

Biogeochemical cycles of iron and carbon in biogenic iron-rich sediment

KIKUCHI, Sakiko^{1*} ; MAKITA, Hiroko² ; KONNO, Uta² ; SHIRAIISHI, Fumito¹ ; TAKAI, Ken² ; TAKAHASHI, Yoshio¹

¹Department of Earth and Planetary Systems Science, Graduate School of Science, Hiroshima University, ²Japan Agency for Marine-Earth Science and Technology

Biogenic iron oxides are the mixture of iron oxyhydroxides and organic materials which are produced by the metabolic activities of bacteria. These biogenic iron oxides work not only as adsorbent for various trace elements, but also as a source of iron and carbon for microorganisms. However, there is only little information about the degradation process of biogenic iron oxides and the effect to microbial activities after their sedimentation. Thus, the purpose of our study is to identify the spatial changes of iron species and microbial communities in biogenic iron-rich sediment (10 cm long).

We observed the existence sharp shifts for iron mineral species and microbial communities in the sediment. The dominance of ferrihydrite at the surface sediment (0-2 cm) subsequently turned into goethite and siderite at sediment depth 2-5 cm, corresponding to the iron reduction. However, iron reduction was depleted at depth deeper than 5 cm, as opposed to the remarkable increase of methane concentration. The microbial clone libraries were dominated by iron-oxidizing chemolithoautotrophic bacteria in the sediment 0-2 cm. In contrast, phylotypes represented by iron reducing and fermenting bacteria at 4 cm, and uncultured delta-proteobacteria and methanogenic archaea were recovered at 10 cm depth. These changes of iron mineral species, carbon metabolisms, and microbial communities only within a few centimeter intervals will also couple to the drastic change in cycles of trace element around the biogenic iron-rich sediment.

Keywords: iron oxides, iron-oxidizing bacteria, Ferrihydrite, Siderite, iron-reducing bacteria, methane