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Preliminary results of groundwater age-related isotopic tracers for shallow groundwaters in the Eastern Osaka Basin

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High chloride groundwaters are often found in the coastal regions, possibly due to intrusion of sea water, squeezing pore water from clay layers by excessive pumping of the wells and/or infiltration of sea water during the sea level rise period. Groundwater age is a key factor for investigating the nature of high chloride component. However, the ages measured by isotopic and chemical methods give only 'mean age' if mixing of groundwater has occurred. This 'mean age' has no meaning when we consider the nature of high Cl water. It is important to know the age for the timing of the high Cl water infiltration into the fresh water.

Since the 1950s, the groundwaters with high Cl concentrations as high as 800mg/L were found in the Eastern Osaka Basin (Kawachi Plain), especially in the region around Yodo River (e.g., Tsurumaki, 1967). The high Cl groundwaters are still found in this area (Nakaya et al., 2009). In this study, we preliminary investigated the mixing condition between the high Cl water and the freshwater and inferred the age of high Cl water using tritium, helium, carbon-14 and chloride-36.

Both He concentration and isotope ratio in shallow groundwaters in the studied area are almost identical to those in air saturated water, indicating these groundwaters are very young sufficient to accumulate little amount of crustal (and mantle) He. It is not contradict with tritium results. Significant amounts of tritium (up to 3.4 T.U.) are detected from most of selected samples analyzed in this study. The $^{14}C/^{12}C$ ratios show various values ranging from -33 to -809 permil, but these values are significantly high relative to the deep groundwaters in this region which is mostly composed of dead carbon. Four analyses of the $^{36}Cl/Cl$ ratios also show various values (2.8 - 52.4x10^{-15}). Considering with the relatively low Cl concentration (55 - 230mg/L) and the detection of significant amount of tritium, the samples with the high $^{36}Cl/Cl$ ratio may be due to the contribution of cosmogenic ^{36}Cl dissolution during recharge. After subtracting the contribution of cosmogenic ^{36}Cl, the $^{36}Cl/Cl$ ratios in these groundwaters are in the range of those in seawater. High Cl shallow groundwater in the Eastern Osaka Basin may originate from mixing with relatively modern sea water and fresh water, although both the He and ^{36}Cl results for saline groundwaters in the deeper region of this area show the characteristics of nearly stagnant saline water (Morikawa et al., 2011).

References: Tsurumaki (1967) Journal of Groundwater Hydrology, 9, 11-23. Nakaya et al. (2009) Journal of Groundwater Hydrology, 51, 15-41. Morikawa et al. (2011) Japan Geoscience Union Meeting 2011, AHW023-22 (Abstract)

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