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Water Chemistry of the Song Stream, a headwater tributary in the South Han River

Jong-Sik Ryu[1)]* · Kwang-Sik Lee[1)] · Ho-Wan Chang[2)]

1. Introduction

Water chemistry provides important information on the sources of dissolved loads, chemical weathering process, and chemical and isotopic compositions of the drainage basin (Goldstein *et al.*, 1984; Négrel *et al.*, 1993; Han and Liu, 2004). Over last three decades, many studies of river water chemistry have been carried out to infer source rocks affecting chemical compositions (e.g., Potter, 1978; Karim and Veizer, 2000; Quade *et al.*, 2003).

This study investigates on a local-scale chemical and isotopic compositions of the Song Stream, a small headwater tributary of the South Han River (SHR), and factors controlling the water chemistry. This study will provide baseline information on the geochemical and isotopic characteristics of a headwater of the SHR basin.

2. Materials and methods

The Song Stream (SS), one of the uppermost tributaries of the SHR originates from the Mt. Odae and has a drainage area of 352 km^2 with a length of 81.4 km. It flows through Pyeongchang-Gun and Jeongseon-Gun, and joins the Joyang River. There is only one dam, named Do-Am, which covers an area of 144.9 km^2 and stores water of 4×10^7 ton.

The upper and middle reaches of the SS catchment are dominated by Jurassic granites and sedimentary rocks, and Paleozoic sedimentary rocks (sandstones, shales, sand shales and siltstones). In the lower reaches are mainly Paleozoic sedimentary rocks (limestones, coal-bearing formations, dolomitic limestones, shales and sand shales).

Major elements and strontium were analyzed by ICP-AES and ICP-MS in the Korea Basic Science Institute (KBSI). Stable isotopes (hydrogen, oxygen, carbon and sulfur) and Sr isotopes were determined using Prism II stable isotope ratio mass spectrometer (SIRMS) and MC-ICPMS, respectively at the KBSI.

3. Results and discussion

We report dissolved major elements, stable isotopes (oxygen, hydrogen, carbon and sulfur) and Sr isotope compositions of stream water and groundwater samples collected during summer of 2003. The dissolved loads of the SS water show a big difference

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1) Korea Basic Science Institute (jsryu@kbsi.re.kr, kslee@kbsi.re.kr)
2) Seoul National University (changhow@snu.ac.kr)

between two water-types: low concentrations of major ions and Sr, but high $\delta^{13}C$ values in Na+K-rich water, while the contrasting characteristics in Ca-rich water. The SS dissolved loads originate from mainly carbonate dissolutions with minor contribution of rainwater. The oxygen and hydrogen isotopes show the origin of the SS water is of meteoric. $\delta^{34}S_{SO4}$ data suggest dissolved sulfates of the SS are mostly from atmospheric deposition. The Sr system clearly show there is a mixing between two end-members: Na+K-rich water having low Sr concentrations (mean 0.08 μmol/l) and $^{87}Sr/^{86}Sr$ ratios (mean 0.7140), and Ca-rich water having high Sr concentrations (mean 1.54 μmol/l) and various range of $^{87}Sr/^{86}Sr$ ratios.

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