Origin of REY-rich mud in the North Pacific Ocean constrained from bulk geochemistry and depositional age

KAZUHIDE MIMURA[1], KATSUSHI YAMAMOTO[1], KENTARO NAKAMURA[1], KAZUTAKA YASUKAWA[1,2], JUNICHIRO OHTA[2], KOICHIRO FUJINAGA[2,1], SHIKI MACHIDA[2], YOICH USUI[3] AND YASUHIRO KATO[1,2*]

[1] The University of Tokyo, Tokyo, 113-8656, Japan (*Correspondence: ykato@sys.t.u-tokyo.ac.jp)
[2]Chiba Institute of Technology, Chiba, 275-0016, Japan
[3]Japan Agency for Marine-Earth Science and Technology, Kanagawa, 237-0061, Japan

Deep-sea mud with high concentrations of rare-earth elements and yttrium (termed as 'REY-rich mud') has been reported as a prospective resource for these industrially critical elements [1]. More recently, we discovered 'extremely REY-rich mud' that contains >5000 ppm of total REY in the Japanese exclusive economic zone [2,3], which suggests that this new deep-sea mineral resource may be commercially developed. However, the origin of REY-rich mud has not been fully understood, and thus distribution of the high-grade REY-rich mud in the Pacific Ocean also remains uncertain.

REY-rich mud is lithologically categorized into pelagic clay. This type of sediment has long been considered as an important medium recording changes of atmospheric/oceanic circulations and surface ocean productivity in pelagic realm [4], which provides key constraints on the genesis and distribution of REY-rich mud. Our recent studies in the western North Pacific have shown that bulk chemical composition clearly characterizes source components of REY-rich mud (e.g. terrigenous dust, Mn-oxide, biogenic components) [5], and that microfossils of fish teeth (called 'ichthyolith') effectively constrain depositional ages of the mud [6].

Here, we construct a comprehensive dataset of bulk geochemistry and depositional ages of pelagic clay at DSDP Sites 576, 578, ODP Sites 777, 886, 1149, and 1179, covering a broad area in the North Pacific Ocean. We then discuss the origin of REY-rich mud from the environmental changes recorded in the pelagic clay.

References: [1] Kato et al. (2011) *Nat. Geosci.* **4**, 535-539. [2] Iijima et al. (2016) *Geochem. J.* **50**, 557-573. [3] Mimura et al. *submitted*. [4] Kyte et al. (1993) *Geochim. Cosmochim. Acta* **57**, 1719-1740. [5] Mimura et al. (2017) *Goldschmidt 2017*. [6] Mimura et al. (2018) *Goldschmidt 2018*.