S081-006 Room: 201B Time: May 29 15:00-15:15

Development of a MMR system for the ocean bottom (2)

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We have newly developed a magnetometric resistivity (MMR) system as a part of Archaean Park Project, which is useful to estimate electrical conductivity structure of a shallow part of the oceanic crust. Our MMR system consists of a source unit for a vertical electric current, receivers and acoustic units. We designed them to be used by JAMSTEC research vessels.

The source unit allows supplying 240 volts with the maximum electric current of 50A between two electrodes; one is just under the sea surface and the other is near the seafloor (bottom electrode). The bottom electrode is connected to the onboard source unit through a winch cable, which enables us to change its depth. The current waveform is rectangular and its period can be varied between 4 seconds and 64 seconds with 5 steps.

The receivers are ocean bottom electro-magnetometers (OBEMs), which measure three components of magnetic field variation, three components of electric field variation, two components of instrument tilt and temperature with the sampling interval of 1 second. They have pipes for attaching five Filloux-type silver-silver chloride electrodes. Fluxgate type magnetometers, voltmeters, and tilt meters are packed in a pressure-resistant glass sphere for each OBEM. The OBEM has another glass sphere that contains both the battery and transponder.

The positioning of the bottom electrode is indirectly determined from the position of an acoustic unit (so called 'fish') fixed to the winch wire at 100 m above the bottom electrode. The fish measured water depth, altitude, and slant ranges to the ship and also to each OBEM with accuracy of 1 meter. An onboard acoustic unit communicates with the fish acoustically and controls it. Those data are used for the positioning. Further, the onboard acoustic unit synchronizes the SSBL system of JAMSTEC vessels, which gives continuous SSBL positions of the fish with its scatter of 100 m.

We had four cruises to test our MMR system in the Seto inland sea (20m water depth) in Japan using a vessel, Onokoro (8.5t). The results were used to develop the system. We conducted an initial MMR experiment in the Mariana Trough during the KR02-14 Kairei cruise and confirmed validity of our MMR system. The OBEM data indicate that the source signal is recognized even if the separation between the source and the receiver is 2.5 km, which would allow us to estimate the conductivity structure at the depth of 800m from the ocean bottom. Tada et al. will show results of the data analysis in this meeting.

Our system has two potential advantages for the estimation of electrical conductivity structure. First, our receivers are OBEMs, not OBMs that were used for MMR experiments up to the present. OBEM data from our MMR experiment indicate electric field variation due to the source signal is well recognized, suggesting its importance. Second, our acoustic units well determine the bottom electrode position all the time. This condition allows us to develop a new method; slowly towing the electric current source, while the conventional method requires keeping the vessel a fixed position during supplying the source, because of the assumption of the 'vertical' electric current source. We obtained OBEM data during supplying the source by both methods and we will compare differences in the methods. The new method would lead better performance because source supply points becomes source supply lines.

Our first target for the system is hydrothermal sites. The reason is that the electrical conductivity of the seafloor depends primarily on seawater within the crust (amount, spatial distribution, temperature, and salinity) and the electrical conductivity estimation is suitable way to understand overall feature of the hydrothermal circulation system. Another targets are marine gas hydrates, prevalent in offshore sediments in Japan, which is based on the assumption of a reduced electrical conductivity in hydrate rich zones.