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Late Pleistocene MIS 3 high temporal resolution climate reconstruction using giant clam fossils in Kikai Island, Japan

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Giant clam (Tridacnidae) widely distributed over the coral reefs in Indo-Pacific Ocean and has symbiotic algae, facilitating fast growth and forming daily shell growth pattern (daily growth increment). Thus, giant clam shell could be useful tool for high temporal resolution analysis for past environment.

Kikai Island located in the northern Ryukyu archipelago has the well-developed coral reef terraces with the highest uplift rate (1.8 m/ka) in Japan tracking back to that formed in marine isotope stage (MIS) 5e (Ota et al., 2000). With this feature, middle Pleistocene to Holocene giant clam shell fossil are continuously available through the period. Especially, MIS 3 has been the subject of intense study in deep-sea cores and in ice records as it shows unusual high frequency climate variability. Therefore, MIS 3 giant clam fossil in Kikai Island can provide high temporal resolution environment information at the period.

We sampled giant clam fossil samples from Late Pleistocene MIS 3 (55 ka) and modern specimen from Kikai Island, Japan. The fossil specimen was well preserved from diagenesis alternation. Stable isotope ratio (δ^{18}O, δ^{13}C), trace element, and sclerochronological analysis were performed in each shell specimens. δ^{18}O and growth increment thickness in the modern shell specimen well reflected annual SST cycles. The Ba/Ca peaks and growth reduction in summer coincided with the typhoons approached to Kikai Island. As well as modern specimen, MIS 3 fossil specimen had Ba/Ca peaks and growth reductions in summer season. These results suggested that MIS 3 Kikai Island could be cooler condition than today but also some typhoons could approached Kikai Island. Moreover, the signature of typhoons in MIS 3 fossil specimen suggested lower frequency and the different distribution of typhoon approaching at that time.