Superplume-supercontinent cycle induced by subducted-accumulated TTG on the CMB

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The tonalite-trodhjemite-granite (TTG) crust on the Earth, although small in amount with only 0.1wt% of the total mass of the Earth, is one of the important characteristics of a habitable planet, in addition to the presence of liquid water. Geologists have long believed that the granitic crust must have survived on the surface of the Earth without any subduction, because of its buoyant physical character.

However, recent studies on the juvenile arc in the western Pacific region indicate that immature island arcs subduct into the deep mantle in most cases, except in the case of parallel arc collision. Moreover, sediment trapped subduction and tectonic erosion are also common. This has important implications in evaluating the role of TTG crust in the deep mantle and probably on the bottom of the mantle.

Because the TTG crust is enriched in K, U and Th, ca. 20 times more than that of CI chondrite, the accumulated TTG on the Core Mantle Boundary (CMB) would have played a critical role in terms of thermal evolution of the mantle. Particularly the subducted TTG layer would have worked as a triger of superplume-supercontinent cycle after 2 Ga. This is because selective subduction of oceanic lithosphere including sediment-trapped subduction, tectonic erosion and arc- and microcontinent- subduction proceeded under the supercontinent before the final amalgamation ca. 200-300 million years after the formation of the nuclei. In this paper, we will speculate the mechanism of superplume evolution through the subducted-accumulated TTG on the Core-Mantle Boundary (CMB).