REY-rich mud: A perspective on science and engineering of the new REY resource

YASUHIRO KATO1,2,3*, KOICHIRO FUJINAGA1,2, KAZUTAKA YASUKAWA1,2, JUNICHIRO OHTA3, YUTARO TAKAYA4, TATSUO NOZAKI3, SHIKI MACHIDA1, KENTARO NAKAMURA1 AND HIKARU IWAMORI3,5

1The University of Tokyo, Tokyo, 113-8656, Japan (*Corresponding: ykato@sys.i.u-tokyo.ac.jp)
2Chiba Institute of Technology, Narashino, Chiba, 275-0016, Japan
3Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Yokosuka, Kanagawa, 237-0061, Japan
4Waseda University, Tokyo, 169-8555, Japan
5Tokyo Institute of Technology, Tokyo, 152-8550, Japan

The potential of deep-sea “REY-rich mud” in the Pacific Ocean as a new resource for rare-earth elements and yttrium (REY) has been reported in 2011 [1]. The mud has multiple advantages as a mineral resource: e.g., enormous resource potential, very low contents of radioactive elements, easy leaching/refining. In 2013, JAMSTEC and the University of Tokyo revealed that the REY-rich mud with $\Sigma$REY contents more than 6,000 ppm exists at a very shallow depth (2 to 4 meters) below the seafloor in the Japanese Exclusive Economic Zone (EEZ) around Minamitorishima Isl and that is located ~1,900 km southeast of Tokyo [2].

Since the discovery of the “extremely REY-rich mud”, we have conducted a comprehensive study with various approaches such as geochemical analyses, detailed microscopic observations, REY-leaching experiments, application of sub-bottom profiling to the exploration, and statistical analysis of the geochemical data set, towards the exploitation of the new and highly promising REY-resource in the near future. In addition, together with private-sector corporations, we are also starting to address the challenges for developing the deep-sea REY-rich mud deposit, including various technical issues (e.g., how to lift the mud from the seabed deeper than 5,000 m of water depth) and economic evaluations. The collaborative efforts of industry, academia, and the government are the key to success of deep-sea mining of REY-rich mud.

Here we report a general overview of our latest researches to unravel the genesis of the REY-rich mud in the Minamitorishima EEZ, together with our development system for the REY-rich mud deposits.