Search the hydrothermal circulation system by the electric conductivity

Noriko Tada[1]; Nobukazu Seama[2]; Tetsuo Matsuno[1]; Hisanori Iwamoto[1]; Kazuya Kitada[3]; Motoyuki Kido[4]; Tada-nori Goto[5]; Masashi Shimoizumi[6]

[1] Earth and Planetary Sci.,Kobe Univ; [2] RESEARCH CTR INLAND SEAS, KOBE UNIV.; [3] Earth and Planetary Sci.,Kobe Univ.; [4] KURCIS, Kobe Univ.; [5] JAMSTEC; [6] Kyushu Polytechnic College

Hydrothermal vent fields exist on the spreading axis, where the sea water penetrates into the crust, are warmed by heat source, and erupts from the hydrothermal vents. Understanding of this hydrothermal circulation system is extremely important to reveal the cooling process of the oceanic crust. The thermal structure beneath the oceanic crust where the hydrothermal circulation occurs indicates the extent of underground activity and the convection scale of hot water. The temperature is estimated by the electrical conductivity of the crust, because the conductivity depends on the volume, the salinity concentration and especially the temperature of the sea water in the crust.

Magnetometric Resistivity (MMR) method that uses the controlled current source is useful to estimate the conductivity structure of the uppermost oceanic crust. The MMR method consists of three important parts; source, receiver and positioning. The source part supplies the electrical current between two electrodes which exist near sea surface and seafloor, respectively. The receiver parts are Ocean Bottom ElectroMagnetometers (OBEMs), and the OBEMs observe the magnetic and electric signals resulted from relation between the crustal conductivity and the current. The positioning parts determine the location of the source and receiver parts by GPS and the acoustic ranging.

The hydrothermal vent fields are discovered around the spreading axis in the southern Mariana Trough. We researched around an active vent field (Fryer site; 12-57.2N, 143-37.1E and ~2850m deep) by MMR method from November 16 to December 8, 2003 using R/V 'Kairei', JAMSTEC. We deployed six Kobe type OBEMs surrounding the Fryer site, and all OBEMs can measure three components of magnetic field variation, those of electric field variation, two components of instrument tilt and temperature. We supplied the controlled electric current whose amplitude and period are ~16A and 16seconds, respectively. We supplied the electric current by two ways. One required stopping each site for 30 minutes and carried out at 10 sites. The other was supplying the electric current continuously while the ship was shifting along the survey line at 0.5knot. In this way, we have five lines; three are perpendicular to the spreading axis and two are parallel. Because the receiving signals depend on the conductivity of the crust between the lower electrode and the OBEMs, we used the 'Kairei' SSBL system, a transponder and the acoustic unit to determine the position of the lower electrode accurately. All OBEMs were recovered, and five of them recorded available data.

We will show the 2-dimensional conductivity structure resulted from the data of these five OBEMs and present interpretation about it.