

The structure of iron-silica rich chimney in shallow marine hydrothermal environment at Iwo-Jima Island, Kikai caldera, southern Japan

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Satsuma Iwo-Jima is a volcanic island in the northwestern rim of Kikai caldera. Two post-caldera volcanoes exist, so one has volcanic and hydrothermal activity at the present. Nagahama bay where the orange-brownish discoloration is taken place is located in the southwestern island. The bay is half-closed environment and separated into two parts of East and West-site. The origin of the discoloration is ferrous rich hot spring (pH=5.5, 55-60 degree Celsius) (Shikaura and Tazaki, 2001). Kiyokawa et al. (2012) reported the fast deposition of about 1 m per ten years at West-site which is under control of tide, rain and wind. East-site is distinct because of the presence of chimney mounds, but yet studied in detail.

Samples were the massive chimney (20-30cm) and the floating particle divided from the sea water. We observed the structure of chimney with X-ray CT scan, thin section and FE-SEM, as well as EDS for composition analysis. The massive chimney is classified into two parts: black high-density hard layer and brownish low-density soft layer. The result of X-ray CT scan shows that the chimney is constructed by the aggregation of convex structures (3-4cm). Low-density layer has many pipes (radius of 1mm). Petrographic observations indicate that both high- and low-density layers have the filament-like form, and the form at the low-density layer is vertical to outer rim. In the low-density layer, the number of particles attaching to the filament-like form increases toward the high-density layer. FE-SEM observation shows that the filament-like form at the high-density layer is consists of aggregation of bacillus-like structure that looks the chain of particles (about 2 μ m). At low-density layer, bacteria-like form attached particles (<1 μ m) existed and this form is classed into 3 types (helix, ribbon-like, twisted). The floating particles were aggregation of fine particles (<0.5 μ m) has no bacteria-related form. All particles consist of Fe, Si and O, and those particles are chemically homogeneous by EDS.

According to the observation results above, we present a hypothesis of growth process of a chimney-complex mound in Nagahama bay. The chimney is constructed by aggregation of convex structure with many pipes probably work as the hydrothermal vent. All grains are consist of Fe, Si and O. Bacteria-like form resembles Gallionella spp. as iron-oxidizing bacteria. The bacteria is known as neutrophilic bacteria and prefers to living at redox interface (Weber et al., 2012). The activity of bacteria around hard rim makes high density layer. The chimney is likely to be influenced by activity of microbe.

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