Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

BBG22-P01 Room:Convention Hall Time:May 25 17:15-18:30

Reconstruction of marine environments around Todoroki River in Ishigaki Island using trace elements of coral skeletons

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I. Introduction

Coral reefs form one of the most productive ecosystems in the world, providing complex and varied marine habitats that support a wide range of other organisms. However, they are being greatly stressed by recent human activities. Especially, coastal areas are subject to river discharge of polluted material from its watershed. Since corals of the genus Porites with annual bands assimilate trace elements in their skeletons depending on their concentrations in seawater, coral skeletons are considered as a useful indicator of estuarine environment.

II. Samples and Methods

Coral skeletons were collected around river mouth of Todoroki River, Ishigaki Island, Okinawa. To demonstrate spatial distributions, 5 short coral cores (S1, S2, S3, S4, S5) were collected along an inshore-offshore transect line. To reconstruct time series variations, 2 long cores (L1, L2) were collected and sub-sample were collected along annual bands. 13 elements including manganese (Mn) and barium (Ba) were measured by ICP-MS (Inductively Coupled Plasma Mass Spectrometry) and 2 elements including iron (Fe) were measured by ICP-AES (ICP-Atomic Emission Spectrometry). In order to remove secondary contaminations during coral coring and/or sample storage, and to understand the state of elements, appropriate pretreatment on coral samples is required. In order to find out an appropriate pretreatment procedure, I conducted a stepwise cleaning on coral samples.

III. Results and Discussion

It has been suggested that Ba concentration of coral skeleton can be a proxy for

freshwater discharge while Mn and Fe concentrations would indicate terrestrial runoff. Variations of Ba, Mn and Fe concentrations in coral skeletons in this study have reconstructed marine environments around Todoroki River, Ishigaki Island described as below.

The results of pre-treatment experiments have suggested that dissolved Ba is incorporated into coral skeletons while Fe seems to be attached to skeletal surfaces as

particles. In addition, corals would uptake both the dissolved and particulate Mn. Time series variations of L1 core showed seasonal variations of Ba and Mn concentrations corresponding the variation of precipitation. On the other hand, Fe concentration of L1 core did not show seasonal variations, although Fe has also reported as a proxy of soil runoff as well as Mn. It can be explained by differences of uptake mechanism of each element by corals. Because corals seem to uptake Fe as particles in the study area, Fe concentration may represent not only soil runoff but also sediment resuspension. Chronological variations of Mn and Fe concentrations reconstructed by L2 core showed increasing trends from late 1980s with the maximum during 1990s, although this trend was not found in chronological records of Ba and precipitation. Subsequently, Mn and Fe concentrations decreased after 1990s. This might be attributed to red soil runoff due to land improvement projects and subsequent conservation actions.

Keywords: coral skeleton, trace elements, red soil