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Remote sensing on volcanoes from stable isotopic compositions in the plume

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Molecular hydrogen (H_2) in a high-temperature volcanic fumarole ($>$ 400 degreeC) reach to the hydrogen isotope exchange equilibrium with coexisting fumarolic H_2O under the outlet temperature of the fumarole. In this study, we applied this hydrogen isotope exchange equilibrium of fumarolic H_2 as a tracer for the remote temperature sensing on volcanic fumaroles, by deducing the hydrogen isotopic composition of fumarolic H_2 remotely from those in volcanic plume. To verify this new remote temperature sensing actually works or not, we determined both concentrations and hydrogen isotopic compositions of H_2 in the volcanic plume emitted from the summit crater of Satsuma-Iwojima volcano, Japan, where the fumaroles exhibited various temperatures from 100 degreeC to more than 800 degreeC. The remote temperature sensing using hydrogen isotopes (HIReTS) developed in this study can be applicable to obtain the highest fumarolic temperature in many volcanoes.

Keywords: fumarolic gases, volcanic plume, molecular hydrogen, stable isotopes, isotope exchange equilibrium, remote temperature sensing