# Geochemical characterization of REY-rich mud in the western North Pacific Ocean by an integrated multivariate analysis

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Deep-sea sediments significantly enriched in rare-earth elements and yttrium (REY) were recently discovered in the western North Pacific Ocean [1]. The presence of REY-rich mud with bulk total REY content of >5,000 ppm, including ~1,000 ppm of heavy rare-earth elements, strongly attracts our attention as a novel and highly promising source for the industrially critical metals.

To clarify the distribution of the "extremely REY-rich mud", eight research cruises collected 71 piston core samples in total from 2013 to 2018. Now we have constructed a comprehensive dataset of major- and trace-element contents of 1,646 samples by XRF and ICP-MS.

In order to depict geochemical features of the deep-sea sediments including the extremely REY-rich mud, we applied an integrated method of k-means cluster and independent component analyses [2] to the huge (1,646 samples x 41 elements) dataset. Then we found that the data clusters are vertically aligned from the seafloor to depth in a specific order and thus constitute stratigraphic units defined by multi-elemental features. In addition, the downhole variation of an extracted independent component (IC) shows a characteristic transition across the extremely REY-enriched layer.

In the presentation, we will demonstrate these systematic distributions of the geochemical clusters and ICs in the real space, and discuss their implications for a formation process of the extremely REY-rich mud in the western North Pacific Ocean.

References:
[1] Iijima, K. et al., *Geochemical Journal* **50**, 557-573 (2016).
[2] Iwamori, H. et al., *Geochemistry, Geophysics, Geosystems* **18**, 994-1012 (2017).