Geochemical characteristics of the granite, Taitao Peninsula, southern Chile

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It is the essential to study evolution of solid earth to understand growth and origin of granitic continental crust. Recent in-situ analyses of U-Pb ages and Hf-isotopic composition of detrital zircons demonstrate episodic growth of continent through geologic time. However, origin of the granite is still poorly known. It is commonly considered that the genesis of tonalite-trondhjemite-granodiorite (TTG) magmas in the Archean is different from the modern equivalents. Rare earth elements (REE) patterns of the granitic magma allow us to differentiate slab melting from lower crustal melting for their geneses, and high La/Yb ratio and low Yb contents of the Archean TTG indicate slab melting for the genesis. The difference is commonly explained by higher subduction geotherm in the Archean than in the Phanerozoic, and the geotherm strongly depends on the ages of subducted slab.

The Taitao Peninsula is the youngest site of ridge subduction in the world, where a young oceanic plate subducts, probably equivalent to the Archean subduction zone. It is supposed that the granitic magma in the Taitao Peninsula was formed through slab melting of a very young subducted oceanic crust. This paper presents whole rock analyses of REE of the granitic rocks so that we obtain the detailed compositional characteristics of the granitic magmas, which were formed by slab melting.

There is a triple-junction of Trench-Trench-Ridge off the Taitao Peninsula, southern Chile. A volcanic front runs along the western coastal line of the South American continent. The Taitao Peninsula is located at the fore-arc, and comprised of ophiolite complex and several intrusions of granitic batholiths. Cande and Leslie (1986) suggested that a mid-oceanic- ridge passed the below of Taitao peninsula at 3-6 Ma. And the Taitao granites were emplaced at that time (Herve, 2003). Origin of these granites is important to understand igneous activity at ridge subduction.

Bourgois et al. (1996) analyzed whole rock composition of the granitoid, and concluded that the Taitao granitoid was generated at least 30 km deep due to slab-melting of eclogitic rocks. But, the whole rock compositions have slight negative Eu anomaly, high HREE contents, and low Sr contents. Moreover, Y contents were not reported. These signatures are inconsistent with typical slab-melting related melt such as adakitic magma.

The compositions of the Taitao granitoid are tonalitic to granitic with SiO2 ranging from 66% to 77%. Trace and rare earth elements are characterized by low Sr (50-300ppm) contents, moderately both high Y (10-50ppm) and Yb_N contents (8 - 35) and low Sr/Y ratios (1 - 20). Chondrite-normalized REE patterns are characterized by moderately high $[La/Yb]_N$ ratios (5 - 20). These chemical characteristics are similar to typical calc-alkaline arc magmas rather than adakite. The characteristics suggest that the primitive magma was generated by partial melting of amphibolite rather than eclogitic rocks. Based on geological evidence and age and composition of the granite, we conclude that the granitic magma was generated over 10 km depth below a fore-arc region, and imply that ridge subduction played an important role in the igneous activity as a heat source. Moreover, REE patterns of granitoid are not necessary good signature of slab melting.