

An isotopic study on Cl-rich groundwater in the lower reaches of the Tone River, Japan

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In the Kanto plain, Japan, there are three regions whose groundwater is characterized by a high Cl concentration: 1) central Kanto plain (eastern parts of Saitama Prefecture), 2) lower reaches of the Tone River (southern parts of Ibaraki Prefecture and northwestern parts of Chiba Prefecture), and 3) northwestern Kanto plain (southeastern parts of Gunma Prefecture and southern parts of Tochigi Prefecture). A study based on water chemistry, delta-18O, delta-D, 3H, 13C, 14C, 3He/4He and 36Cl/Cl has been in progress to elucidate groundwater system of the respective regions with special reference to origins and residence times of both water and Cl. As a part of the study, eighty water samples from the depth interval between 30 and 250m were analyzed in this paper to have a clear grasp of the geochemical status quo of groundwater in the lower reaches of the Tone River.

As a result, groundwater in the Pleistocene sediments in the depth of 80-150m along the Tone River course proved to be characterized by a high Cl concentration of 62-173mg/L as well as highly depleted delta-18O and delta-D values. With regard to the origin of this groundwater, a potential source is assumed to be the precipitation of low stable isotopic composition in the Last Glacial Maximum (peak period at around 20,000 yrs. BP) when the sea level of the Tokyo Bay was lower than the present by more than 100 m. The 36Cl/Cl analyses indicate admixture of 'fossil' sea water trapped in the sediments during the Shimosueyoshi transgression (peak period at around 125,000 yrs. BP) or even earlier transgressions is likely to account for its elevated Cl concentration. On the other hand, groundwater in the overlying Holocene sediments in the depth 30-40m, which is also have a high Cl concentration of 768mg/L, is assumed to have its origins of Cl and water in sea water of the Jyomon transgression period starting around 10,000 yrs. BP and precipitation of the same period, respectively.

Keywords: Kanto plain, Cl-rich groundwater, water chemistry, multi-isotope study, residence time, origins of water and Cl