



Relative sea-level changes recorded by coral microatolls above the Manila trench in Ilocos region (West Luzon, Philippines)

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Due to oblique convergence, Luzon is a region of complex deformation, where megathrust and upper-plate faults coexist. Little is known about the seismic potential of the Manila trench that faces the west coast of Luzon. To assess seismic hazard in western Luzon, we are investigating coral microatolls. Coral microatolls record relative sea-level (RSL) changes with centimetric accuracy, which can be used to infer vertical deformation, and hence the history of strain accumulation and relief along the megathrust through multiple seismic cycles. By combining microatoll records, observations of uplifted terraces, and geodetic data, we hope to gain information about megathrust segmentation, as well as interseismic coupling and its variability through time.

In Ilocos Region, we have identified several sites with multiple generations of fossil emerged microatolls. In Ilocos Norte and Ilocos Sur, we focused on three target sites: Gabut Norte, Badoc and Cabugao (from north to south) that cover ~22 km of the coast. Emerged fossil microatolls at Badoc and Cabugao are all mid-Holocene, whereas Gabut Norte has younger emerged fossil corals U-Th dated to ~650 and ~260 yr BP. At Cabugao we identified a trend between coral ages and elevation with older corals at higher elevation. Pronounced cup-shaped corals at Cabugao and Badoc suggest an alternation of periods of gradual submergence interrupted by sudden emergence. In Gabut Norte, the better represented higher fossil corals display variable morphologies, which could be explained by a mix of corals of different ages or by the natural variability in coral HLS.

In Cabugao, the RSL pattern inferred from microatolls could be explained by interseismic subsidence and coseismic uplift related to elastic strain accumulation and release along the Manila trench. The long-term emergence might thus be explained if a substantial fraction of the coseismic uplift is permanently retained. An alternative explanation would invoke long-term uplift due to Glacial Isostatic Adjustment (GIA) with the seismic cycle signal superimposed on the longer-term GIA signal. Contrary to Cabugao, the long-term emergence in Gabut Norte could rather be related to deformation along upper-plate faults, since we suspect that corals of different ages are standing at the same elevation.

The sites along the west coast of Luzon with multiple generations of emerged microatolls suggest a high seismic hazard. The Cabugao record, in particular, is the first with compelling evidence for multiple sudden uplifts within a period of ~800 yr.