

Seafloor hydrothermal alteration at Suiyo Submarine volcano: geochemical and mineralogical characteristics

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Archaeon Park Project focuses on the influence of magma-hydrothermal activities on biological communities of a seafloor hydrothermal system developed on atop of Suiyo seamount, Izu-Ogasawara island-arc, western Pacific.

We made 2.65-6.65m-depths drilling at the active seafloor hydrothermal areas of Suiyo seamount, using the Boring Machine System (BMS) and RV Daini-Hakurei Maru. We also determined the hydrothermal mineral assemblages in the BMS core samples by XRD, XRF and TEM methods to describe the interaction of volcanic rocks and hydrothermal fluids beneath seafloor.

The core samples from drill holes APSK01 and APSK02, located the south-east and south margins of hydrothermal area, contain feldspar and cristobalite of dacite and pumice origin, and sulfides, anhydrite, barite and montmorillonite of hydrothermal origin. Meanwhile, the core samples from central part of the hydrothermal system (drill holes APSK04, APSK05 and APSK07) contain hydrothermal sulfides, anhydrite, barite, chlorite/montmorillonite mixed-layer minerals, mica and chlorite with little or no feldspar nor cristobalite. Hydrothermal clay minerals change from montmorillonite to chlorite and mica through chlorite/montmorillonite mixed-layer minerals with depths.

These core samples contain Cu (up to 0.1%), Pb (up to 1%), Zn (up to 40%), As (up to 0.2%), BaO (up to 10%), CaO (up to 30%), Sr (up to 0.4%). The Ca/Sr ratios of core samples are very similar to the seawater value, suggesting most of Ca and Sr of anhydrite are seawater origin. The MgO (up to 40%) and K₂O (up to 3%) concentrations are also high due to formation of Mg-chlorite and mica.

Oxygen isotope analyses were performed on montmorillonite, chlorite/montmorillonite mixed-layer minerals, mica and chlorite. Oxygen isotopic compositions of these clay minerals are +7.2-+7.6permillage for montmorillonite, +3.-2+4.6permillage for chlorite/montmorillonite mixed-layer minerals, and +3.1-+3.8permillage for mixtures of chlorite and mica. Assuming that the oxygen isotopic composition of hydrothermal fluid responsible for the formation of these clay minerals is seawater value, we can evaluate that the formational temperatures of montmorillonite and the mixture of chlorite and mica are 200C and 300C respectively.