Oral | Symbol S (Solid Earth Sciences) | S-CG Complex & General

[S-CG67_2AM2]Ocean Floor Geoscience

Convener:*Kyoko Okino(Ocean Research Institute, University of Tokyo), Keiichi Tadokoro(Research Center for Seismology, Volcanology and Earthquake and Volcano Research Center, Nagoya University), Osamu Ishizuka(Institute of Geoscience, Geological Survey of Japan/AIST), Tomohiro Toki(Faculty of Science, University of the Ryukyus), Narumi Takahashi(Earthquake and Tsunami Research Project for Disaster Prevention, Japan Agency for Marine-Earth Science and Technology), Chair:Tomohiro Toki(Faculty of Science, University of the Ryukyus), Kyoko Okino(Ocean Research Institute, University of Tokyo)

Fri. May 2, 2014 11:00 AM - 12:45 PM 418 (4F)

Ocean Floor Geoscience session covers a broad range of research on seafloor such as mid-ocean ridge process, subduction dynamics, arc magmatism, hot spot and LIPs, crustal movement and structure etc. Every field of researches and every approaches are welcomed. The session aims to encourage discussion among scientists from different study fields and to integrate our understanding of ocean floor.

12:00 PM - 12:15 PM

[SCG67-P10_PG]Electrical resistivity structure of the Snail site at the Southern Mariana Trough spreading center

3-min talk in an oral session

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Keywords:electrical resistivity structure, temperature and porosity, oceanic crust, hydrothermal circulation, magnetometric resistivity method

The electrical resistivity of the oceanic crust is sensitive to the porosity of the crust and the fluid temperature within crustal fractures and pores. The spatial variation of the crustal porosity and the fluid temperature that is related to a hydrothermal circulation can be deduced by revealing an electrical resistivity structure of the oceanic crust involving a hydrothermal site. We carried out a magnetometric resistivity experiment using an active source to reveal an electrical resistivity structure of the oceanic crust at the Snail site on the ridge crest of the Southern Mariana Trough. Active source electric currents were transmitted along and across the ridge axis in a 4000 m² area including the Snail site. Five ocean bottom magnetometers were deployed around the Snail site as receivers to measure the magnetic field induced by the transmission of the active source electric currents. The amplitude of the induced magnetic field was calculated by maximizing data density and the signal to error ratio in the data, and locations of the transmissions were determined using several types of calibration data. An optimal 1-D resistivity structure of the oceanic crust, averaged over the experimental area, was deduced by least squares from the data of the amplitude of the magnetic field and the location of the transmission. After calculating magnetic field anomalies, which are deviations of the observed amplitude from the prediction of the optimal 1-D resistivity model, an optimal 3-D resistivity structure was deduced from the magnetic field anomalies through trial and error 3-D forward modeling. The optimal 1-D resistivity structure is a two-layer model, which consists of a 5.6 Ω-m upper layer having a 1500 m thickness and a 0.1 Ω-m underlying half-space. Using Archie's law and porosity profiles of the oceanic crust, the resistivity of 5.6 Ω-m at depths ranging from 800 to 1500 m suggests the presence of high-temperature fluid related to the hydrothermal circulation. The resistivity of 0.1 Ω-m below 1500 m depth may represent a magma mush that is a heat source for the hydrothermal circulation. The optimal 3-D resistivity structure

includes a conductive anomaly (0.56 Ω -m in approximately 300 m² area down to 400 m depth) just below the Snail site, two resistive anomalies (56 Ω -m with slightly larger volumes than the conductive anomaly) adjacent to the conductive anomaly on the across-ridge side, and three conductive anomalies away from the Snail site. The conductive anomaly just below the Snail site suggests hydrothermal fluid, and the adjacent resistive anomalies suggest areas of low porosity. The size and distribution of the conductive and resistive anomalies near the Snail site constrains the size and style of the hydrothermal circulation.