

On concentration and origin of chloride ion in small rivers in Jyoboji area, Fujioka, Gunma, Japan

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Ten short streams including Minamizawa-gawa, each of them is about 1 km long, in Joboji area on the left bank of Kanna River, Fujioka City, were investigated in July and December 2018 for the chloride ion concentration, load of chloride ion, and origin of chloride ion in stream waters. Saline low-temperature small springs (“Yashio mineral springs”) are seeping naturally on some spots in the area.

The concentration of chloride ion of Yashio mineral springs were between 4,798 mg/L and 11,892 mg/L in August, and between 5,162 mg/L and 11,032 mg/L in December. The concentration of chloride ion was very high in the streams; for example, in Minamizawa-gawa, the maximum concentration of chloride ion ranged up to 632.5 mg/L in July, while up to 213.7 mg/L in December. The load of chloride ion in Minamizawa-gawa was calculated to be as much as 45 kg/day in December, accounting for 90 % of the total load of chloride ion transported by these ten streams. In spite of being a short stream 1 km long, the hydrogen (δD) and oxygen ($\delta^{18}O$) isotopic ratios of Minamizawa-gawa in December showed a sharp increase from -54.5 ‰ and -8.0 ‰ in headwaters to -46.7 ‰ and -7.3 ‰ at a downstream end portion, respectively. In addition, the Li/Cl ratio of Minamisawa-gawa was found to be more than 0.001 for most of its watercourse with a maximum ratio of 0.0018 at a downstream end portion. These characteristics of the chloride ion, δD and $\delta^{18}O$ isotopes, and Li/Cl ratio are attributed to the deep-seated fluid which flows upward through the Sambagawa crystalline schists and mixes with shallow water bodies.

Keywords: stream water, chloride ion, dissolved load, stable isotopes of water, Yasio mineral springs, deep-seated fluid