

## Effect of natural and anthropogenic sources on water chemistry in the Nakdong River before implementation of the Four Rivers Restoration Project of South Korea

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We investigated the sources impacting the water chemistry of the Nakdong River (NR) in South Korea, to reveal how its main channel is affected by both natural and anthropogenic contributions. Water samples were collected at eight sampling sites from the upper to lower reaches of the river, and seasonal and spatial variation in the concentrations of major ions were monitored to assess the water chemistry. In addition, the chemical and isotopic compositions of the samples were evaluated to identify the natural and anthropogenic sources contributing to the river's water chemistry. According to plots of  $Mg^*/Na^*$  versus  $Ca^*/Na^*$  and  $2(Ca+Mg)$  versus  $HCO_3+2SO_4$ , the water samples were mainly explained by chemical weathering occurring in the watershed, but anthropogenic sources were partly related to the water.  $\delta^{34}S$  values varied within the narrow range of 1.8‰ to 3.1‰, irrespective of spatial and temporal variation. The  $^{87}Sr/^{86}Sr$  ratios of the water samples, 0.71043 to 0.71520, were within those of the Mesozoic volcanogenic sedimentary rocks developed in the watershed, supporting the results that the water chemistry of the NR is governed by chemical weathering. On plots of  $1000*(B/Na)$  versus  $Cl/Na$  and  $SO_4/Na$ , the water samples collected in the summer and winter were discriminated by  $1000*(B/Na)$  ratios of 5.50 to 8.79 and 3.25 to 4.09, respectively, with the exception of one sample collected near an industrial district in the winter. Most of the samples collected in the summer were within the  $1000*(B/Na)$  ratio, indicative of precipitation. These results indicate that the water chemistry of the NR is ultimately regulated by rainwater, lithology, and a combination of these two sources and provide baseline information for comparing the water quality before and after implementation of the Four Rivers Restoration Project of South Korea.