

Estimation of ferromanganese crust exposure and thickness of surface sediments using multibeam acoustic sonar and sub-bottom profiler

*Taku Kaji¹, Oak Yono¹, Hikari Hino², Haruhisa Morozumi²

1. Ocean high technology institute, Inc., 2. Japan Organization for Metals and Energy Security (JOGMEC)

Ferromanganese crusts (FMCs) are an important potential resource for cobalt, nickel and platinum. FMCs mainly form on the exposed hard rock bases on the flanks and tops of seamounts with thicknesses ranging from a few centimeters to several tens of centimeters. We attempted to estimate the exposure distribution of FMCs and thickness of surface sediments (TSS) based on exploration data acquired in the seamount located in the Western Pacific Ocean using a multibeam echo sounder (MBES) and a sub-bottom profiler (SBP), validated by comparing with ground-truth data collected at the selected sites in the studied area. We developed a new method to estimate the distribution of exposure areas of FMCs and TSS, and successfully generated models to predict FMC exposure rate and TSS from the MBES, the SBP and ground-truth data. For this estimation, we applied statistical analysis methods including principal component analysis, generalized linear model and neural net regression to estimate the distribution of exposed FMCs and TSS. The estimation accuracy of FMC exposure rate and of TSS were 17% and 2.5m, respectively, which were satisfactory for our purposes. Our method requires solely minimal data processing and ground-truth observations and provides an estimation of the distribution of FMCs. Near-bottom surveys using remotely operated vehicles (ROV) are time-consuming and labor-intensive, however, this method can be used to estimate the distribution area of FMCs and TSS in the entire seamount efficiently in a short time. The method developed in this study is useful as a method to explore seafloor resources using onboard acoustic equipment.

Keywords: ferromanganese crust, mineral exploration, topographic features, surface sediment thickness, multibeam echo sounder, sub-bottom profiler