

Common chemostratigraphy based on bulk geochemistry of deep-sea sediment cores in the western North Pacific Ocean.

*Katsushi Yamamoto¹, Kazuhide Mimura¹, Kentaro Nakamura¹, Kazutaka Yasukawa^{1,2}, Junichiro Ohta², Koichiro Fujinaga^{2,1}, Shiki Machida^{2,3}, Yasuhiro Kato^{1,2,3}

1. Department of Systems Innovation, School of Engineering, the University of Tokyo, 2. ORCeNG, Chiba Institute of Technology, 3. JAMSTEC

Rare-earth elements and yttrium (REY) are widely recognized as strategic materials for green and advanced technologies. A deep-sea sediment containing high concentrations of REY (termed as REY-rich mud [1]) is recently expected to be a new resource for the elements due to its multiple advantages such as huge resource potential and paucity of radioactive elements [2]. More recent study confirmed the presence of “extremely REY-rich mud” that contains 6,800 ppm of total REY in the Japanese exclusive economic zone (EEZ) around Minamitorishima Island [3].

For the future development of the REY-rich mud, clarifying the stratigraphy and lateral extent of the extremely REY-rich mud is critically needed. In this respect, continuous cores of deep-sea sediments obtained by deep-sea drilling can provide important information. In the western North Pacific Ocean, a few drilling cores were almost continuously recovered from the seafloor surface to basement rock (chert). We previously reported the bulk chemical composition of the sediments at Ocean Drilling Program (ODP) Sites 1149 [4] and 1179 [5], and found out the common chemostratigraphy observed in the two ODP sites. However, the entire picture of the common chemostratigraphy of deep-sea sediments in the western North Pacific Ocean, including the Minamitorishima EEZ, is still uncertain, because only short piston cores (less than 15m) have been recovered from the Minamitorishima EEZ. In the present study, we newly analyzed bulk chemical composition of sediment samples collected from ODP Site 777 that is located at ~500 km southwest of the Minamitorishima EEZ.

The sediments in the Site 777 have been classified into three units [6]: biosiliceous layer of Subunit IA (from the core top to 3.5 mbsf), generally monotonous brown hemipelagic clay of Subunit IB (3.5 to 30.4 mbsf), light brown clay of Unit II (30.4 to 36.5 mbsf) and chert and cherty claystone of Unit III. Analytical results of 131 bulk sediment samples from Units IA, IB and II show that the REY-rich mud occurs in the Units IB and II (lower than ~8.25 mbsf). However, whereas the extremely REY-rich mud containing >5,000 ppm of total REY has been discovered at the Site 1149 and the Minamitorishima EEZ, the total REY content at the Site 777 was at most 2,034 ppm. We also quantified the relative contributions of the geochemical end-members constituting the sediments at the Site 777. By comparing them with the previous results [5], we confirmed both a common chemostratigraphy of deep-sea sediments in the western North Pacific Ocean as well as local characteristics overlapping the common features at each site.

References

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