Acoustic characterization of REY-rich mud in the Minamitorishima EEZ using high-resolution sub-bottom profiler data

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In 2011, deep-sea sediments containing a high concentration of rare-earth elements and yttrium (REY) were discovered in the Pacific Ocean [1]. More recently, the presence of "extremely REY-rich mud "(maximum total REY content reaches 6800 ppm) was confirmed within the Japanese Exclusive Economic Zone (EEZ) around Minamitorishima Island [2]. The discovery of the mud in the Japanese EEZ raised expectation for future exploitation of the deep-sea REY resource.

To investigate the features and distribution of the REY-rich mud, shipboard sub-bottom profiling (SBP) has been conducted within the Minamitorishima EEZ [3]. The results of the surveys clearly indicated that deep-sea sediments in the Minamitorishima EEZ can be classified into two acoustic facies: transparent and layered. Combining with lithological and geochemical characteristics of sediment core samples, it has been demonstrated that REY-rich mud (acoustically transparent) lies at a shallow depth below the seafloor with very thin non-REY-rich sediment (acoustically layered) cover in the southern and southeastern part of the Minamitorishima EEZ. However, sub-bottom depth of the REY-rich mud as well as thickness of the non-REY-rich sediment are significantly variable, and factors controlling the sediment features have not been fully elucidated yet.

In this study, we investigated the spatial distribution of REY-rich mud, non-REY-rich sediment, and acoustic basement using the SBP data. We also compared the results of the investigation on the SBP data to petrological and geochemical results of sediment core samples. In the presentation, we will show the results of these analyses and discuss the three dimensional distribution of the REY-rich mud (including extremely REY-rich mud layer) within the Minamitorishima EEZ.

Keywords: Geophysical exploration, REY-rich mud, Minamitorishima EEZ, sub-bottom profiler, sediment classification