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Ground water flow system in the Nakano-shima Island, based on dissolved major components, CFCs, and tritium.

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Securing fresh water resources is vital for the human beings, and is more critical for isolated islands. Therefore, appropriate use and management of fresh water resources are critical issue for these areas, and it is necessary to understand the hydrological circulation for the sustainability of the society. This study attempts to reveal the groundwater flow system in the Nakano-shima Island, Japan, using major components, CFCs, and ³H as tracers. The island is composed mostly of trachy-basalt and trachy-andesite rocks and partly of alkali olivine basalt lava (Tiba et al., 2000). Basalt/andesite rocks are rich in fractures, and groundwater exists mainly in fractures (Tsukimori, 1984).

Groundwater and spring water samples were taken from 15 wells and 3 springs in the island in June and September 2009. Most of the wells have multiple screened zones. Field parameters, including temperature, pH, EC, DO, and ORP were measured before sampling. All samples were analyzed for major components (Na⁺, K⁺, Ca²⁺, Mg²⁺, Cl⁻, HCO₃⁻, SO₄²⁻, NO₃⁻) and CFCs. Several samples were also analyzed for ³H.

Major components of groundwater obtained from the area covered by trachy-basalt and trachy-andesite rocks were rich in Na⁺ and Cl⁻, and HCO₃⁻. Particularly, springs and shallow wells were rich in Na⁺ and Cl⁻. This implies that major components of shallow groundwater are influenced by sea salt. On the other hand, major components of groundwater obtained from the area covered by alkali olivine basalt lava were rich in Mg²⁺ and HCO₃⁻, suggesting that the components are controlled by geology. ³H concentrations of two wells, W4 and W7, were 0.3 tritium unit (T.U.) and 0.6 T.U., respectively, lower than other samples (1.0 to 5.0 T.U.). CFCs concentrations of these 2 samples (17pg/kg and 16pg/kg, respectively) were also lower than other samples (about 90 to 260pg/kg). The elevation of the screened interval in W7 is about 4 to -50m, and is similar depth with other wells. The results indicate the existence of the groundwater flow system with longer residence time in similar depth, at least locally, in the island.

Keywords: volcanic island, groundwater flow system, CFCs, tritium