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鹿児島湾姶良カルデラ海底から湧出するマグマ起源 CO_2 フラックスの高精度化
A precise evaluation of magma-derived CO_2 flux from seafloor on Aira Caldera in Kagoshima Bay, Southern Kyushu,

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Aira Caldera is one of the huge volcanic depressions located Kyushu, Japan, and it occupied the innermost part of Kagoshima Bay, southern Kyushu. The caldera is designated one of the active volcanoes in Japan due to its vigorous fumarolic activity on seafloor in Wakamiko Crater. The caldera is almost submerged (caldera floor is about 140 m in water depth) and is about 20 km in width from east to west. Wakamiko Crater is another depression located at the east side of the caldera floor, water depth of the crater floor is about 200 m. Vigorous fumarolic activity in and around the crater has been known as “Tagiri” by local fishermen, and the gas is composed mainly of carbon dioxide with significant amount of methane derived from thermal decomposition of organic matter.

Monitoring of gas flux and composition associated with volcanic activity is expected one of the useful proxies for evaluation of volcanic activity. CO_2 is the most sensitive indicator to reflect clearly the state of magma because CO_2 is degassing preferentially relative to the other components. Since 2007, we have tried to estimation of CO_2 flux from the seafloor in the caldera based on accumulation rate of dissolved inorganic carbon (DIC) in the stagnant bottom water with in the crater. However, the DIC possibly include additional CO_2 derived from methane oxidation in water column and decomposition of organic matter in the sedimentary layers filled in the crater and caldera. Therefore, we evaluate the contribution of the additional CO_2 and try to estimate pure CO_2 flux from magma excluding the additional CO_2.

Significant high δ^{13}C and δD values of dissolved methane in the seawater samples indicated that methane oxidation was occurred in the water column overlying Wakamiko Crater. Based on the isotopic data the isotope fractionation factor (α) for carbon and oxidation rate of dissolved methane were estimated α = 1.023 and 3.4 μM/d, respectively. The oxidation rate is significantly higher relative to the previous reported values from other seafloor hydrothermal systems, suggesting that quite active methane oxidation is occurred within seawater occupied in Aira Caldera. Using those results we calculated the original methane concentration before oxidation as 0.01mM. Therefore, the contribution of methane oxidation to concentration and isotopic ratio of DIC in the water column can be ignored because dissolved CO_2 concentration is two orders of magnitude higher than the methane concentration.

Furthermore, we estimated the contribution of CO_2 derived from decomposition of organic matter in the sedimentary layer. δ^{13}C value of CO_2 in the fumarolic gas from the crater could be estimated *c*. -10 ‰ based on those of DIC in the water column. The δ^{13}C value of CO_2 in magma volatile was assumed -5.5 ‰ based on the data of adjacent volcanoes. The δ^{13}C value of CO_2 derived from organic matter was reported *c*. -30 ‰. According those data the contribution of additional CO_2 from organic matter is estimated c. 18 %. Based on the estimation, we can calculate an accurate flux of magmatic CO_2 from the Aira Caldera.