Large contribution of the magmatic water to the seafloor hydrothermal fluid at the Wakamiko hydrothermal field and its associated mineralization in Aira Caldera, southern Kyushu, Japan

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Active hydrothermal venting from shallow seafloor (200-m depth) with talc chimneys has been discovered at the Wakamiko Crater floor in the Aira Caldera, southern Kyushu, Japan. The major chemical composition of the fluids suggests that the fluids are supplied from a single reservoir. Silica and alkaline geothermometers indicate that the fluid-rock interaction in the reservoir occurs in the temperature range of 230 to 250℃. The fluid is characterized by a high alkalinity and high ammonium and dissolved organic carbon concentrations, indicating interaction of the fluid with organic matter in sedimentary layers. The fluid is also characterized by a low chloride concentration relative to seawater, suggesting that boiling of hydrothermal fluid occurs below seafloor and/or that the source of the fluid contain both seawater and meteoric water which is derived from the surrounding land mass. In addition, a low δD and a high δ^{18}O values of the fluid also imply that the fluid is mixed with andesitic water and that the proportion of andesitic water may reach 50 %. Such abundant magmatic input may be supported by the significant occurrence of As, Sb, and Hg minerals in the chimneys and crater-floor sediment. The graben-fill and/or caldera-fill sediments that include abundant organic matter and volcaniclastics deposited under bay conditions in this area are expected to provide a reservoir and medium for water-rock interaction. At least three hydrothermal vents have been observed in the crater. Two of them have similar cone-shaped chimneys. The chimneys have a unique mineralogy and consist dominantly of talc (kerolite and hydrated talc) with lesser amounts of carbonate (dolomite and magnesite), anhydrite, amorphous silica, and stibnite. The precipitation temperature estimated from δ^{18}O values of talc was almost consistent with the observed fluid temperature (*c.* 200℃). Geochemical modeling calculations also support the formation of talc and carbonate upon mixing of the endmember hydrothermal fluid with seawater and suggest that the talc chimneys are currently growing from venting fluid.