Heavy metal distribution in estuarine sediments of Koronia lake, Central Macedonia, Northern Greece

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Metal contamination in aquatic ecosystems is of great concern due to its toxicity and environmental persistence. Heavy metals into a river system may come from natural or anthropogenic sources and they are distributed between the aqueous phase and bottom sediments [1]. River sediments have a long residence time, so the level of metals therein does not undergo sudden changes because of altering external conditions, unlike surface water [1,2]. Heavy metals concentrations in estuarine sediments are important because their estuarine behavior in part determines dissolved metal fluxes to the corresponding water body. An example of an aquatic system which has constantly been downgraded in the past is that of Koronia Lake in Central Macedonia, Greece and the torrents that flow into the lake [3].

Concentrations of As, Cd, Cu, Cr, Hg, Mn, Ni, Pb and Zn were determined in 3 sediment samples (K1, K2, K3) collected by the area of Bogdana's river estuaries in Koronia lake, in order to evaluate the level of contamination. The sediment portion with particle size <0.063mm was used for analyses, since contaminants accumulate mainly in the finest particles of sediments. The determination of heavy metals revealed Fe concentration with a mean of 2.58%. As, Cd, Cu, Mn and Hg concentrations remain low, presenting mean values of 5.7 mg kg-1, 0.08 mg kg-1, 22.4 mg kg-1, 403.3 mg kg^{-1} and 0.03 μg kg^{-1}, respectively. The corresponding mean concentrations of Cr, Ni, Pb and Zn were 67.97 mg kg^{-1}, 44.77 mg kg^{-1}, 13.85 mg kg^{-1} and 67 mg kg^{-1}.

Contamination analysis was carried out with reference to average shale concentrations of metals [4]. Fe was used as the reference element for geochemical normalization because its natural concentration tends to be uniform and its geochemistry is similar to that of many trace metals. Pollution assessment was carried out by some of the most often used indicators of contamination in sediments such as the enrichment factor (EF), geoaccumulation index (Igeo) and contamination factor (CF). The EF values for all metals except Cr, Ni, Pb and Zn were <1 in every site indicating no enrichment, as suggested by Sakan et al. 2009. For the 4 previous metals, EF values range from 1.06-1.61 at all sites, suggesting minor enrichment. Igeo values for all metals in all sites are classified, according to Muller's (1981) classification, in Class 0 (I_{geo}<0) and so interpreted as practically unpolluted. CF values for every sample range from 0.04-0.85. As suggested by Hakanson (1980), this indicates low contamination.

Total heavy metal concentrations in the sediments followed the order Fe > Mn > Cr > Zn > Ni > Cu > Pb > As > Cd >Hg. The highest concentrations were found in sample K2. Nevertheless, indicators suggested that metal contamination is not considerable enough, demonstrating that under the prevailing conditions, anthropogenic impact on metal levels in the sampling area is no longer observed.

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