Distribution and concentration process of rare earth elements in apatite of the Heavy REE-rich deep-sea mud from the Minami-Torishima Area, Southeastern Japan

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Kon et al. (2014) studied deep-sea mud rich in heavy rare-earth elements (HREE) from Minami-Torishima Area to clarify the variation of REE + Y (REY) and REY host-phase. According to their results, whole-rock geochemical compositions of the REY-rich mud have large variations of CaO (1.8–10.6 wt%), P_2O_5 (0.7–6.1 wt%) and they are positively correlated to REY contents (0.07–0.55 wt%). Thus, Kon et al. (2014) concluded that the main REY host phase of the REY- rich mud is apatite.

In the present study, occurrence of apatite and REY distribution in apatite in the REY-rich mud were investigated to clarify the REY concentration process in the apatite, using FE-EPMA and LA-ICPMS.

The origin of the apatite in REY-rich mud is regarded as fish debris such as fish bone, tooth, placoid scales and sea urchin spine. The REY contents in apatite vary with respect to each type of fish debris. The REY-contents of compact apatite from a tooth are 0.00-0.16 wt%. On the other hand, porous apatite from a fish bone is enriched in Y (0.20-0.78 wt%) relative to the compact apatite. Apatite also occurs as nuclei in Mn-nodules in REY-rich mud. The Y contents of these apatite are variable and depend on the internal textures of fish debris. No significant difference of Y content is recognized between the free apatite and apatite covered by Mn-nodules. Moreover, it is found that the variations of negative Ce anomaly and La/Yb ratio are related to the morphology and internal texture of apatite.

Our study results suggest that the concentration process of REY in the apatite of the REY-rich mud from Minami-Torishima Area is related to the internal texture of apatite.