Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

SCG64-19 Room:A05 Time:May 28 09:45-10:00

On the origin of seafloor flattening

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The subsidence of an aging seafloor starts to slow down at ∼70 Ma old with respect to the prediction of simple half-space cooling, and this phenomenon has long been known as seafloor flattening. The flattening signal remains even after removing the influence of the emplacement of hotspot islands and oceanic plateaus. The combination of small-scale convection and radiogenic heating has been suggested as a mechanism to explain seafloor flattening, and this study explores a possibility of using the magnitude of seafloor flattening to constrain the amount of radiogenic heating in the convecting mantle. By comparing properly scaled geodynamic predictions with the observed age-depth relation of the normal seafloor, the mantle heat production is estimated to be ∼12±3 TW, which supports geochemistry-based estimates. A widely-held notion that small-scale convection enhances cooling thus being unable to explain seafloor flattening is suggested to be incorrect. The ability to predict the age-depth relation of seafloor based on the thermal budget of Earth has an important bearing on the future theoretical study of early Earth evolution.

Keywords: seafloor flattening, mantle convection, internal heating, early Earth, surface environment