

Deep groundwater system capturing magmatic CO₂ at Aso volcano, Japan

Makoto Yamada[1]; Shinji Ohsawa[2]; Kohei Kazahaya[3]; Masaya Yasuhara[4]; Hiroshi Takahashi[5]; Kazuhiro Amata[2]; Shin Yoshikawa[6]

[1] none; [2] BGRL; [3] Geol. Surv. Japan, AIST; [4] Geol. Surv. J.; [5] Geological survey of Japan, AIST; [6] Aso Volcanological Laboratory, Kyoto Univ.

Deep groundwater samples for water isotope analyses and measurements of the stable carbon isotope ratio and concentration of dissolved inorganic carbon (DIC) were collected from hot spring wells near a volcano. They revealed how magmatic CO₂ mixes into groundwater at Aso volcano. The waters' stable hydrogen and oxygen isotope ratios indicate the meteoric-water origin of deep groundwater of that region. However, relationships between the stable carbon isotope ratio and DIC concentrations of the sampled waters indicate that magma-derived CO₂ is mixed into the deep groundwater. Furthermore, groundwaters of deeper areas show higher carbon-13 values, except in samples from fumarolic areas. A similar relationship pertains between the sample-collection elevation and D value of the groundwater: those collected from deeper areas have a lower D value. A positive linear relation exists between the D value and recharge elevation on recharged meteoric water; the higher the recharge elevations, the deeper the groundwater flow is formed. Therefore, a negative relationship of sample-collection elevation versus carbon-13 of the sampled waters dictates that magma-derived CO₂ is probably captured in deeper groundwater recharged at a higher elevation. Carbon dioxide emanated from magma to the volcanic edifice is presumed to mix into deeper groundwater that flows nearer the magma conduit or chamber.