

荒川低地堆積物の重金属の溶出と存在形態に温度環境が与える影響 Effects of temperature environment in dissolution and chemical forms of heavy metals of sediment in Arakawa lowland

植木 崇¹; 斎藤 健志^{1*}; 濱本 昌一郎²; 川本 健¹; 小松 登志子¹

UEKI, Takashi¹; SAITO, Takeshi^{1*}; HAMAMOTO, Shoichiro²; KAWAMOTO, Ken¹; KOMATSU, Toshiko¹

¹ 埼玉大学大学院理工学研究科, ² 東京大学大学院農学生命科学研究科

¹Graduate School of Science and Engineering, Saitama University, Saitama, JAPAN, ²Graduate School of Agricultural and Life Sciences, The University of Tokyo, Tokyo, JAPAN

Global warming, heat island phenomenon in urban areas, and increased use of geothermal energy would affect the subsurface thermal, chemical, and biological environment. Change in subsurface temperature might affect dissolution and transport of chemical materials and the subsurface microbial activities. However, effects of temperature change on the subsurface environment including dissolution and chemical forms of heavy metals have not been fully clarified. In this study, effects of temperature on dissolution and chemical forms of heavy metals in sediment of Arakawa Lowland, Kanto district, Japan have been investigated by laboratory experiments.

Laboratory experiments to evaluate the relation between temperature and dissolution characteristics were conducted under three different temperature conditions (15°C, 25°C and 40°C). Five chemical forms of heavy metals in residues from the dissolution experiment were also fractionated (Water soluble, Exchangeable, Bound to carbonates, Bound to iron and manganese oxides and Bound to organic matter) by the sequential extraction method. These experiments were conducted on sediment samples obtained from boring cores at around 17m, 31m, 39m and 44m depth (denoted as 17m-sample, 31m-sample, 39m-sample and 44m-sample, respectively).

Results showed that temperature conditions affected dissolution characteristics and chemical forms of heavy metals. Especially, boron in 17m-sample (marine sediment) and arsenic in 31m-sample (non-marine sediment) dissolved more at higher temperature and linear relations between temperature and dissolved concentration of these components were observed. Additionally, temperature condition also affected their chemical forms. Under 40°C and 25°C conditions, Bound to iron and manganese oxides and Exchangeable forms of boron in 17m-sample both decreased and Water-soluble boron increased compared to the 15°C condition. Also under 40°C and 25°C conditions, Bound to iron and manganese oxides form of arsenic in 31m-sample decreased and Water-soluble and Exchangeable arsenic both increased compared to the 15°C. These results imply that hardly-soluble forms of boron and arsenic might change to readily-soluble forms at higher temperature.

キーワード: 地表面温度, 溶出特性, 存在形態, 沖積堆積物

Keywords: subsurface temperature, dissolution characteristics, chemical forms, alluvial sediment