C datings yield age estimates >37 ka, i.e. most probably beyond the applicability of the method, which sheds doubt on the usefulness of this method in the current context. It seems that the bivalves had incorporated the old $CaCO_3$ from the MIS 5.5 mother rock. A U/Th age of the calcitic flowstone points to the Late Holocene period (1.3 ka); it represents a minimum age for boulder transport. Further U/Th dating is in progress. Four coral samples collected from three overturned boulders yielded similar 36Cl concentration measurements, also pointing to a late Holocene dislocation of the clasts. However, it remains unclear whether this concentration cluster mostly results from nuclide accumulation at the “blank” side, subsequent to their overturning during the depositional event, or already from pre-exposure at depth in the MIS 5.5 coral reef platform prior to the EWE. Further analysis is in progress to disentangle the problematic role of inheritance. These preliminary results show the potential and the current limitations of the applied methods for dating the dislocation of supralittoral megaclasts.

Reference:
Engel, M., May, S.M.: Bonaire’s boulder fields revisited: evidence for Holocene tsunami impact on the Leeward Antilles. Quat. Sci. Rev., 54, 126–141, 2012.