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長良川河口堰域における堆積物の重金属汚染の評価
Evaluation of heavy metals pollution in sediment in the Nagara River Estuary Barrage region

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Heavy metals are the most common and serious pollutants in natural environment because of their toxicity, persistence and bioaccumulation problems. The excess occurrence of heavy metals in sediment can be attributed to either natural or anthropogenic sources. Heavy metals that released from these sources tend to be absorbed onto suspended particulate matters, furthermore, incorporated into bottom sediment as SPM precipitated. Sediment acts as carrier and source of heavy metals in aquatic environment, and reflects water quality.

The Nagara River had long been recognized as one of the cleanest rivers in Japan. However, in 1995, for the purposes of flood control and water use, the Estuary Barrage has been brought into operation, and the natural environment of the Nagara River has changed remarkably. So far, the studies carried out by numbers of researchers and communities which were mainly focused on downstream of the Estuary Barrage, and the upstream area was not studied that much. However, unpublished work by Hiramatu (2009) suggests that by the Barrage (the Nagara River Dam) and inflow of poorly treated sewage waters cause the environmental problems at its upstream area.

We collected systematically 70 sediment samples within a stretch of 30 km along the upstream of the Barrage, from 2009 to 2011, using Ekma-Birge Grab. Sediment samples were dried at 105 ?C for 24 hours and homogenized. These samples were fractionated using a series of sieving process according to needs of further analysis. The grain size distributions of sediment samples suggest that the fraction <180micrometer would be a reasonable choice for further analysis. Major components (SiO2, TiO2, Al2O3, Fe2O3, MgO, MnO, Na2O, K2O and P2O5) and minor components (Ba, Co, Cr, Cu, Nb, Ni, Pb, Rb, Sr, Th, Y, Zn, and Zr) were analyzed by X-ray fluorescence (XRF) spectrometer. FLASH 2000 organic elemental analyzer was employed to analyze the C, N, H, and S.

Compare to the upper stream, the content of finer fraction, and that of P2O5 and Ctotal in sediment increased at the Barrage area. Meantime, the high C/N ratios (C/N>10), suggest terrestrial organic matter likely to be responsible. The major compositions (SiO2, TiO2, Al2O3, Fe2O3, MnO, MgO, CaO, Na2O, K2O, P2O5) of the sediment are in a great agreement with the upper crustal average of Japan. Compared to the upper crustal average values of Japan (Togashi et al, 2000), these elements are enriched or depleted to various degrees; Co (x1.5-2.2), Cr (x0.3-2.1), Cu (x0.2-2.1), Ni (x0.5- 1.7), Pb (x0.9-3.6) and Zn (x1.5-4.2). The enrichment factors of heavy metals differ from site to site, and some samples are remarkably enriched in Zn and Pb. According to the location of these enriched sites, Sakai River, Sai River, and Kuwabara River, these three branches likely to be contributing to the enrichment of those two elements.

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