Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

MIS33-P03 Room:Convention Hall Time:May 23 18:15-19:30

Chemical Relationship between spatially coupled suspended particles and the crust surface

Tomoya Niiyama[1], Ayaka Tokumaru[1], Tetsuro Urabe[1], Blair Thornton[3], Akira Usui[2], Yohey Suzuki[1*]

[1]Dept Earth & Planet Sci, Univ Tokyo, [2]Geology Dept, Kochi Univ, [3]Institute of Industrial Science, Univ Tokyo

Objective:

It is considered that the formation of ferromanganese crusts is mediated partly by sedimentation of Mn-bearing particles from seawater. However, the extremely slow rate of crust formation (~2 mm/ Ma) remains to be poorly explained mainly due to the lack of characterizations for suspended particles in seawater in contact with the crust surface. Although suspended particles have been conventionally collected by water samplers deployed from the ship, it is difficult to collect seawater closely located to the seafloor. Recently, submersibles, which are capable of collecting water samples by observing the seafloor outcrops, provide us opportunities to collect suspended particles above the ferromanganese crusts. The main purpose of this study is (1) to evaluate suspended particles adjacent to the crust surface collected by a submersible, (2) to correlate chemical compositions of collected particles to those of the corresponding crust surface and (3) to validate the submersible-based sampling method to study the formation process of ferromanganese crusts.

Method and samples:

By using a remotely operated vehicle called Hyper Dolphin, deep seawater and crust samples were collected at water depths of 1460-1838 m from Tobu Seamount on the Daito Ridge, Western Pacific. Immediately after retrieval, suspended particles were collected on a filter with 200 nm pore diameter. Thin sections were prepared for crust samples, which were embedded in LR-White resin. Suspended particles on the filter and thin sections of a crust sample at a depth of 1460 m were observed by backscatter electron imaging (BEI) of scanning electron microscopy (SEM) and analyzed by energy-dispersive spectroscopy (EDS) for chemical composition.

Results and discussion:

Among filter samples at seven depths, 1460-m and 1545-m deep samples were abundantly associated with Fe- and Mn-bearing particles. In contrast to the similar size range (average sizes of 1800 and 1600 nm), the Mn/Fe ratio was heterogeneous for the 1460-m deep (0.6-2.5; n=11) and homogeneous for the 1545-m deep sample (0.6-1.1; n=7). Two filter samples at depths of 1614 m and 1753 m were mainly associated with Fe- and Cr-bearing particles. The remaining three samples at depths of 1480 m, 1586 m and 1838 m were not associated with Fe- or Mn-bearing particles but Ca- and C-bearing particles. As for a crust sample at a depth of 1460 m, the homogeneous range of Mn/Fe ratio of ~0.8 at the crust surface was shifted to 1.4 towards the inside. The discrepancy in Mn/Fe ratio between suspended particles and the crust surface might be resulted from the contamination of previously collected crust samples in the sample basket. On the other hand, a good agreement in Mn/Fe ratio between the 1460-m deep crust surface (~0.8) and the 1545-m deep suspended particles (0.6-11) might suggest the natural occurrence of the suspended particles in the vicinity of the crust surface. The Ca- and C-bearing particles are considered to be originally present, while the Fe- and Cr-bearing particles were probably supplied from the metal alloy material used for Hyper Dolphin. It is also known that the dissolution of CaCO3 particles produced by surface bioproductivity and transported through deep-sea circulation is a major process to provide Fe to the ferromanganese crusts. Hence, the major formation processes are potentially clarified by our sampling method and chemical analysis.