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Crustal deformation in the Andaman Islands suggested from paleoseismological data

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The Andaman Islands were located in the northern part of the rupture area of the 2004 Sumatra-Andaman earthquake, and accompanied with coseismic crustal movement which was southeastward tilting based on the height of uplifted corals and tide gauge data. After the 2004 earthquake, we carried out paleoseismological survey all through the islands.

In the Interview Island situated in the 2004 uplifted area, northwestern part of the Andaman Islands, we found older uplifted corals divided into at least four levels. Radiocarbon ages suggest that uplift events have repeatedly occurred at every 250-350 years during 6600-5700 years ago. However, their heights reached to 0.6-1.3 m above present mean sea level are unexpectedly low in spite of repeating uplift. And curiously, no visible evidence of uplift in the period until the 2004 since 5700 years ago was found. This phenomena can be explained by influence of eustatic sea level change, but also it suggests that residual uplift per event is little (0.1-0.5 m).

In the southeastern part, the 2004 subsided area, we found the evidence of past subsidence as well as the 2004 event from the stratigraphy observed by trenching and coring survey. Radiocarbon ages indicate that the timing of event is after 400 years ago which is probably correlated with the historical earthquake of the 1679 in Eastern Bengal. Although this area has repeatedly subsided, we also found in-situ fossil coral of 5000 years ago at almost present sea level, which suggests residual subsidence is very little.

In the Neil Island located at back arc side, further east of the 2004 rupture area, five steps of distinct marine terraces have been developed, though this island was coseismically stable during the 2004 earthquake. Height distributions and radiocarbon ages obtained from each step suggest that coseismic event accompanied with net uplift of 1-2 m have occurred at every 700 years during 6000-3000 years ago.

Summarizing above results, cumulative amount of coseismic crustal movement in the 2004 rupture area of the Andaman Islands is little through Holocene. Recurrence interval revealed by paleoseismology is consistent with geodetical estimations in and around the islands (230-600 years; Subarya et al., 2006, nature. ave. 400 years; Gahalaut et al., 2008, JGR.). This suggests that the most of crustal strain associated with plate subduction has been released by great earthquake such as the 2004 event. On the other hand, back arc side of the islands has been actively uplifted by another type event probably related to intra-plate fault.

Keywords: giant earthquake, crustal deformation, Holocene, uplifted coral, marine terrace, Andaman Islands