

Groundwater flow system of Iwate volcano inferred from isotopic analyses of pore waters in the 485 m-thick volcanic products

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A study of the isotope distribution in pore waters from a 485 m-deep borehole was performed at the northeast flank of 2038 m-high Iwate volcano, northern Japan, where hydrological study on the shallow and deep groundwater regime and geophysical survey have been carried out over a couple of years. In this study, a series of downhole core samples were taken from the borehole. The borehole was continuously cored from the surface at a 526 m elevation to a depth of 485 m and, for the stable isotope analysis, pore waters of pF less than 3.0 (more than -1,000 H₂O) were extracted from undisturbed core samples using a centrifuge technique. In the course of drilling, NH₄I solution was mixed in the drilling mud (circulation fluid) to quantify its contribution to the extracted pore water samples. Based on the iodine concentration, mixing ratios of drilling mud in the respective water samples were determined and isotope ratios were corrected for the mud water contribution. The results suggest a clear tendency of decreasing dD values of porewaters with depth, from -70 to -60 permil for a depth interval of 10-150 m to -80 to -73 permil for that of 300-400 m. An isotope/altitude effect on infiltrating precipitation established by Kazahaya and Yasuhara (1999) indicates recharge is predominant at an area of 600-1,400 m elevation for the 10-60 m deep pore/groundwaters; 1,000-1,600 m and 1,600-1,900 m elevation for the 120-150 m and 300-400 m deep pore/groundwaters, respectively. This estimation of higher recharge elevation of groundwater with depth also has been found in Yatsugatake and Fuji volcanoes (e.g. Yasuhara et al., 1993) and strongly supports the development of the so-called hierarchical groundwater flow systems is of universal validity in the flanks of stratovolcanoes.