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Groundwater flow regime in Kyoto basin estimated from hydrogeochemical characteristics

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Groundwater is valuable water resource used for a variety of uses because it has generally better water quality compared to surface water. Flow velocity of groundwater is slow, so it takes a long time to recover if it receives pollution or water level drop. In order to maintain the quality and quantity of groundwater, management method that enable to use groundwater appropriately. Final goal of this study is development of hydrogeological model that can be used to predict groundwater flow regime with high accuracy. Kyoto basin was selected as study area.

This year, groundwater samples were collected from 19 wells around Katsura River, Uji River, and Kizu River, and pH, oxidation-reduction potential (ORP), electrical conductivity (EC), and dissolved oxygen concentration (DO) were measured on site. The samples were analyzed together with groundwater samples collected by Fumita et al. (2014) from 28 wells around Kamo River and Takanogawa river. for main dissolved ions, hydrogen and oxygen isotopic ratios, and strontium isotope ratio. Principal component analysis (PCA) was applied to the analysis results of the components except for strontium isotope ratio.

The analysis results showed that groundwater from wells in southern region has higher concentration of main dissolved components. From the PCA, it was clear that the eigenvector coefficients of the first principal component were positive except for ORP, DO, and SO_4. In the eigenvector coefficients of the second principal component SO_4, K, and EC were positive, and pH was negative. Additionally, the wells were distributed in different domain in scatter diagram of the first and second principal component, depending on the watershed. The water quality is presumably reflect the differences in the geological features of the watersheds.

In the watershed of Kamo River and Takanogawa River, Fumita et al. (2014) indicated that groundwater is recharged and surface water and groundwater are mixing around the confluence of the two river. Additionally, distribution of underflow water around the Kamo River was implied in downstream area of the confluence. $^{87}Sr/^{86}Sr$ was 0.715 in the most northerly well in the studied wells, and $^{87}Sr/^{86}Sr$ values of groundwater from wells in the east area near from granite body were about 0.712. Each ratio is similar to the values of Tanba formation and granite (Wada, Komatsu, 2010). In addition, the ratios of the samples collected in southern wells were 0.708˜0.709. In this area, groundwater flow from mountains in east is estimated (Kyoto newspaper company, 1983), so it is indicated that the origin of groundwater was different from it of the upstream of the Kamo River.

Reference

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Keywords: groundwater flow, geochemistry, principal component analysis, isotope