

Grain size distributions of extremely REY-enriched pelagic sediments in the western North Pacific Ocean

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In 2013, piston core samples of pelagic sediments were collected from the seafloor in the western North Pacific Ocean during the cruise KR13-02 of R/V *Kairei*. Some portions of two cores of them were found to have extraordinary high concentration of total rare-earth elements and yttrium (REY) reaching up to ~7,000 ppm [1] [2]. Microscopic observations of the cores showed that these extremely REY-enriched layers contained significant amounts of large biogenic apatite grains, which is known to concentrate REY [3], and large phillipsite crystals [1]. We conducted grain size distribution (GSD) analyses of bulk sediments, apatite and phillipsite from these cores to elucidate the mechanism of the anomalous REY enrichment.

The GSDs of bulk sediments from the extremely REY-enriched layers were bimodal with fine (~4 μm) and coarse (~40–80 μm) peaks. The fine-grained portions of the sediments mainly consisted of clay-sized particles. Apatite and phillipsite were the major components of the coarse-grained portions of the sediments. A positive correlation between the median diameter of the apatite grains and the REY contents indicated that an increased accumulation of coarse-grained biogenic apatite was responsible for the REY enrichment. The median and maximum diameters of the phillipsite grains also correlated positively with REY and phosphorus contents. An increased phillipsite grain size might suggest a low sedimentation rate. Thus, the anomalous REY enrichment could be attributed to a slow sedimentation which allowed biogenic apatite (especially coarse-grained apatite) to accumulate without dilution by low-REY-content components.

[1] Iijima et al. (2015) *Geochem. J.* submitted. [2] Fujinaga et al. (2015) *Geochem. J.* submitted. [3] Toyoda et al. (1990) *Geochim. Cosmochim. Acta* **54**, 1093-1103.