

## Inner-structural and microbiological comparison on hydrothermal sulfides

Hitoshi Furutani<sup>1\*</sup>, Yohey Suzuki<sup>1</sup>

<sup>1</sup>Graduate School of Science the University of Tokyo

Around deep-sea hydrothermal vents, the characteristic ecosystem thrives, which is different from the one on shallow-sea. This ecosystem is based on primary production of chemolithoautotrophs using metal sulfide deposition precipitated in response to mixing of hot fluids with cold seawater, such as "chimney". Because inactive chimney is potential hydrothermal deposits, it is in the spot light not only in geochemistry but in aspect of utilization as resource. For the purpose to reveal microbial community of inactive chimney, Suzuki et al.(2004), Kato et al.(2004), and Sylvan et al.(2012) powdered inactive chimney to extract 16S rRNA gene. However, at the same time, it becomes too difficult to clarify microorganisms' distribution within the chimney structures on that method.

To explore that comparison, I collected five inactive sulfide chimneys and divided them into altered and unaltered portions for microbiological and mineralogical analyses at the South Mariana Trough. For shore-based study, the powdered altered (-EX) and unaltered (-FI) portions were subjected to total cell counting and powder X-ray diffraction (XRD) pattern analysis conducted for identification of mineral constituents. For the thin sections of intact subsamples, fluorescence in-situ hybridization (FISH) with probes targeting bacteria was performed to clarify their distribution within the chimney structures. In addition, optical microscopy with transmitted and reflected light and scanning electron microscopy (SEM) coupled to energy-dispersive spectroscopy (EDS) was conducted to correlate the extent of alteration and mineral assemblage to the distribution pattern of microorganisms.

Total cell counting revealed that cell densities ranged from  $2.8 \times 10^6$  cells/ml to  $1.9 \times 10^8$  cells/ml. And XRD revealed samples in which many microorganisms were harbored was majored by calcopyrite, pyrite, and marcasite. Then #1435-5 and #1437-2, that has  $10^8$  and  $10^{6-7}$  scale in total cells, respectively, selected to more research by the thin section. At #1437-2-exterior, EDS revealed the main mineral component was silica and there were fewer microorganisms than #1435-5-exterior and -interior referring fluorescence. Interestingly, although metal sulfide was dominant at #1437-2-interior, there were the least total cells in all subsamples. Compared #1437-2-middle with #1435-5-middle, it was the fact that porosity on the former was apparently lower.

These results suggest that both mineral composition and porosity play important roles on total cells within inactive sulfide chimney. Specifically, microorganisms prefer living metal-sulfide-rich and high porosity section.

Keywords: hydrothermal vents, metal sulfides, microorganisms