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Fluid geochemistry and trace element composition of a marine hydrothermal circulation system at the Wakamiko crater

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Marine shallow-water hydrothermal activity was located in the Wakamiko submarine crater at 200 m depth in the northern part of Kagoshima Bay, which is considered as the main vent of a gigantic eruption that formed Aira caldera structure. WHV site in the northwest part of the crater was considered as the activity center, where vigorous venting of high-temperature fluid (Tmax = 200 degC) was observed. In SES site located approximately 1 km southeast of WHV site, weak diffusive fluid emanation (T = about 60 degree C) associated with vigorous fumarolic gas discharge was observed. Along the coast of the Kagoshima Bay, that is corresponded to the outer rim of the Aira Caldera, some onland hot springs (T = 43-81 degC) are pumped up from 500-1000m deep.

In this presentation, we will report fluid chemistry of submarine hydrothermal fluids from two sites (WHV site and SES site) in the Wakamiko crater and of onland hot springs, focusing on concentration of trace elements.

[Methods]

Submarine hydrothermal fluid samples were collected during NT10-05 expedition in March of 2010, using ROV *Hyper Dolphin* of JAMSTEC (Japan Agency for Marine Earth Science Technology). Onland hot spring water samples were collected in July of 2010.

We analyzed chemical composition of the fluid samples as follows; ion chromatography and atomic absorption spectrometry for potassium, ICP-AES for sodium, calcium, magnesium, ICP-MS for lithium, rubidium and cesium, AgNO3 titration for chloride.

[Results and discussion]

Both Wakamiko submarine hydrothermal fluids (WHV site and SES site) and onland hot springs have significantly low Na and Cl concentrations with the same Na/Cl ratio as seawater and significantly negative delta D value. These results suggest that both fluids are originated from common reservoir which is contributed from onland ground water and seawater.

It is notable that Ca and K concentrations of the submarine fluid from SES site are lower than those from WHV site. According to the conventional geothermometer assuming equilibrium for water-rock interactions, reservoir temperatures were estimated as 250 degC for WHV site and as 200 deg C for SES site. On the other way, based on temperature records of a platinum resistance thermometer during the fluid-sampling, vent fluid temperatures were estimated as 240 degree C for WHV site and as 180 degree C for SES site, after correction for seawater mixing. This accordance supports the idea that major elements composition of submarine hydrothermal fluids is controlled by hydrothermal interactions within the reservoir at different temperature condition. Fluid temperatures of the onland hot springs in the reservoir are estimated as around 100 degree C.

Li, Rb, and Cs concentrations of three fluids showed highest for WHV site followed by SES site and the onland hot springs. It is known that trace elements are subject to leach from the primary minerals into the fluid and not involved into the secondary minerals during fluid-rock interaction in the reservoir. Positive correlation between the Li, Rb, Cs concentrations and the estimated temperature among these three fluids implies that Li, Rb, Cs concentrations reflect the temperatures of aquifer.