Regionality and diversity of qualitative properties in spring waters in the western part of the Tokyo metropolitan area

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The Tokyo metropolitan area which is the largest megacity in Japan is located in the Kanto plain. The Arakawa river alluvial fan, the Iruma upland, and the Musashino upland are distributed from north to south in the western part of the Kanto plain and the degree of urbanization in each region differs largely. In the Arakawa alluvial fan, much farmland remains, whereas the Musashino upland is mainly covered by urban and suburban land use. The Iruma upland is an intermediate land use between the two regions. We have studied the influence of human activities in urban areas on the groundwater flow and qualitative characteristics of groundwater in the three regions, by examining the hydrogeological structure, land use change, groundwater quality, and its evolution. The subject of this study is to comprehensively elucidate the formation mechanisms and processes of qualitative characteristics of groundwater by understanding the qualitative properties: the major dissolved ions, environmental isotopes, PPCPs, artificial sweeteners, E. Coli and coliforms, chronological indicators, etc. As a part of this project, we collected water samples from the 22 springs distributed in the three regions in December 2022.
The results of these indicators showed different trends respectively. For example, NO_3^- and SO_4^{2-}, the major dissolved ions, ranged from 6.1 to 88.2 mg/L and 13.3 to 61.8 mg/L, respectively. The concentrations of NO3- were in approximately similar ranges in the three regions, while the SO_4^{2-} concentrations were relatively high in the Arakawa alluvial fan and Iruma upland and low in the Musashino upland. However, in the Musashino upland, SO_4^{2-} concentrations were higher in the northern part (Saitama Prefecture) and lower in the southern part (Tokyo metropolis). On the other hand, Cl^- concentrations were higher in the southern part of the Musashino upland and lowered in the northern part.
As for the E. coli and coliforms, regional differences were not clear. Although coliforms were widely detected except for a few springs in the northern part of the Musashino upland, the number of counts was low. E. coli was detected only in one spring in the northern part of the Musashino upland.
$\delta^{18}O$ and δD of spring waters were relatively low in the Arakawa alluvial fan and Iruma upland and high in the Musashino upland, and they were similar in the northern and southern Musashino upland.
These results suggest that the regional trends and the diversity within each region reflect differences in land use, the distribution and deterioration of the sewerage network, and the progress of water-rock reactions and biological activities such as denitrification during the groundwater flow process. In this presentation, we will report the results of our evaluation of these factors.

Keywords: urban area, groundwater flow and solute transport, Tokyo metropolitan area, multi tracers

