Geochemical studies of hydrothermal interaction within modern sedimentary layer in the Wakamiko submarine crater, south Kyushu

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The Wakamiko submarine crater is a small depression (4km x 2km) at 200m depth seafloor located in the northern part of Kagoshima Bay in south Kyushu, Japan. The seafloor is covered with recent unconsolidated sediment, which thickness has reached up to 80m. Warm fluid shimmering from a sediment mound associated with fumarolic bubble emissions had been located at the center of the crater. In Aug. 2005, NT05-13 cruise was conducted using ROV Hyper-Dolphine (JAMSTEC) to confirm distribution of hydrothermal activities within the Wakamiko submarine crater by extensive measurements and samplings and two located active sites, Center Site and North Site.

Seven surface sediment cores (up to 30cm) are collected from the Wakamiko crater seafloor. Chemical profiles of the pore fluids extracted from these sediments showed wide diversity site by site. The pore fluids collected from Center Site and North Site showed significant variations in concentrations of several species, such as degrease of Mg, Cl and SO4 and the drastic increase of Si. These profiles are attributed to mixing of ascending of the hydrothermal component and modification by fluid-sediment interactions. Moreover, the endmember composition of the hydrothermal component show some difference between two sites; K concentrations in Center Site was lower than that of seawater, it is high in North Site. In North Site, temperature in the hydrothermal aquifer can be estimated as around 230 degrees C, based on silica and alkali geothermometer. However, it was difficult to apply geothermometers for Center Site.

Bulk chemistry and mineralogy of the sediment samples were also analyzed. Both the pore fluid chemistry and the bulk sediment composition show poor in potassium in Center Site. In Center Site and North Site, the mineral compositions of the sediments are feldspar, quartz with or without cristobalite. For feldspar, plagioclase is commonly present in Center Site while both K-feldspar and plagioclase in North Site. In North Site, illite/smectite interstratified minerals are slightly present, with no large amount of clay minerals like montmorillonite in the bulk-sediment.

Although Center site and North site are only 0.8 km parted from each other, the geochemical characteristics of the hydrothermal interaction shows different signature, which is considered due to effect of differ from the pore fluid chemical composition each site. Such a difference of pore fluid chemical composition is likely effect by volcanic gas interfusion. While in North Site, the pore fluid chemistry was well explained by simple mixing between the hydrothermal component and seawater, which indicates that mobility of the elements during the fluid-sediment interaction is limited, In Center Site, it not takes to balance between sediment and fluid due to volcanic gases entrainment into upwelling hydrothermal fluid. Identified montmorillonite clay mineral was considered as evidence for low temperature hydrothermal alteration at past.