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The mixing process of magmatic CO₂ into groundwater flow system in Aso volcano

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In order to acquire a knowledge on deep groundwater flow system and its interaction with CO₂ emanated from magma seated at depth in volcanic edifice, 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 in Aso volcanic area. Relationships between the stable carbon isotope ratio ($\delta^{13}\text{CDIC}$) 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 $\delta^{13}\text{CDIC}$ values, except in samples from fumarolic areas. The waters' stable hydrogen and oxygen isotope ratios ($\delta\text{-D}$ and $\delta^{18}\text{O}$) indicate the meteoric-water origin of deep groundwater of that region. A negative correlation exists between altitude of well bottom and recharge altitude calculated by the equation of recharge water line and $\delta\text{-D}$ value especially in Aso-dani area. It shows that the higher the recharge altitude, the deeper the groundwater flow is formed. These results show that the $\delta^{13}\text{CDIC}$ of groundwater recharged at high altitude is higher than that at low altitude. This relation strongly suggests that it becomes much contribution of magmatic CO₂ for much deeper groundwater. These results lead to the conclusion that magmatic CO₂ mix into deeper groundwater which flows nearer the magma conduit or chamber.