Oral | Symbol S (Solid Earth Sciences) | S-IT Science of the Earth's Interior & Techtonophysics

[S-IT41_28PM2]Origin, Evolution, Destruction, and Recycling of Oceanic Plate

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Mon. Apr 28, 2014 4:15 PM - 6:00 PM 314 (3F)

Formation and subduction of oceanic plate play an important role in the thermochemical evolution of the Earth interior and surface environmental conditions including biological activities. However, we have never clearly answered basic questions: such as (1) Origin and modification (metamorphism and alteration coupled with biological activities) of oceanic plate before and after subduction, (2) Impact of destruction of oceanic plate on subduction zone processes, such as volcanism and earthquake, (3) Differences between mid-ocean ridge and back arc settings. In order to understand the origin, evolution and deconstruction of oceanic plate, the session invites contributions from a range of geophysics, geochemistry, petrology, modeling, simulation and biology working on intact as well as fossil oceanic lithosphere, e.g., ophiolite.

5:45 PM - 6:00 PM

[SIT41-P02_PG]Upper mantle electrical resistivity structure at the continental margin of East Antarctica

3-min talk in an oral session

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The breakup of the Gondwana supercontinent is one of targets of the study on the plate tectonics and related mantle dynamics. The crust and the upper mantle structure under the western Cosmonauts Sea at the continental margin of East Antarctica, where a rifting of Gondwana and a subsequent seafloor spreading occurred, are anticipated to reflect the breakup process of Gondwana. We carried out a marine electromagnetic experiment to reveal an electrical resistivity structure at depth of the crust and the upper mantle under the western Cosmonauts Sea. Time variations of the electromagnetic field were acquired at two seafloor sites in the experiment. The time variations data were processed on the basis of the magnetotelluric (MT) method. The MT response function was obtained after considering influence of non-plane magnetic field sources at high geomagnetic co-latitude. The obtained MT response functions and polar diagrams imply that the MT responses involve topographic distortion and/or reflect a higher dimensional resistivity structure under the observational sites. Three dimensional forward modeling was conducted to examine influence on the observed MT responses from the topographic variation around the observational sites and a conductive layer just under the sites, which is mostly regarded as sediment. The results of the forward modeling clearly show that the topographic variation and the surface conductive layer have severe influence on the observed MT responses. A series of 3-D forward modeling with the topographic variation and the surface conductive layer was implemented to

examine a resistivity structure at depth of the crust and the upper mantle. The results indicate that the resistivity structure is explained by a two-layer resistivity structure, in which the upper layer is resistive and the lower layer is conductive. The upper resistive and the lower conductive layers likely represent dry and water/melt rich oceanic upper mantle, respectively. The thickness of the upper resistive layer is thinner than that expected for a typical oceanic upper mantle of the seafloor age of the study area. The thin upper resistive layer may require high temperature and high water/melt anomalies that were generated through mantle convection, which was related to the breakup process of Gondwana at the continental margin of East Antarctica.