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# Marine DC resistivity survey at deep-sea mine in the Izu-Bonin arc, Japan

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The recent growth of world-wide requirement of metals demands advanced explorations for finding metal mine and deposits. Here we propose a new way for exploration of buried submarine massive sulphides with marine controlled-source electromagnetic

technique, and magnetic survey. We demonstrated feasibility studies using various marine electromagnetic soundings: magnetometric resistivity (MMR) survey, CSEM survey and marine DC resistivity survey. As a result, we confirmed that the electromagnetic responses of each marine electromagnetic survey are very sensitive to the conductive layer simulating the submarine massive sulphide deposits, which is buried at the depth of several tens meters. We newly developed our own controlled-source EM survey system for AUV and ROV, and the real field test for the ROV-based marine DC resistivity survey system was conducted on Jan-Feb in 2011. The JAMSTEC R/V Kairei and ROV Kaiko 7000II gave us a chance to apply our system to a deep-sea mine at the Bayonnaise knoll, Izu-Bonin arc, off Japan. Our system stably obtained the resistivity information in the seawater at the middle depth of sea, which allows us the system calibration because the seawater electrical conductivity is known. Then, we obtain the apparent resistivity distribution on the seafloor. Although our sounding depth is limited (one system has a few meters and another has several tens of meters), the deep-sea mine zone shows relatively conductive feature compared to the surrounding area. We also found that the resistivity distribution seems to be complicated possibly reflecting heterogeneous geological structures. In addition, the magnetic survey using AUV, to which three-components and total-force magnetometers were attached, was carried out on the same area, and the magnetic anomaly around the knoll was successfully obtained. These results suggest us a possibility of our new CSEM survey with ROV and magnetic survey with AUV to imaging the distribution of exposed and buried deep-sea mine.

Keywords: deep-sea mine, controlled-source, EM survey, ROV, AUV