Coral barium/calcium record of sediment load in Sumiyo Bay, Amami Oshima

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Massive coral skeletons (*e.g. Porites sp.*) which distributed through sub-tropical and tropical regions provide the archives of various proxies for environmental and climatic reconstructions with high-temporal resolution owing to their rapid extension rate. Barium (Ba) is incorporated into the coral skeletons in close proportion to seawater concentration, therefore coral skeletal Ba/Ca ratio reflects the variation of Ba concentration, which is associated with oceanic upwelling, river discharge and terrestrial input. Additionally, high sediment resuspension and water turbidity caused by coastal runoff will lead the disturbance of coral growth and reef ecosystem.

In Amami region, south-west part of Japan, the localized heavy rainfall has occurred frequently in autumn season (Sep to Nov) during recent years. Remarkable heavy rainfall events have occurred on 18^{th} -20^{th} Oct 2010, 20^{th} Sep and 2^{nd} Nov 2011 in Amami Oshima, which have been reported devastating damages on the coastal ecosystem by the river flood. Understanding the influences of the environmental stress such as heavy rainfall and sediment input on reef corals (and their responses) is important for predicting inhabit environmental changes in the future. In this study, we reconstruct the heavy rainfall event in Amami Oshima using coral skeletal growth parameters analysis (annual extension rate (mm/yr); annual average density (g/cm^3); annual calcification rate (g*cm^{-2}/yr)) and skeletal geochemical records (stable isotope ratios and trace elements) with weekly resolution. Our coral record of seawater Ba concentration during last 50 years also provide the coral responses to habitat environmental changes by sediment load after heavy rainfall events.

We collected a living *Porites* coral core at 5.1 m depth in Sumiyo Bay (nearby Sumiyo river mouth; eastern area of Amami Oshima) on Oct 2014. Annual bands of the coral skeletons were observed by X-radiographs. We analyzed stable oxygen and carbon isotope ratios ($\delta^{18}O$ and $\delta^{13}C$) using a mass spectrometer coupled a carbonate reaction device, and trace element ratios (Sr/Ca, Mg/Ca and Ba/Ca) using inductively coupled plasma atomic emission spectroscopy (ICP-AES) with ultrasonic nebulizer under pre-treatment with ultra-pure water. $\delta^{18}O_{sea\ water}$ was calculated skeletal Sr/Ca and skeletal $\delta^{18}O$. Seawater Ba concentration was calculated from skeletal Ba/Ca.

Low density bands were observed in winter season and/or rainy season (including Typhoon season). This result suggests that low density bands of our specimen would be produced by environmental stress such as low sea surface temperature, low salinity and sediment input by rain fall.

During 2010 heavy rainfall event, estimated SST from skeletal Sr/Ca and Mg/Ca were lower than those for averaged during last 50 years. $\delta^{18}O_{seawater}$ calculated from $\delta^{18}O$ and Sr/Ca ratio in coral skeletons were corresponding with precipitation records, with negative peak after the flood events. On the other hand, skeletal $\delta^{13}C$ did not show large variation during heavy rainfall events. Skeletal Ba/Ca tracked the changes in sediment load by heavy rain in 2010 and 2011 with increasing trend during several months. The estimated seawater Ba concentration in Sumiyo Bay was increased two- or three-fold than averaged background during last 50 years. In addition, skeletal extension rate decreased dramatically in the aftermath of 2010 heavy rainfall, suggested that the skeletal growth was influenced by river runoff (lower salinity and sediment input).

The baseline of estimated seawater Ba concentration was characterized by increasing trend toward the present day. In addition, there were significant negative correlations between the annual baseline of

estimated seawater Ba concentration and annual extension rate and calcification rate. It may be due to the influences of increasing sediment input from Sumiyo river by land development and the frequent localized heavy rainfall nearby Sumiyo Bay.

