Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)


SCG71-05 Room:103 Time:May 21 16:45-17:00

# Three-layers model of continent and whole mantle dynamics through time

MARUYAMA, Shigenori[1*], KAWAI, Kenji[1], TSUCHIYA, Taku[2], TSUCHIYA, Jun[3]

[1]Tokyo institute of Technology, [2]Geodynamics Research Center, Ehime University, [3]Senior Research Fellow Center, Ehime University

A huge continental crust covers the solid Earth, ca. 35 km in average and 1/3 of the Earth's surface. Geologists have long considered that granite cannot subduct into deep mantle by its buoyancy, hence accumulated through geologic time. However, ubiquitous occurrence of sediment-trapped subduction, tectonic erosion at trenches and direct subduction of arc itself as seen now in Japan and other subdduction zone around the Pacific clearly document the idea is wrong. Moreover, the Archean geology for the mechanism to make a continent suggests the extensive amounts of arc asuduction in the Archean. Moreover the recently obtained growth curve of continental crust through time indicate 7 times more TTG crust subducted by 2.5Ga (Rino e al., 2008).

Following these works, Kawai et al. (2009) and Tsuchiya et al. (2009) have calculated density contrasts in mantle depth down to CMB pressure at elevated temperature, and concluded that TTG crust is gravitationally stable at mantle transition zone (MBL) depth, and never subducts into lower mantle. Moreover, once subducted into MBL, it cannot rise up hence stagnant forever and grows bigger through time.

Another conclusion by First Principle Calculation by above authors is fate of anorthosite. As an evidence of thick (50-60km) anorthosite layer on the Moon, as a fossil record of magma ocean at 4.5Ga, an argument of fate of anorthosite on the Earth occurred during early 1970s. One conclusion was density cross-over of anorthosite vs basaltic or komatiitic magma is not possible at shallow depths on the wet Earth. If so, anorthosite must have subducted into deep mantle, or to make a layer at depths. Calculated density structure in deep mantle indicates that the anorthosite could be most probable candidate in the D" layer on the CMB. We here define these continents as, First (surface), Second (MBL) and Third (D" layer) Continents.

As the First continent has a Wilson cycle, Second and Third Continents would have such a cycle, reflecting preferential arrangement of trenches on the surface, controlled by the birth of strong mantle down-flow, and afterwards by the birth of superplume and continental dispersion. Fate of First supercontinent would be strongly controlled by the stagnant Second supercontinent in MBL by radiogenic heating.