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Seafloor EM experiment in Japan Trench, off-Sanriku: Natural source MT survey

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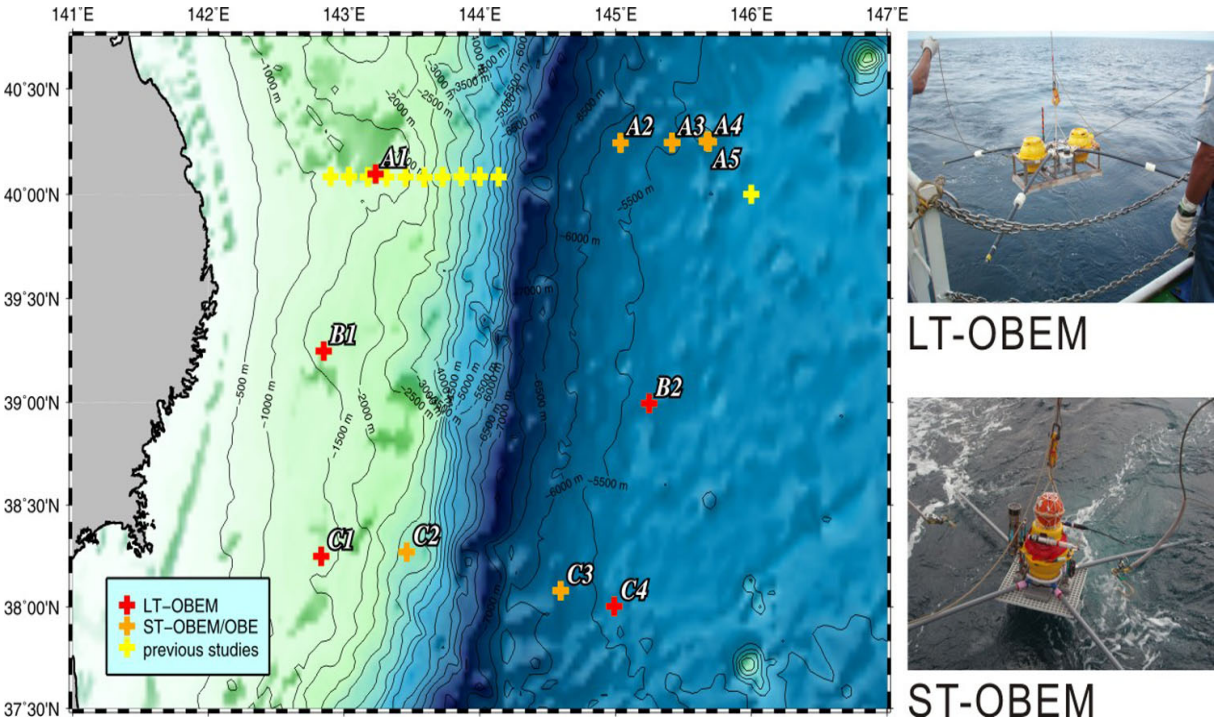

We have conducted a collaborative observations of heat flow measurement and electromagnetic (EM) exploration using both natural and controlled sources on the seafloor aroung Japan Trench, off-Sanriku, since October, 2008. In this presentation, we introduce the detail of the natural source EM survey and preliminary result of the data analysis based on magnetotelluric (MT) method.

The project aims to image thermal structure and distribution of water in the upper most plate subducting at Japan Trench through the heat flow and EM explorations and then elucidate the processes of heat transfer and water cycle accociated with intra-plate volcanism and normal fault formation on ocean-ward slope of the trench. It will also enable us to discuss relation of heat and water with asperity in the seismogenic zones. The natural source EM survey contribute the project by imaging regional electrical conductivity structure of the crust and upper mantle in the survey area.

The EM exploration was conducted by three cruises; R/V Kairei KR08-10 in September 2008, R/V Tansei-maru KT09-8 in June 2009, and R/V Kairei KR09-16 in November 2009. Total 10 seafloor instruments were deployed along three survey lines crossing the Japan Trench (See figure and photos attached) and successfully recovered during the cruises. We utilized five long-term ocean bottom electromagnetometers (LT-OBEMs), four short-term ocean bottom elecromagnetometers

(ST-OBEMs), and two short-term ocean bottom electrometers (ST-OBEs). LT-OBEMs and ST-OBEMs/OBEs measured the time variation of three-components magnetic field, two-components electric field and two-components instrumental tilts, every one minute and eight hertz.

We are now analyzing the obtained data based on MT method. For LT-OBEM data, quality is good except for the electric field at site B1. Available response functions were obtained in the period range between about 300 seconds to one day by preliminary analysis. For ST-OBEM/OBE, we obtained high quality response functions in the period range between tens and thousands seconds. There is room for improvement by further correction of time series data in terms of temperature drift and tilt variations and by selection of remote reference site.After estimating the reliable response functions, we will attempt to image two- or three-dimensional conductivity structure by inversion of the response functions.

Keywords: Japan Trench, Pacific plate, water, electrical conductivity, magnetotellurics, ocean bottom electromagnetometer