Origin and role of lost continents

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<Purpose>

Continental crust had long been regarded that it cannot subduct into mantle forever because of lower density. If so, the Earth must have extraordinary thick continental crust over 300km in thickness. But, of course, not. We elucidate where continental curst has gone?

<Method>

Recently, on-going process of direct subduction of island arcs off Japan was reported (Yamamoto et al., 2007), as well as tectonic erosion of hanging wall of continental crust (von Huene and Scholl, 1991), the physical process by numerical simulation (Ichikawa et al., 2009), the presence of abundant TTG materials in MTZ (Kawai et al., 2013), and spatial distribution of the second continents in the MTZ over the world (Maruyama et al., 2008).

<Result>

We revealed continental curst is subducted into mantle and accumulated as “lost continent”. The estimated mass of the lost continent in MTZ (depth range of 520-660km) is 7.5 times more than total volume of TTG crust on the surface Kawai et al (2009; 2013), and the existing material is expected to be TTG, not MORB or harzuburgite based on seismology. Kawai et al. (2007) also predicted that D” layer ca. 300km thick right above CMB could be another lost continent, which anorthosite and KREEP dominated. However, this idea cannot explain reasonable enough that the density of KREEP basalt is close to that of surrounding peridotites. According to more recent estimate by Greaux et al. (2018), lost continent on CMB is expected to be fractionated KREEP and anorthosite. If KREEP lower crust of the Hadean continent subducted and segregated at 660km depth, these material could be falling preferentially into lower mantle, and they must have been accumulated on the CMB.

<Discussion>

It is pointed out that those lost continents may have played critical role for the thermal history of Earth, because most radiogenic elements such as U, Th, and K were predominantly concentrated into the primordial continents, whereas these elements were rare in the mantle. Radiogenic elements contained in lost continents must have contributed as the heat generator of the inner Earth and controlled thermal history of the Earth. One of the most significant next research targets is to conduct the quantitative estimates of lost continent. The idea of lost continents would change the concept of mantle dynamics.

Keywords: KREEP basalt, Lost continent, mantle dynamics

