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Hydrochemical study of alluvial groundwater in Wolha area bordering on the Nakdong River: preliminary results

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We are studying the hydrochemistry of alluvial groundwaters in Wolha area on the border of Nakdong River, in order to help sustainable development of alluvial groundwater. Alluvium in the Wolha area, about 30 m thick, overlies Cretaceous sedimentary rocks (mainly shale) and comprises highly permeable medium-grained sand with intercalated lens-shaped silty layers. Small villages are located in groundwater upflow sites, and agricultural activity is active within the alluvium. Totally 26 samples (20 alluvial groundwater (AW), 4 bedrock groundwater (BW), 2 surface water (SW)) were systematically collected in October, 1999 by considering groundwater flow path and depth. Compared to BW and SW, AW is typically 1-1.5 unit lower in pH value owing to the soil CO_2 influx and nitrification. Variable Eh (114-350 mV) and TDS (94.3-645 mg/L) values of AW reflect not only the aquifer's heterogeneity but also the diverse interacting factors controlling the chemistry.

The Na and K concentrations decrease toward groundwater downflow sites. This trend is possibly due to 1) adsorption of Na and K onto clay minerals in silt layer, 2) intake by plants, and 3) local mixing of different water masses. For anions, HCO_3 concentration rapidly decreases downflow, whereas Cl and NO_3 become enriched, resulting in the gradual change of water type from Ca-HCO_3 type to Ca-Cl(-NO_3) type toward downflow sites. The NO_3 concentrations of AW range widely from 15.6 to 301.4 mg/L, and exceed the drinking water standard (10 mg/L NO_3-N) in 75% of the examined samples. This reflects the local infiltrating recharge of pollutants in central part of alluvium, which is also indicated by carbon isotope data. The chemistry of SW, characterized by high values of pH (8.56), Ca (31.0 mg/L) and NO_3 (86.1 mg/L), also indicates the impacts from lime and N-fertilizer (or manure) used as soil additives. In conclusion, AW in the study area is influenced by the influx of sewage from villages and then the large degrees of local infiltration of surface waters affected by dissolution of lime and fertilizer.

Key words: alluvial groundwater(AW), local infiltration, mixing, nitrification, agricultural activity, lime, fertilizer