Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)
©2009. Japan Geoscience Union. All Rights Reserved.

SIT042-P07 Room: Convention Hall Time: May 25 17:15-18:45

Numerical simulation of mantle convection with chemical heterogeneity and continental drift

Masanori Kameyama[1*], Masashi Fukuda[1]

[1]Geodynamics Research Center, Ehime Univ.

We are conducting numerical simulations of mantle convection in order to study the generation of plumes in the presence of chemical heterogeneity in the mantle and continental drift. In this study we employ a model of a two-dimensional rectangular box of 2900km height and the aspect ratio (width/height) of 12, under the extended Boussinesq approximation with variable viscosity and depth-dependent thermal expansivity. The mantle materials are modeled by a mixture of two components with different density and/or viscosity. The convecting motion of fluid is driven by not only a thermal but also a chemical buoyancy coming from the variation in the content of denser component. In addition, we impose a block of highly viscous fluid of 11600km width along the top surface, as a model of a supercontinent. We also assumed that the continental block horizontally moves along with the overall convection in the mantle. Our preliminary calculations showed that, when the effect of negative chemical buoyancy is sufficiently large, a dome-like structure of the dense material develops at the base of the mantle which survives for more than several gigayears. We also found that the long-lived dome-like structure forms a broad region of high temperature which is similar to the superplumes or the large low shear velocity provinces (LLSVPs) observed in the lower mantle. In the presentation, we will discuss the details of our present numerical results, with special emphasis on the stability of chemical heterogeneities at the base of the mantle as well as on the spatial relations between surface continents and tomographic features in the deep mantle.

Keywords: mantle convection, numerical simulation, continental drift, thermal-chemical convection, plumes