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Title: Geochemical Distribution of Trace Metals and Assessment of Anthropogenic Pollution in Sediments of Old Nakagawa River, Tokyo, Japan

Author: H.M. Zakir, Naotatsu Shikazono and Kazuo Otomo

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Abstract: The geochemical distributions of cadmium (Cd), copper (Cu), chromium (Cr), lead (Pb) and zinc (Zn) were examined in sediments collected from Old Nakagawa River (NR), Tokyo, Japan. A widely used 5-step sequential extraction procedure was employed for the fractionation of the metals and the concentrations were measured in the liquid extracts by inductively coupled plasma mass spectrometry (ICP-MS). The association of Cd (76-98%) and Zn (48-67%) were found highest with AEC (adsorbed/exchangeable/carbonate) phase, Cu (45-60%) and Pb (44-73%) with amorphous Fe oxyhydroxide phase and the maximum fractionation of Cr was in both crystalline Fe oxide (12-60%) and amorphous Fe oxyhydroxide phase (15-60%). For retention by amorphous Fe oxyhydroxide minerals, the observed stoichiometric gradient was: 1.52 for Cu, 1.23 for Pb, 2.25 for Cr and 3.09 for Zn. Corresponding values for association with crystalline oxides and sulphides and organics were an order of magnitude greater than those for amorphous oxyhydroxide, indicating a greater affinity of trace metals for these phases. The total concentration ranges of Cd, Cr, Cu, Pb and Zn in NR sediments were 2.86-16.95, 551.7-3953.1, 340.6-1565.3, 136.9-385.9 and 931.4-3650.1 µg g- 1, respectively. The observed order of potential trace metal mobility in the aquatic system was: Cd>Zn>Pb>Cu>Cr. Organic carbon contents in sediment samples were comparatively high (mean 5.48%) and the X-ray diffraction (XRD) study detected the presence of several clay minerals, those are likely to be major host of trace metals in sediments. The sediments of NR was considered to be polluted on the basis of unpolluted sediments and geochemical background values with respect to Cd, Cr, Cu, Pb and Zn. According to the enrichment factors (EFc), most of the sites have several times higher values of trace metals than the standard. The study revealed that the pollution in sediments of NR could be linked to anthropogenic activities such as industrialization, urbanization, deposition of industrial wastes and others.