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Water quality maps of Laguna de Bay Basin, Philippines

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This study, conducted in Laguna de Bay Basin, aims at creating water quality maps for the Basin and its watersheds. The Laguna de Bay is the largest lake in the Philippines, with a surface area of 900 km^2 and its watershed area of 2920 km^2 (Santos-Borja, 2005). It is located on the southwest part of the Luzon Island and its watershed contains 5 provinces, 49 municipalities and 12 cities, including parts of Metropolitan Manila. The water quality in Laguna de Bay has significantly deteriorated due to pollution from soil erosion, effluents from chemical industries, and household discharges. Recent studies have suggested that concentration of heavy metals in the edible fishes and aquatic plants in the Laguna de Bay are high and likely to have health risks to eating them (e.g., Molina 2011). In this study, we performed multiple element analysis of water samples in the lake and its watersheds for chemical mapping, which allows us to evaluate the regional distribution of elements including toxic heavy metals.

We collected water samples from 24 locations in Laguna de Bay and 160 locations from rivers in the watersheds. The sampling sites of river are mainly downstreams around the lake, covering urbanized and rural areas. We also collected well water samples from 17 locations, spring water samples from 10 locations, and tap water samples from 21 locations in order to compare their characteristics with the river and lake samples and to assess the quality of household use water. The samples were collected in dry season (March and May in 2011) as well as wet season (October and November in 2011) of the study area in order to evaluate seasonal differences. Water samples were filtered through a cellulose acetate disposable filter (0.2 micrometer pore size), then brought to the Research Institute for Humanity and Nature (RIHN), where the analysis was performed. The concentrations of the major components (F, Cl, NO_3, SO_4, NO_2, Br, PO_4, Ca, Mg, Na, and K) dissolved in the samples were determined with Ion Chromatography System (Dionex Corporation ICS-3000). We also analyzed major and trace elements (Li, B, Na, Mg, Al, Si, P, K, Ca, Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn Ga, Ge, As, Se, Rb, Sr, Y, Zr, Mo, Ag, Cd, Sn, Sb, Cs, Ba, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, W, Pb and U) with Inductively Coupled Plasma-Mass Spectrometry (ICP-MS, Agilent Technologies 7500cx). We used Geographic Information System (GIS) to create water quality maps for each components.

At most sampling locations, concentration of dissolved components in the wet season samples are lower than those in the dry season samples which can be attributed to dilution effect of rain water during wet season. The element concentrations of rivers are characterized by remarkable regional variations. For example, heavy metals such as Ni, Cd and Pb are markedly high in the western region as compared to the eastern region implying that the chemical variation reflects the urbanization in the western region. On the other hand, As contents is relatively high in the south of the lake and some inflowing rivers in the area. The higher concentration of As is also observed in the spring water samples in the area. Therefore, the source of As in the area is probably natural origin rather than anthropogenic.

References:

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