Radiometric ages and Nd-Sr isotopic compositions of felsic plutonic rocks from the Ulleungdo volcanic island, South Korea

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The Ulleungdo is a submarine to subaerial dormant strato volcano (12 km×10 km in size) with a small Nari caldera (2 km in diameter) at the summit. The Ulleungdo volcanic activities are divided, on the basis of lithology, occurrence and radiometric age, into 5 stages in the order of eruption/deposition: Stage 1 (1.37-0.97 Ma, basaltic agglomerate, basaltic lava, picritic basalt and trachyte), Stage 2 (0.83-0.77 Ma, trachyte, trachybasalt and trachyte agglomerate), Stage 3 (0.24-0.73 Ma, trachyte, trachyandesite, trachybasalt, phonolite, trachyte agglomerate), Stage 4 (9300-6300 YBP, pyroclatics, tuff block, pumice and ash) and Stage 5 (0.01 Ma, leucite bearing trachyandesite).

Numerous fragments of felsic plutonic rocks (monzonites) were found in the recent (6300-9300 YBP) tephra formed by the Stage 4 eruption of the Ulleungdo volcano, an oceanic island, which consists mainly of Quaternary alkali volcanics, South Korea.

This unusual occurrence of felsic plutonic rocks in the tephra formation gives us important information about felsic (monzonitic) magmatism and the basement underlying the alkali volcanic province of a back arc basin. Herein we document the occurrence of fragments of Ulleungdo monzonites, present their age and propose a petrogenetic model for the evolution of the extremely young plutonic rocks. We also discuss the origin and source characteristics of the felsic (monzonitic) magmas in terms of Nd and Sr isotopes and whole rock geochemistry and the relationship between volcanic and plutonic rocks in a back arc basin located along the active continental margin of the southeastern corner of the Eurasian plate.

Geochemical characteristics of the felsic plutonic rocks, which are typically silica undersaturated alkali felsic rocks, which can be classified as monzonites, are similar to

those of alkali volcanics in the Ulleungdo in terms of concentrations of major, trace and REE elements.

The Rb-Sr mineral isochron age for the monzonites is 0.12 Ma. K-Ar biotite ages from the same monzonite samples gave relatively concordant ages of 0.19 Ma. The initial Nd-Sr isotopic ratios of the monzonites are also comparabled with those of the alkali volcanics erupted during Stage 3 Ulleungdo volcanism. The high initial $^{87}Sr/^{86}Sr$ values of the monzonites imply that seawater and crustal contaminated pre-exisited trachytic rocks may have been melted or assimilated during differenciation of the alkali basaltic magma.

The radiometric ages, geochemical characteristics and Nd-Sr isotopic signatures of the Ulleungdo monzonites strongly suggest that the felsic (monzonitic) magma was cogenetically evolved from Stage 3 alkali basaltic magma via fractionating felsic trachytic magma, formed in the back arc basin and related to the opening of the East Sea and the Japan Sea.