Probabilistic Evaluation of Coastal Aggradation Models of Kamakura and Zushi areas, Japan

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In coastal lowlands of Kamakura and Zushi areas, a pebbly tidal flat deposit is widely recognized near the present sea level. The 14C datings of the pebbly tidal flat deposit form 3 cohorts. Since each cohort forms near the ages in which major historical earthquakes appears in historical documents, these pebbly tidal flat could be generated by tectonic uplifts of these earthquakes. However, it is hard to deny other aggradation process such as gradual or not tectonic but intermittent. Here I attempted statistical approach to evaluate models that assume intermittent and gradual and obtain optimum solution to explain observed dating dataset. In these models, parameters such as life span of the pebbly tidal flat or uplift ages are varied to obtain optimum solution.
First, 14C age distributions of samples in the pebbly tidal flat are calculated for the gradual (Model 1) and intermittent (Model 2) aggradation models. For each basin models, dating samples are randomly picked up to form a virtual dataset and its age distribution is compared with the dataset obtained in the field. We define similarity of the virtual dataset to the observed one based on Kormogolov-Smirnov Test and probability to obtain “similar” dataset from the virtual basin is calculated. The probability denoted by p* is compared among the models and scenarios from various life span of the basins or timings of uplifts.
The optimum solution for Model 1 assumes life span of the tidal flat from AD500 to 1800 (p* = 0.0600).
The optimum solution for Model 2 assumes aggradation events in AD1680, 1180 and 780 (p* = 0.2150).
The scenario that assumes the aggradation event were coeval to the historical major earthquakes (AD1703, 1257 and 878) marks p* = 0.0942. Comparison between observed dataset and age distribution in the virtual basin implies that the 1703 and 1257 or 1293 earthquakes were responsible for the aggradations; however, the AD 878 major earthquake seems to have less responsibility for the aggradation event.
In summary, the tidal flat deposit found in the lowlands of Kamakura and Zushi areas 1) seem to be formed by intermittent aggradation rather than gradual aggradation, and 2) the intermittent aggradations could be coeval to the historical major earthquakes. However, 3) other possibilities such as human activity should be considered before we conclude the historical major earthquakes are responsible for the aggradations.

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