

Ichthyolith stratigraphy constraints on ages and areas of REY-rich mud deposition in the South Pacific Ocean

*Shugo Minabe¹, Kazuhide Mimura¹, Kentaro Nakamura¹, Junichiro Ohta^{2,1}, Kazutaka Yasukawa^{1,2}, Koichiro Fujinaga^{2,1}, Shiki Machida², Yasuhiro Kato^{3,1,2}

1. Department of Systems Innovation, School of Engineering, The University of Tokyo, 2. Ocean Resource Research Center for Next Generation, Chiba Institute of Technology, 3. Frontier Research Center for Energy and Resources, School of Engineering, The University of Tokyo

REY-rich mud, a type of deep-sea sediment containing high concentrations of rare-earth elements and yttrium (REY), is widely distributed in the North and South Pacific Oceans [1]. It is expected to be a new resource of the critical elements that are essential for multiple high-tech devices and environment-friendly technologies. Recently, high-grade REY-rich mud layers have been discovered in the western North Pacific Ocean [2], whereas the formation process of the layers is still unclear.

Clarifying the depositional ages and areas of the high-grade REY-rich mud layers is the key to understanding their formation process. Regarding the North Pacific Ocean, the ages and areas of deposition of the high-grade REY-rich mud layers have been constrained recently [3,4]. In contrast, the ages and areas of deposition of the high-grade REY-rich mud in the South Pacific Ocean have been poorly understood, although high-grade REY-rich mud layers comparable to that in the North Pacific Ocean have been recognized [5,6].

In this study, based on the ichthyolith stratigraphy, we constrained the depositional age of high-grade REY-rich mud layers at the IODP Sites U1366 and U1370 that were drilled in the South Pacific Gyre [7]. Ichthyolith is a type of microfossil of fish teeth and denticles, which remains well even in deep-sea sediments beneath the carbonate compensation depth (CCD). Therefore, it has been used for age determination of pelagic clay with a paucity of typical age-diagnostic microfossils such as foraminifera or radiolaria [8]. We determined the depositional age of the high-grade REY-rich mud layers based on identification of more than 700 ichthyoliths contained in the sediments at Sites U1366 and U1370 and collation of them with the already known taxa associated with the ages. Based on the age data, we also located the depositional area of the layers by backtracking of plate motion. Consequently, we revealed that the depositional area of REY-rich mud during the Paleogene was significantly extended to the south of the present one. Moreover, based on the constrained depositional age, we suggest that the period of high-grade REY-rich mud deposition in the South Pacific Ocean likely continued for up to 50 million years, which is much longer than that in the North Pacific Ocean.

References

- [1] Kato, Y. et al. (2011) *Nature Geoscience* **4**, 535-539.
- [2] Iijima, K. et al. (2016) *Geochemical Journal* **50**, 557-573.
- [3] Mimura, K. et al. (2018) *JpGU Meeting 2018*
- [4] Yamamoto, K. et al. (2018) *JpGU Meeting 2018*.
- [5] Nakamura, K. et al. (2017) *JpGU Meeting 2017*.
- [6] Yasukawa, K. et al. (2016) *Scientific Reports* **6**, 29603.
- [7] D' Hondt et al. (2011) *Proceedings of IODP Expedition 329*.

[8] Doyle, P. S., and Riedel, W. R., (1979) *Scripps institution of Oceanography*, University of California, San Diego, 1-231.

Keywords: REY-rich mud, ichthyolith, depositional age, depositional area, South Pacific Ocean