Redox cycling of heavy metals under different digenetic environments in lake sediments

X.D. ZHENG[1,2], L.T. SONG[1,2*], Y.G. TENG[1,2], W.F. YUE[1,2] AND J. LIU[2]

[1]College of Water Sciences, Beijing Normal University, 100875, China (ltsong@bnu.edu.cn)
[2]Eng. Res. Center of Groundwater Pollu. Control and Remed., ME, Beijing, China (ltsong@bnu.edu.cn)

Introduction

Both iron and manganese are ubiquitous elements in natural aquatic systems and they are important electron acceptors as they are highly sensitive to the redox state, and the change of oxidation state will influence the distribution and mobility of trace metals during early diagenesis of lake sediment. Fe, Mn, As, Cu, Co, Ni and Zn of porewater, sediment and reactive fractions were investigated to better understand the distribution and redox cycling of these heavy metals in a highly mineralized reservoir, Aha Lake, and a mesotrophic water system, Hongfeng Lake, southwest of China.

Results

The reactive fractions of lake sediments were extracted by 1N HCl and the heavy metals concentrations were measured with ICP-MS. Different patterns of Mn and Fe were clearly observed in both reactive fractions of sediment and porewaters of Aha Lake. The concentrations of Mn in these two fractions were higher in surface sediments and significant decreases occur with the increase of burial depth. In contrast, increases in both dissolved Fe and reactive Fe were observed from just the depth where concentrations of Mn became very low. These indicate that Mn oxides/hydroxides are main electron acceptors in surface sediments while iron oxides/hydroxides are more active in deep sediments.

The mobility and distribution of As in sediments of Aha Lake was mainly influenced by cycling of manganese, while Cu was mainly influenced by iron. The mobility of Co□Ni and Zn were influenced by both iron and especially manganese. As for Hongfeng Lake, the mobility and distribution of trace metals were mainly influenced by iron. The mobility of As can be influenced by both Mn and Fe. However, when content of Mn is higher enough, As tend to preferentially associate with the cycling of Mn.