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富士山麓における降雨の湧水への直接的な影響のシグナルを追跡するための複合的な解析
Multiple analyses to chase the signature of direct impact of rainfall into groundwater in Mt. Fuji

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A huge amount of groundwater is stored in subsurface environment of Mt. Fuji, the largest volcanic (basalt) mountain in Japan. There distribute many springs flushing out between lava (high permeability) and underlying older lava (low permeability) at various points of the foot. Based on the concept of piston flow transport an apparent residence time was estimated to ca. 30 years by ^{36}Cl/Cl ratio (Tosaki et al., 2011). However, this number represents an averaged value of the residence time of groundwater mixed before flushing out. On the other hand, we found that pH of spring water in the lower part of the foot of Mt. Fuji decreased shortly after the typhoon in August 2011 which suggested the newly supplied rainwater was mixed into groundwater. Thus, we try to chase signature of direct impact of rainfall into groundwater from multiple analyses to elucidate the routes of groundwater under the torrential rainfall. Though analyses of groundwater chemistry show just an averaged value, microbial DNA analysis could suggest the routes of transport; if thermophilic microbial DNA is detected this suggests at least a part of groundwater must originated from the environment >ca. 40^{o}C (=600 m deep in Mt. Fuji). Thus, we employed three different tracers; stable isotopic analysis (δ^{18}O and δD), chemical analysis (concentration of silica) and microbial DNA analysis.

Stable oxygen isotopic ratio of shallow groundwater became higher than usual value reflecting torrential rainfall and the concentration of silica decreased after the torrential rainfall amounting more than 300 mm. In addition, the density of Prokaryotes in shallow groundwater apparently increased. These findings indicate a direct impact of rainfall into groundwater was observed after torrential rainfall with more than 300 mm in the studied geological setting. This did not appear when rainfall did not exceed 100 mm/day. Increase in the density of Archaea at deep groundwater after the torrential rainfall suggests a possible mixing of deep groundwater which was pushed by piston flow transport as an indirect impact of rainfall into deep groundwater, if it is true to this geological setting that Archaea is predominant in deep subsurface environment as was suggested. Microbial DNA can give possible information about the route of groundwater.

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