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The origin and formation mechanism of the water quality of deep hot springs from the northern foothills of Mt. Fuji

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Since the mid-1990s, drilling wells for hot spring bathing purpose was performed on a deep aquifer at depths reaching 1,500m below the surface in the northern foothills of Mt. Fuji. Meanwhile, the origins of the water and the formation mechanisms of the water qualities have not always been investigated thoroughly. Clarification of the forming environment of the hot spring waters is indispensable for the protection and sustainable development of hot spring sources.

In this study, water samples were collected from wells for hot spring bathing purposes and from natural springs in the northern foothills of Mt. Fuji and the adjacent Misaka and Tanzawa Mountains area, and were subjected to chemical and isotopic analysis of hydrogen, oxygen, and sulfur (δD, δ^{18}O, δ^{34}S). Based on the analytical results, the origin of the water and water-rock interactions, which affect the water quality of the deep hot springs, were discussed.

The water in samples were thought to be originated through mixing of meteoric water with very small amounts of altered seawater, which had been trapped in the pore space in the basement rock, so-called green tuff formation. After subtraction of the seawater-derived components, concentrations of major components of the water samples were thought to be controlled by the dissolution of gypsum and/or anhydrite, calcite precipitation, and the formation of Na-smectite by weathering of albitized plagioclase. Around the distribution areas of volcanic products of Mt. Fuji, the weathering process of olivine may also influence the concentrations of Mg^{2+} ions. The δ^{34}S values of SO_4^{2-} ions of hot spring waters were higher on the Misaka and Tanzawa Mountains side, whereas they were lower on the foot of Mt. Fuji side (down to +8.2 ‰), indicating the presence of different SO_4^{2-} ion sources; the former SO_4^{2-} ions with high SO_4^{2-} values are derived from marine anhydrite and/or gypsum, whereas the latter SO_4^{2-} ions with low δ^{34}S values are involved in volcanic anhydrite and/or gypsum.

Keywords: northern foothills of Mt. Fuji, deep hot spring, water quality, water-rock interaction, stable isotope ratio