

Environmental assessment of Ariake Bay during past 100 years based on the concentration of heavy metals in the sediment cores

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Ariake Bay is one of major inland seas with many fisheries resources in Japan. Recently reduction of products in seaweed and shells is reported, and is considered to have occurred by disharmony between biological productivities and social activities. Such development of infrastructures, reclamation of coast and river improvements, around Ariake Bay area is considered to have affected biological productivities during past 10 years.

In this study, six core samples were taken from Omuta (Sta. 1), western river mouth of Chikugo River (Sta. 2), northwestern part of the bay (Sta. 3), northeastern Isahaya Bay (Sta. 4), southeastern Isahaya Bay (Sta. 5) and southwestern Midori River (Sta. 6). These samples are analyzed in age determination, concentration of heavy metals and planktonic diatom and dinoflagellata. These cores are composed of massive mud except Omuta (Sta. 1) in which the upper 40 cm of the core is composed of sandy mud. The sandy muds may have been replaced artificially for fisheries.

The age determination with Pb210 isotope reveals that sediments accumulation rates in the Chikugo River mouth (Sta. 2) and the northeastern Isahaya Bay (Sta. 4) are 0.12 cm/year and 0.18 cm/year respectively. Approximately the upper 15 cm of the cores have accumulated since 1900. Therefore, the analyzed data in the lower parts of the cores are considered to be a background value in Ariake Bay prior to industrial activities.

Samples were segmented in every 2 cm and dried in oven. Decrease in weight is water contents. The dried samples are powdered to form in a pressed pellet. Minor elements (S, Cl, Ba, Rb, Th, Nb, Zr, Y, Ga, V, Zn, Cu, Ni, Co, Cr, Pb) have been analyzed using XRF at Kumamoto University. The analytical errors are within 5 %.

The abundances of minor elements in the background samples (deeper than 10 or 20 cm) are nearly constant. Moreover, contamination of heavy metals in upper samples are not so high compared with those of the background samples. The concentrations of many heavy metals in samples from the upper most part of the cores are in the same level as the sediments deposited before 1900 in Tokyo Bay (Matsumoto, 1980). This suggests that Ariake Bay is not heavily contaminated by industrial activities and is consistent with planktonic fossil data.

Slight changes, however, are observed in the sediments after 1900 and may result in the human activities. The abundances of Zn, Zr and Sr change widely with depth. Kinoshita et al. (1979) worked on the distribution of the heavy metal contents in the sediments of Ariake Bay and concluded that the distribution of heavy metals contents in the surficial sediments are higher in the river months suggesting the result of human activities. However, we revealed that Zn decreases with time in the river months area (Sta. 2 and Sta. 6) but increases with time in the Stations 3, 4 and 5 in which are the far side from the Chikugo river. These suggest that the content of Zn in sediments are not reflect of waste by human activities but time variation of sedimentary process. That is the place of sediments supply have been changing slowly during past 100 years. The vertical variation in minor elements may reflect the flow patterns of sedimentary particles through river to the bay. Therefore, this change probably correspond to the river improvements which have been constructed to prevent flood disasters since Edo period.