Common origin of plagioclase in last three eruptions of Unzen volcano, Japan

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The results of micro-drilling analyses on megacrysts (large phenocrysts from 2 to 15mm in length) of plagioclase extracted from lavas of the last three eruptions of Unzen volcano (AD1663, AD1792 and AD 1991-1995), southwestern Japan, indicate that the variation of $^{87}Sr/^{86}Sr$ ratios was restricted to 0.70439-0.70454. This is in sharp constrast to the large variation of $^{87}Sr/^{86}Sr$ ratios of groundmasses of lavas in the last three eruptions (0.71417, 0.70467, 0.70447-0.70450, respectively). In addition, all the samples of plagioclase have similar trace element abundance ratios (La/Nd and Sr/Ba) as well. The similarity in chemical and isotopic compositions suggests a possibility that they may have formed from a single source before AD1663. The lavas which erupted four and five thousand years ago have $^{87}Sr/^{86}Sr$ ratios of 0.70454 and 0.70442, respectively [*Chen et al*., 1993], and they may be the parent magma with regard to the Sr istope ratios.

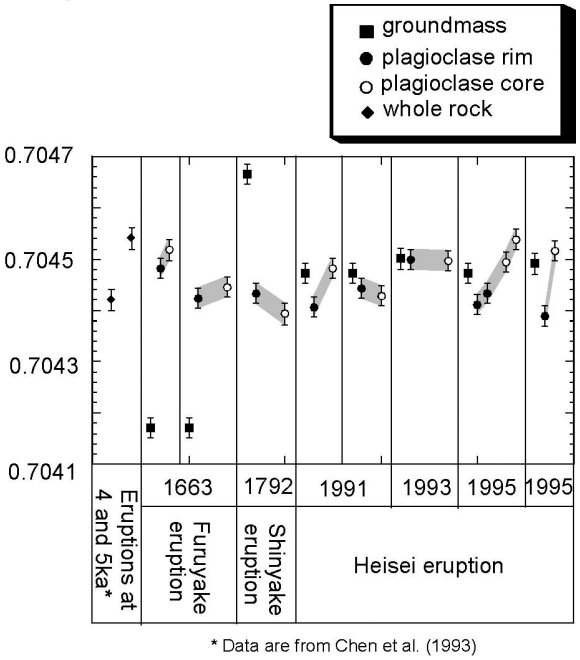

Figure 1. Sr isotopic ratios of plagioclase megacrysts and groundmasses of the last three eruptions. Sr isotopic data for the whole rock samples erupted at 4 and 5 ka [data were from Chen et al., 1993] were also shown. Plagioclases in the last three eruptions record similar Sr isotopic ratios. Six plagioclases of the eight show isotopic disequilibrium between their rims and groundmasses.

Nature of juvenile granite generated in the lower arc crust: Dasu tonalite in the Kohistan block, northern Pakistan

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In the growth history of granitic continental crust, only juvenile granite magma contributes to its net growth. The Kohistan block in northern Pakistan exposes a crustal cross section down to near-MOHO level of an ancient island arc which was sandwiched by Eurasian and Indian continents durng the Tethys closure. We can observe the generation and development of the juvenile granitic magma in the mafic lower crust of the Kohistan arc.

The silicic melt pod appears from garnet pyroxenite of the lowermost crust unit and develops in the overlying amphibolite unit to the granitic rock. It grows up to kilometer-sized tonalite sheets called Dasu tonalite, which intrude banded amphibolite in the lower crustal unit. Since the Dasu tonalite is deformed concordantly to the structure of the host amphibolite, which is estimated petrologically to be 20-30 km depth. It is supported by the presence of magmatic epidote in the Dasu tonalite, which indicates high-pressure crystallization.

The Dasu tonalite is extremely poor in K2O (0.6-0.9 wt.% for SiO2 65-70%) and Rb (18-28ppm), indicating no involvement of upper crustal recycled materials. It is also poor in Zr, Y, Th and Nb, compared to common arc granitoids with similar SiO_2 content, such as Cretaceous Circum-Pacific granitoids. Chondrite-normalized REE pattern is not steep and the REE abundance is totally small. The initial $^{87}Sr/^{86}Sr$ ratio of the Dasu tonalite is 0.7037-0.7038, which is similar to the lower crustal rocks of the Kohistan block, inferring no interaction with the Indian craton component which presumably is tectonically underlying the Kohistan block now. This initial Sr isotopic ratio is plotted within the range of those of the felsic rocks from Izu-Bonin oceanic arc and their on-land obducted equivalents.