Examination of the possibility about the paleoclimate reconstruction by using the Porites corals in Ishigaki Island

Daisuke Araoka[1]

[1] Natural Environmental Studies,Tokyo Univ

1. Introduction

Coral skeletons are composed of calcium carbonate (aragonite), and oxygen isotope ratio in the skeleton can provide insight into environmental information such as sea surface temperature (SST) and also the seawater oxygen isotope ratio. strontium/calcium (Sr/Ca) and magnesium/calcium (Mg/Ca) ratios in the skeleton might be useful for reconstructing SST. Yasura Peak, Ishigaki Island, Ryukyu archipelago where we gathered corals is unique as a low-latitude site where a temperature range of the year is big and annual precipitation is little. There is an enormous number of massive Porites coral boulders scattered on the shore. These boulders likely were cast ashore by the Meiwa Tsunami in 1771 AD.

Therefore, at first, we identified the correct generation of the emerged Porites coral boulders by an annual ring measurement and radioactive age assays. we measured oxygen isotope ratio, Sr/Ca and Mg/Ca of the Porites coral boulder and compared it with the Porites coral of Actual money (98IY03) that oxygen isotope ratio and Sr/Ca were measured by Tsunoda et al.,(2006) and Taira (2008).

2. Materials and methods

For a number of the samples, we performed radiocarbon dating and U/Th-dating and an annual ring measurement. IYT1 which was about 320cm cores launched for about 1778 (+-3) years, and I confirmed an annual ring for about 185 years, cut off an IYT1 to eighteen Slabs whose thickness are 7mm. According to a method of Suzuki et al., (2003), we gathered the whit sample by the milling and weighted it and we used the OPTIMA and ISOPRIME mass spectrometers for oxygen isotope ratio analysis and used the ICP-AES for Sr^{2+},Mg^{2+} and Ca^{2+} analysis.

3. Result and Discussion

The analysis precision of the radiocarbon dating was +- 30-95 years, whereas the analysis precision of the U/Th-dating was +- 2-5 years. it seems that, furthermore, the precision turns worse Because the radiocarbon dating needs the calibration such as a change of the atmospheric ^{14}C density or the marine reservoir effect. In addition, the generation when we calculated by the annual ring measurement accords with the generation when we calculated by U/Th-dating, it is very likely that there is an error for an annual ring measurement. Therefore, the U/Th-dating has very high precision. In addition, from radiocarbon dating and the U/Th-dating, we can think about the marine reservoir effect.

we measured Sr/Ca, Mg/Ca and oxygen isotope ratio about some Slabs of the IYT1, and a significant linearity was found (oxygen isotope ratio, Sr/Ca and Mg/Ca). Because oxygen isotope ratio might be useful for reconstructing SST and precipitation, oxygen isotope ratio might be an index which influence by the SST is big in Ishigaki Island. we compared growth rate with Mg/Ca, but no linearity was found. Therefore, Mg/Ca might be an index which influence by the SST is big, too.

we compared 98IY03 with IYT1 with Sr/Ca. I was able to confirm a decrese of Sr/Ca (=SST rise) in both the summer and the winter when we separately compared with the average of the extreme value in both the summer and the winter about Sr/Ca, part of 1685-1704 of IYT1, and part of 1981-1998 of 98IY03. In addition, SST in the winter rose more. When we converted Sr/Ca into SST with the value of each documents, I was able to elucidate the rise of SST of 0.40-0.74 centigrade in the summer and the rise of SST of 0.88-1.63 centigrade in the winter. It is clear that SST rose in the winter, because analysis precision in Sr/Ca is +-0.7 centigrade.

Therefore it is likely that we can restore various climate change in Ishigaki Island from the present more than 400 years by comparing with Sr/Ca, Mg/Ca and oxygen isotope ratio of IYT1 and 98IY03.