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Contribution of volcanic gas to spring waters in the Mt. Yotei.

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The Mt. Yotei is a stratovolcano in southwest Hokkaido with an altitude of 1893 m. There are a lot of springs in the foot of the mountain and most of these are found from the altitude of 200 to 260 m. This elevation is consistent with that of boundary between volcanic rocks of the volcano and basement consists of tuff and pumice. Northern, eastern, and southern slopes of the mountain are covered by pyroclastic fall and reworked deposits of that, while the western slope is covered by lava erupted from summit and parasitic volcanos in western slope (Katsui, 1956).

It is revealed that springs in eastern and southern slopes tend to show lager discharge and lower dissolved components, while those in the western slope tend to show smaller discharge and higher dissolved components (Yamaguchi and Sato, 1971; Yamaguchi, 1972; Tsurumaki, 1989). Because of higher HCO_3^- and free CO_2 gas concentrations and higher temperature of springs in the western slope, addition of volcanic gas to those is estimated (Yamaguchi and Sato, 1971; Tsurumaki, 1989). However, contribution of volcanic gas to groundwater has not been evident. In this study, contribution of volcanic gas to spring waters will be discussed based on dissolved components and isotopic compositions.

Spring water samples were collected on August 2013, and were analyzed for major dissolved components, isotopic compositions (δD, δ^{18}O, δ^{13}C, ^{3}He/^{4}He), and groundwater-age indices (CFCs and SF_6). Dissolved components of spring waters are Ca-HCO_3 type or Na-HCO_3 type. Spring waters in the western slope tend to show higher HCO_3^- and free CO_2 gas concentrations. These results are consistent with those of previous studies. δ^{13}C of dissolved inorganic carbon (DIC) in spring waters in eastern and southern slopes are -21.7 to -17.7 ‰, while those of the western slope are -18.1 to -3.0 ‰. This result suggests that spring waters in western slope contain DIC of which origin is different from that contained in springs in eastern and southern slopes. Dissolution of marine carbonates is unlikely because groundwater flow in volcanic rocks. Relationship between δ^{13}C and inverses of concentrations of total carbon are plotted in mixing zone of volcanic CO_2 and soil CO_2, and spring water showing higher δ^{13}C and total carbon concentration were correspond to higher contribution of volcanic CO_2. These results suggest that spring waters in western slope showed higher δ^{13}C and total carbon concentrations because of addition of volcanic CO_2. δD and δ^{18}O of spring waters are plotted along the meteoric water line (GSJ, undisclosed data), suggesting contribution of magmatic water is quite small. Effect of parasitic volcanos in the wastern slopes is suggested by Yamaguchi and Sato (1971) as a possible factor for higher contribution of volcanic gas to springs in the western slope. Further discussions based on dissolved components, isotopic compositions, and groundwater-age indices will be performed to reveal relationship between contribution of volcanic gas and groundwater flow system.

References

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