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Fossil coral sea-surface temperature reconstructed at Kume Island at the mid- to late Holocene boundary

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The relative warmth and stability of the Holocene was punctuated by several brief climate perturbations. There is evidence for a global late Quaternary climate anomaly at around 4.2 ka, and mechanisms of this event are not well understood. As one of the major climate events in the Holocene, 4.2 ka is proposed as the Middle-Late Holocene boundary (Walker et al., 2012). Although climate perturbations on a global scale are widely reported in this period, the lack of records from regions such as the East China Sea (ECS) results in an incomplete understanding of the underlying mechanism of Middle-Late Holocene climate change.

Here, we present a coral-based paleo-SST (Sea-Surface Temperature) reconstruction from the Kume Island, in the ECS, to reveal climate variability in mid- to late Holocene boundary. Coral (*Porites* sp.) exhibits annual bandings and a rapid growth rate that enables to reconstruct paleoclimate at seasonal time scales. Among the various chemical components in coral skeletons, Sr/Ca ratios are a reliable proxy for SST (e.g., Beck et al., 1992; Correge, 2006). Two fossil corals were collected from the Kume Island, and radiocarbon dates were determined using AMS. The dating results of two fossil corals are 3.8 ka and 4.5 ka, respectively. We measured Sr/Ca ratio of two fossil coral skeletons and estimated paleo-SST (Sea-Surface Temperature) by applying the Sr/Ca vs. SST equation established from modern corals. Our new data confirm that both in summer and winter, cold conditions prevailed at 3.8 cal kyr BP, beginning after 4.5 cal kyr BP.

In the ECS, weak Kuroshio Western Boundary Current event, (*Pulleniatina* Minimum Event; PME, 4.5-3.0 ka) (e.g., Ujiie and Ujiie, 1999) has been reported around Middle-Late Holocene boundary. However, paleo-climate reconstruction of the PME has three problems. First, Some of the previously reported paleo-SST records shows decrease of SST during the PME, while others shows no change. Second, paleo-SST variability during the PME has not been reconstructed on a seasonal scale. Finally, the reported time range of the PME is highly variable. Therefore, a high-resolution, SST reconstruction is beneficial for understanding climate change during the PME.

While the PME has not been resolved seasonality, our high-resolution data clearly indicate sea-surface temperature decreased during both summer and winter. This result, combined with PME event reconstruction as the weak Kuroshio event, suggests that weak Kuroshio current caused SST decrease in the ECS both in summer and winter.

This result, combined with further Sr/Ca analysis using fossil corals collected and dated in this study, provides an important insight into the mechanism of the Middle-Late Holocene boundary in the ECS.

Keywords: Holocene, 4.2 ka, coral, Sr/Ca, SST, East China Sea