

East China Sea mid-Holocene sea surface temperature reconstructed from Sr/Ca measurements for corals from Kume Island

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The Holocene, a period for the last 11,700 years, is generally recognized as a stable and warm period which sea level has relatively been constant (Yokoyama and Esat, 2011). Growing number of studies, however, have been reported the millennium scale climate changes during this time (e.g., Bond et al., 2001, Wanner et al., 2011), but mechanism of millennium scale climate change has yet to be solved. Particular attention has been paid for the cold episodes during the Holocene and global mapping efforts to understand the natures of events are undertaken (Wanner et al., 2011), yet there are still limitations of spatial and temporal coverages of paleoclimate data. One such an area is the East China Sea (ECS) where the region currently being under influenced from both East Asian monsoon (EAM) and the strength of Kuroshio Current (Sun et al., 2005, Kubota et al., 2010). Various studies based on sedimentary archives have been conducted to reconstruct EAM changes in the past though little efforts are made to produce seasonally resolved longer (ie. > 1,000 years) EAM records.

Coral has annual banding with rapid growth rate like a tree-rings thus it enables us to reconstruct paleoclimate with seasonal time scale. Sr/Ca ratio is a highly reliable indicator of SST amongst various other chemical proxies in their skeleton and being widely used (e.g., Beck et al., 1992). Yet, only study using this method to reconstruct ECS paleoceanography is from Kikai Island using modern and 6 ka corals (Morimoto et al., 2007). The study was not able to provide information for the late Holocene, such as 3 to 4 ka.

In this study, fossil corals were collected from Kume Island, Okinawa, and analyzed both radiocarbon and Sr/Ca ratio to reconstruct mid- to late-Holocene paleoceanography. Two fossil corals (3.8 cal kyr BP and 4.5 cal kyr BP) are obtained and are revealed as pristine since they met the rigorous screening criteria of diagenesis based on XRD and SEM analyses. Two modern corals were collected from Sesoko Island, also located in Ryukyu Islands, to establish the equation of Sr/Ca-SST.

Reconstructed SST in 3.8 cal kyr BP showed colder condition than today ($p < 0.01$). This might be corresponding to the cold event previously reported as PME (Pulleniatina minimum event) in ECS (e.g., Xiang et al., 2007; Ujiie et al., 2003). They also suggested that magnitude of those changes were not comparable between summer and winter during the Holocene. Further analyses of coupled Sr/Ca and oxygen isotopes will allow us to separate both SST and salinity and hence can provide detailed information of ECS paleoceanography.

Keywords: East China Sea, East Asian Monsoon, coral, Holocene, Sea Surface Temperature, Sr/Ca