Mineralization and hydrothermal alteration of Suiyo Seamount, Izu-Bonin Arc, western Pacific

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Archaean Park Project focuses on the influence of magma-hydrothermal activities on biological communities of a 200 X 200m size seafloor hydrothermal system developed on atop of Suiyo seamount, Izu-Bonin island-arc.

We made 2 to 6m depths drillings using the Bentic Multi-coring System (BMS) and RV Daini-Hakurei Maru, in order to understand mineralization and hydrothermal alteration .

The sulfide samples from drill holes are characterized by high Au (upto 42ppm), Ag (upto 1,550ppm), As (upto 1,440ppm),Hg (upto 55ppm),Sb (upto 96ppm), Se (upto 44ppm). Micro XRF scanning analysis indicates Hg occurs as micro veinlet in sulfides. The sulfides are also characterized by high Zn (upto 40%), with respect to Cu (0.6%) and Pb (upto 0.6%).

Lead isotope ratios (206Pb/204Pb= 18.546 to 18.562, 207Pb/204Pb=15.535 to 15.551, 208Pb/204Pb=38.322 to 38.375) of sulfide samples are very similar to those of the dacite (206Pb/204Pb= 18.552, 207Pb/204Pb=15.539, 208Pb/204Pb=38.333), suggesting lead is magmatic origin.

Dacite lava samples with no hydrothermal alteration belong to low K (upto 0.9% as K2O), calc-alkaline dacite (SiO2 upto 67%, Al2O3 upto 16%). An Ar-Ar data obtained from a unatrered dacite is 9 + 8ka, suggesting zero age. The 87Sr/86Sr ratio of dacite lava is 0.70345. Meanwhile, the hydrothermally altered dacite lava are enriched in SiO2 (upto 74%), or enriched in MgO (upto 15%) and K2O (upto 3%) depending on their hydrothermal mineral assemblages.

Hydrothermal alteration of Suiyo is characterized by Fe-sulfides, anhydrite, barite, montmorillonite, chlorite/montromollonite 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.

The 87Sr/86Sr ratio (0.70872) of anhydrite suggests that Sr of anhydrite is the seawater value. Hydrogen isotope ratios of chlorite/montromollonite mixed-layer minerals, mica and chlorite obtained from active venting sites range from -24 to -34 permillage, suggesting seawater is only source of hydrothermal fluid. However, hydrogen isotope ratios of lay minerals from a fossil hydrothermal area range from -41 to 49 permillage, indicating some contribution of magmatic fluid.

Oxygen isotope analyses were performed on montmorillonite, chlorite/montromollonite mixed-layer minerals, mica and chlorite. Oxygen isotopic ratios of these clay minerals are +7.2 to +7.6 permillage for montmorillonite, +3.2 to +4.6 permillage for chlorite/montromollonite mixed-layer minerals, and +3.1 to +3.8 permillage for mixtures of chlorite and mica. Assuming that the oxygen isotopic ratios 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 170 to 230 degrees C and 250 to 290 degrees C, respectively.