Major and Trace Element Geochemistry of REY-rich Mud in the Penrhyn Basin, the central South Pacific Ocean

*Marshel Emmanuelle Tampah[1], Kazutaka Yasukawa[1], Junichiro Ohta[1], Kentaro Nakamura[1], Yasuhiro Kato[1]

1. School of Engineering, University of Tokyo

As a key component in the development of high-tech electronics and energy-efficient appliances, such as electric vehicles, wind power generators, and energy-efficient lighting, rare-earth elements and yttrium (hereafter designated as REY) are essential not only for current industries, but also for the transition towards low carbon society. However, the REY resource is facing potential supply risk to the global market, e.g., dominance of REY production by China (especially heavy rare-earth elements that are critically important for the high-tech and green-tech products) and serious environmental problem caused by high concentrations of radioactive elements (e.g., U and Th) contained in REY ores on land. Therefore, research for new deposits for REY has then become of high interest.

A certain type of pelagic clay on the deep seafloor contains high concentrations of REY, named the REY-rich mud [1]. Important characteristics of the REY-rich mud include their wide and stratiform distribution, high REY concentrations with significant HREE enrichment, very low concentrations of radioactive elements, and ease of extraction of REY by acid leaching [1]. The REY-rich mud has also been discovered within the Japanese Exclusive Economic Zone (EEZ) around the Minamitorishima Island, the western North Pacific Ocean [2, 3]. Chemostratigraphic scheme of this area has shown that there are at least three extremely REY-enriched layers (Total REY [ΣREY] >2000 ppm) [4]. More recent study has also discovered similar highly REY-enriched layer in the deep-sea mud of the Penrhyn Basin, the central South Pacific Ocean [5]. Chemical analyses on piston cores P406 and P412 obtained during GH83-3 Cruise by the Geological Survey of Japan have identified a layer highly enriched in REY (ΣREY = 2000-4000 ppm). The similarities in terms of lithology and mineralogy of this layer to the Minamitorishima REY-rich mud then raise further question about the relationship of origin and distribution of the layers between the two areas. Investigation in more details on this particular area is therefore important to address the factor(s) controlling the occurrence of sediment layers highly enriched in REY in the Pacific Ocean.

In this study, therefore, we analyse major and trace element (including REY) compositions of four deep-sea sediment cores from the Penrhyn Basin recovered during the GH83-3 Cruise. In the presentation, we report the results of geochemical analysis of the Penrhyn Basin cores and discuss their geochemical characteristics, as well as similarities and differences with the REY-rich mud previously found in the Minamitorishima EEZ.

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