Geochemical picture of the mantle from oceanic basalt geochemistry requires a depleted MORB and an enriched OIB. Evidence from geophysical observations and numerical models suggested that the MORB comprises most of the mantle. These, combed with results from topography and heat flow, lead to one of the most difficult conundrums in understanding the thermochemical mantle. Results from seismology and numerical simulation imply that subducted crust accumulates a pool in the bottom of mantle, and once formatted, it might survive for a long time.

In this work, we formulated a thermochemical convection model to study the possible influence of the chemical pool in the bottom of the mantle on the thermochemical evolution. Our model is in 2D Cartesian geometry, and the chemical pool is simplified as a layer with a thickness of 1/10 of the mantle. Main results include: existence of a chemical dense layer causes reduction in both the top and bottom heat flux and topography; increasing internal heat rate increases the top heat flux and topography, but reduces the bottom heat flux and topography; keeping the total internal heating rate the same, increasing the internal heating rate in the chemical pool reduces both the top and bottom heat flux, and has little influence on both the top and bottom topography. Our results show that there is little topography variation with 30%-50% of the total internal heat concentrating in the chemical pool. This may offer an alternative to reconcile the geophysical and geochemical mantle. This work was supported by NSFC(91014005)