Quaternary volcanic activity of Hudson & Lautaro volcanoes, Chilean Patagonia: new constrains from K-Ar ages and geochemical data

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At the Titao Peninsula where the Antarctic, Nazca and South American plates meet, subduction of a segment of the active Chile ridge system along the Chile trench forms a ridge-trench-trench-type triple junction, namely the Chile Triple Junction (CTJ) (e.g., Herron et al., 1981). Near the CTJ, there is a significant gap (about 350 km long) in recent subduction-related volcanic activity. This volcanic gap separates two distinct volcanic zones along the axis of the southern Andean Cordillera; the Southern Volcanic Zone (SVZ) and Austral Volcanic Zone (AVZ) (e.g., Stern, 2004). Geochemical characteristics of the Quaternary volcanics drastically change across this volcanic gap; AVZ is composed of calc-alkaline andesite to dacite of adakitic or high-Mg andesitic affinities while SVZ consists mainly of low- to medium-K calc-alkaline basalt and arc-tholeiite with minor andesite and dacite (e.g., Stern, 2004; Stern and Kilian, 1996). The distinction has been attributed to incorporation of contributions related to slab melting in south of the CTJ, caused by subduction of the Chile ridge (Ramos and Kay, 1992; Stern and Kilian, 1996).

Recent study has shown that dacite and basaltic andesite of late Pliocene to Quaternary ages (younger than 2 Ma) dredged on the continental slope offshore of the Taitao peninsula adjacent to the active CTJ also have subduction-related geochemical characteristics (Guivel et al., 2003). This suggests the possibility that volcanic activity along the volcanic front of the Andean Cordillera had ceased and jumped to forearc province near the CTJ during late Pliocene to Quaternary in age. If so, information about spatiotemporal distribution of volcanic activity and chemical composition of this period provides an import ant key to understanding the variety of thermal structures in the mantle wedge influenced by the Chile ridge subduction. Providing precise age-controls of the Pliocene-Quaternary activity of volcanoes of SVZ and AVZ near CTJ allow more focused discussion of this issue.

In this study, we report twenty-nine K-Ar ages and whole rock compositions for Quaternary volcanic rocks of Hudson and Lautaro volcanoes Twenty-nine K-Ar ages and major and trace element compositions for lavas and ejecta obtained from Hudson volcano in the southern end of the Southern Volcanic Zone and Lautaro volcano in the northern end of the Austral Volcanic Zone, which are separated by a 350 km-long volcanic gap near the Chile ridge subduction zone, were determined using unspiked method that has significant sensitivity for dating younger rocks (less than 0.1 Ma). It is newly revealed that Hudson is a significantly long-lived volcano; its activity started at 1.0 Ma and continues to the recent. The Hudson volcano has a well-preserved summit caldera complex of approximately 10 km diameter, previously thought to be formed by a single event during the Holocene, perhaps at 6700 BP. Our results for the K-Ar dating, however, indicate that NE and SE flanks of the volcano formed at different times; formation of NE flank preceded that of SE flank. Aero-photographic observation indicates the presence of two or even three caldera rims. These data suggest that the Hudson volcano evolved rather complexly, superimposing or partially nesting calderas rather than a simple caldera. For Lautaro volcano, the volcanic activity began at 0.17 Ma and has continued to the recent, based on our first results of K-Ar dating. Though Lautaro volcano is a relatively large stratovolcano for Chilean Patagonia, its ranges in chemical composition and age are smaller than those of Hudson volcano. These narrow compositional and geochronological ranges suggest that the Lautaro volcano developed in a short period and from a relatively homogeneous magma chamber produced by a slab melting during the late Quaternary time, assuming that most part of the volcano was exposed and sampled spans the full lifetime of the heavily ice-mantled volcano.