



Research and Development for Multi-stage and Integrated Approach for Seafloor Massive Sulfides (SMSs) Exploration.

Eiichi Asakawa (1), Tomonori Sumi (2), Kazuyuki Kadoshima (3), Masami Kose (4), Sangkyun Lee (1), Fumitoshi Murakami (1), Hitoshi Tsukahara (1), Akira Koizumi (3), Yukiko Koizumi (3), Makoto Ikeda (3), and Michio Higashi (4)

(1) J-MARES/JGI, Inc., Tokyo, Japan, (2) J-MARES/NSENGI, Tokyo, Japan, (3) J-MARES/MMTEC, Tokyo, Japan, (4) J-MARES/JAPEX, Tokyo, Japan

The Cabinet Office, Government Japan started the Cross-ministerial Strategic Innovation Promotion Program (SIP) in 2014. “Next-generation Ocean Resource Exploration Techniques” is scheduled under SIP from 2014 to 2018. J-MARES (Research and Development Partnership for Next Generation Technology of Marine Resources Survey) participates this program and aims “Multi-stage and integrated approach for SMSs exploration” through the development of highly efficient and cost-effective geophysical exploration methods mainly on seismic and electric-magnetic methods, and combination of the known exploration tools and systems.

J-MARES proposed Vertical Cable Seismic (VCS) technique as seismic survey. It is one of reflection seismic methods that uses hydrophone arrays vertically moored from the seafloor. It is useful to delineate detailed structures in a spatially-limited area efficiently. JGI, a member of J-MARES, has developed autonomous VCS systems and carried out several VCS surveys in hydrothermal fields in Okinawa Trough. By the VCS survey, the detailed subsurface structure is revealed and velocity is estimated [U+3000] up to 100m. Then we could recognize the buried sulfide deposit beneath the sediments.

As for EM survey, the system has been originally developed by Waseda University. The system is towed closely to seafloor using ROV. It is one of Time Domain EM (TDEM) survey systems that consists of a loop coil and a 3 component high-sensitive magnetometer. By analyzing the decay curve of the transient magnetic field induced by the loop coil, the subsurface resistivity structure is estimated. The exploration depth depends on the measurement time and it is designed up to 100m enough for SMS exploration. We carried out the EM surveys around the north mound along VCS survey lines in Izena Hole, Okinawa-trough. The EM survey detects the highly conductive zone around the north mound. The efficiency is 3 times faster than the conventional TDEM measurement on the ocean bottom.

Based on the successful results of these surveys, we are improving these systems including deep-towed seismic system (ACS, Autonomous Cable Seismic), which is more efficient than VCS. Other than geophysical surveys, we carried out the sampling on seafloor by ROV. J-MARES finally aims to develop and standardize multi-stage and integrated scheme for SMSs exploration by combining geophysical, geological and mineralogical exploration methods.