

Chemical characteristics of Hot spring gas and water and geological structure around Aira caldera

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Aira caldera located in the Kagoshima Bay, in southern part of Kyushu, Japan is likely to have a large magma chamber, supplying magma to active volcanoes Sakurajima and Wakamiko in the caldera (Roullier et al, 2013). At Sakurajima volcano, rise of magma was observed on August 2015 that brought a raise in the volcanic alert level from 3 to 4 for the following month. Increase in CO₂ release from Wakamiko was also reported on 2015. These observations imply that the activity of Aira caldera is increasing.

Around Aira caldera, there are many hot springs, which are presumed to be affected by the volcanic activity. We tried to clarify relationship between hot springs and the magma under Aira caldera via examining hot springs components in this study. We also investigated the geological structure in relation to the magma and hot springs because it is directly linked with the conduits and aquifer of the hot springs. We sampled 24 hot springs water and analyzed stable hydrogen and oxygen isotopes ratio (δD and $\delta^{18}O$), helium isotopes ratio ($^3He/^4He$), dissolved ions and radon isotope (^{222}Rn) concentration.

The result of δD and $\delta^{18}O$ show that most of all hot springs around Aira caldera is meteoric water origin. High $^3He/^4He$ was recognized at hot springs around northern region from Kagoshima Bay and hot springs in Sakurajima. $^3He/^4He$ and ^{20}Ne results present that gas in hot springs having higher $^3He/^4He$ can be explained by mixing between mantle helium and air. The high $^3He/^4He$ hot springs are also related to active fault distribution in northern region from Kagoshima Bay. Hot springs closer to an active fault show higher $^3He/^4He$ in the region. In Sakurajima, only hot springs at the north and south parts have higher $^3He/^4He$, which is hardly related to the directions of magma intrusions. Several faults showing similar orientation with Kagoshima rift have been recognized within Kagoshima Bay (Hayasaka, 1984). Presence of a large fault on the south of Sakurajima was also suggested by Hayasaka (1984). A line connecting hot springs having $^3He/^4He$ in north of Kagoshima Bay and those in Sakurajima, displays a consistency with the Kagoshima rift and the southern extension of the line includes the large fault reported by Hayasaka (1984). These results suggest that the hot springs with higher $^3He/^4He$ is possibly linked with the large structures of the Kagoshima rift.

Keywords: Aira caldera, Hot spring geochemistry, Fault, Kagoshima rift, Sakurajima