

Groundwater salinization intensities in various Asian coastal mega-cities

Shin-ichi Onodera^{1*}, Mitsuyo Saito², Yuta Shimizu¹, Takahiro Hosono³, Yu Umezawa⁴,
Hirotaka Arimoto⁵, Siringan Fernando⁶, Tsutomu Yamanaka⁷, Makoto Taniguchi⁸

¹Hiroshima University, ²Ehime University, ³Kumamoto University, ⁴Nagasaki University, ⁵Geo-Research Institute,
⁶University of Philippines, ⁷University of Tsukuba, ⁸Research Institute of Human and Nature

To confirm groundwater salinization intensities in various coastal Asian mega-cities, we conducted hydrochemical researches at Osaka, Manila, Bangkok, and Jakarta. Groundwater salinization is caused by seawater intrusion and leaching of saline component in sediment under the condition with lower hydraulic head at the deep groundwater than the sea level with urbanization. The former process is the contribution of present seawater, on the other hand the later is the contribution of palaeo-seawater in alluvial clay layer. The saline content in groundwater were 3.0×10^{10} t in Bangkok, 2.2×10^8 t in Osaka, 5.2×10^7 t in Jakarta, and 3.6×10^6 t in Manila, respectively. The subject area is one order wider in Bangkok than in Osaka, and two orders wider than in Manila and Jakarta. Such huge saline accumulation in Bangkok would be due to the lowest groundwater potential in present as well as the largest subject area. That in Osaka has recovered since 1970 in Osaka, whereas those in Manila and Jakarta are declining. In addition, we estimated the palaeo-seawater content under the mega-cities as total pore volume in the alluvial clay. These values were estimated to be 5.5×10^9 t in Bangkok, 2.1×10^8 t in Osaka, 9.0×10^7 t in Jakarta, and 8.0×10^7 t in Manila, respectively. The comparative results of accumulative contents and palaeo-values indicated that accumulative contents were more than the others in Bangkok and Osaka. These results suggest that seawater intrusion occurred as well as palaeo-water leaching in these cities. In addition, that shows the urbanization period is important to salinization intensity.

Keywords: salinization, groundwater, urbanization, palaeo-seawater, seawater intrusion