

Helium isotopes reveal continuous and intensive degassing in Kagoshima Bay, Japan

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Kagoshima Bay is an embayment located in the southern tip of Kyushu Island in Japan. It is known for the presence of a huge volcanic caldera, Aira caldera, in the northern part of the bay. An active volcano, Mt Sakurajima, exists in the caldera and is well known as one of the most active volcanoes in Japan. Aside from the subaerial volcano, there is also a source of hydrothermal fluids on the seafloor, the Wakamiko caldera, which is thought to be the main vent of a large eruption of Aira which occurred 29,000 years ago. Due to the presence of these geologic features, helium isotopic ratio ($^3\text{He}/^4\text{He}$) in the bay show mantle signature expected in volcanic arcs ($\sim 7R_a$). Helium isotopic ratio provides information on the provenance and mixing of fluids. We collected seawater and sediment samples in the area in 2010, 2014 and 2015 to monitor hydrothermal activity on the shallow seafloor. Air-sea gas exchange tends to equilibrate $^3\text{He}/^4\text{He}$ between the atmosphere and the shallow sea to 1 R_a or no excess $\delta^3\text{He}$ (%). We observed increasing helium concentration and isotope ratio from surface to the seafloor (~ 200 m), which means that profuse degassing in the area is continuing. The Wakamiko caldera is still an active conduit for intensive degassing from the magma chamber. In this study we report the variability of hydrothermal activity using $^3\text{He}/^4\text{He}$ profiles in the water column from 2010, 2014, and 2015. We also estimate ^3He and ^4He fluxes using sediment pore water data and a steady-state diffusion model.