

## Delineation of recharge patterns and nitrate contamination using stable isotopes of water, $^3\text{H}$ - $^3\text{He}$ , and CFCs in an agricultural basin

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Haean basin in Yanggu (Korea) shows a bowl-shaped topography and the drainage system shows a simple dendritic pattern. Stable isotopes of groundwater,  $^3\text{H}$ - $^3\text{He}$ , and chlorofluorocarbon (CFCs) combined with hydrogeochemical data were applied to delineate groundwater residence time, recharge patterns and nitrate contamination of groundwater in the agricultural basin. The study area is consisted of forests (58.0%), vegetable fields (27.6%), rice paddy fields (11.4%) and fruit fields (0.5%). Thus, most of residents in the study area practice agriculture. The concentration of  $\text{NO}_3\text{-N}$  in groundwater showed 0.2 ~ 15.2 mg/L in June, 2012 and 0.4 ~ 14.8 mg/L in September, 2012. Nitrate concentrations were higher in the downgradient area than in the upgradient area due to the land use pattern and topography. The values of  $\delta^{18}\text{O}$  and  $\delta\text{D}$  showed that groundwater is derived mainly from summer precipitation and the evidence of evaporation was observed in some wells in the paddy fields. The apparent groundwater ages using  $^3\text{H}$ - $^3\text{He}$  and CFCs are ranged from 7 to 10 years in the upgradient area and from 15 to 30 years in the downgradient area. The apparent groundwater age corresponds to the different nitrate concentrations in the upgradient and downgradient area. The  $\text{NO}_3\text{-N}$  concentration in recently recharged groundwater showed 3-15 mg/L while the  $\text{NO}_3\text{-N}$  concentration in 30 years old groundwater showed less than 3 mg/L. The reconstructed  $^3\text{H}$  input and initial  $^3\text{H}$  were used to estimate groundwater mixing. A conceptual model of groundwater flow using measured apparent  $^3\text{H}$ - $^3\text{He}$  and CFCs age will be developed to understand the hydrological processes of the study area.

## SHRIMP U–Pb zircon dating, geochemical and petrographical characteristics of calc-alkaline Early Miocene Şapçı volcanics around Balıkesir (W Turkey)

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Tertiary volcanic rocks are widespread in the Biga Peninsula of western Anatolian region (Turkey), and related to a collision tectonics in origin [1]. One of them, the Şapçı volcanics crop out in the northwest of Balıkesir. The volcanics consist of tuffs and lava flows in andesite and trachyandesite compositions. The rocks show microlitic, hyalo-microlitic, microlitic-porphyritic and fluidal textures. Modal minerals of the rocks are plagioclase ( $\text{An}_{30-49}$ ), hornblende, biotite, Fe-Ti oxide and accessory apatite and zircon.

The SHRIMP U–Pb zircon dating from the lava yielded ages between  $22.72 \pm 0.19$  and  $22.97 \pm 0.23$  Ma, which are regarded as the crystallization age. The Şapçı volcanics have a composition of 60.09-66.45 %  $\text{SiO}_2$ , 0.47-0.60 %  $\text{TiO}_2$ , 14.64-16.38 %  $\text{Al}_2\text{O}_3$  and 2.75-4.00 %  $\text{K}_2\text{O}$ . Petrochemically, they have high-K calc-alkaline characteristics, and exhibit similar features of volcanic arc setting. Besides, the trace element compositions are indicative of subduction-related volcanism. The volcanics have high large ion lithophile elements (LILEs) contents and low high field strength elements (HFSEs) contents compared to N-type Mid-Ocean Ridge Basalt (MORB), and have a high ratio of La/Yb, Zr/Nb. Chondrite normalized rare earth element (REE) patterns are concave upwards with  $(\text{La/Lu})_{\text{CN}} = 6.72\text{--}21.84$ , indicating significant fractional crystallization during the evolution of the volcanics. Furthermore, some trace element ratios indicate that the role of a subduction component and/or crustal contamination in the genesis of the Şapçı volcanics.

[1] Altunkaynak, & Genç (2008) *Lithos* **102**, 316-340.