

## Mineralogical and geochemical characteristics of cuttings from Taketomi hot spring

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It is important to grasp carbon cycle on the earth's surface for thinking about global environmental change. A hot spring with a maximum temperature of 64°C is venting with gas containing 70% of methane from several spots on the seafloor at depth of 22 m at 1 km northeast off Taketomi Island. Based on methane and helium isotope ratios in the venting gas, the influence of magmatic gas has been pointed out. In spite of Taketomi Island located on the trench side from island arc, magmatic gas is venting. It suggests the forearc where magma cannot generate, might form new supply path of carbon from the Earth's interior. The mass balance from new supply path of carbon may change estimation of carbon cycle on earth's surface. Therefore, the purpose of this study is to elucidate venting mechanism and quantitative grasp of magmatic gas from forearc, and the history of hot spring activities will be investigated to predict future activities.

In 2017, the hot spring was drilled up to depth of 940 m in Taketomi Island. The cuttings with muddy water were sampled every 10 m. The thin sections were prepared from cuttings to be observed using polarization microscope, and the chemical compositions of grains were analyzed by SEM-EDX. The ground samples were analyzed for mineral and chemical compositions by XRD and EDX. The clay minerals gathered by levitation were measured for half-value width of illite using XRD. He and CO<sub>2</sub> contained in samples that were crashed in vacuum were measured for isotope ratios by mass spectrometer. Calcite and dolomite collected from the cuttings were measured for the carbon and oxygen isotope ratios by mass spectrometer. The vitrinite in the cuttings was separated by a heavy liquid, and the reflectance was measured by a reflecting microscope.

In the microscopy, the stratum was roughly divided two formations; cryptocrystalline quartz layer and sand stone layer. Carbonaceous materials were observed in most of the stratum. Dolomite was limitedly observed in the vicinity of 800 m. In the XRD analysis, Quartz was detected at all depth. Calcite was detected at shallower depth than 30 m, and dolomite was detected only around 800 m. As a result of the EDX analysis, silicon was the most dominant in all layers, and especially, it was contained around 0-100 m, 300 m and around 900 m over 80%. There was a layer that contained much calcium. Around 0-30 m, 400-500 m and around 800 m, calcite was contained 15 % or more. The half-value width of illite was large,  $0.8 \Delta^2 \theta$ , in only 10 m surface, and as low as 0.2 to 0.4  $\Delta^2 \theta$  below 50 m. Vitrinite reflectance was around 5% in the whole layer, close to measurement limit. The helium content was  $10^{-14}$ - $10^{-11}$  mol per 1g of cuttings, and tended to increase with increasing depth. The highest content was detected at 800 m depth. The helium isotope ratio (<sup>3</sup>He/<sup>4</sup>He) have value of 0.4-3.6 times that of atmosphere, and tended to increase with increasing depth. Particularly, it was higher at 100 m, 300-400 m and 700-800 m. The CO<sub>2</sub> content per gram of cuttings, was in the range of  $10^{-8}$ - $10^{-6}$  mol in most layers, but it showed

higher values at 400 m and 800 m depth. the water tended to decrease with increasing depth, and showed especially high values at 400 m and 900 m. The carbon isotope ratio ( $\delta^{13}\text{C}$ ) of calcite was  $-4.7\text{‰}$  VPDB, and the oxygen isotope ratio ( $\delta^{18}\text{O}$ ) is  $-16.3\text{‰}$ VPDB. The  $\delta^{13}\text{C}$  value of dolomite was  $-1\text{‰}$ VPDB, and the  $\delta^{18}\text{O}$  value was  $-10.9\text{‰}$ VPDB. The  $\delta^{13}\text{C}$  value of  $\text{CO}_2$  from cuttings at 800 m was  $-7.3\text{‰}$ VPDB, which contained sufficiently amount of carbon to measure carbon isotope ratio.

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