Temporal changes of geochemical characteristics of volcanic products from Aso volc: Implication for a prediction of super eruption

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Chemical compositions and isotopic ratios ($^{87/86}$Sr and $^{143/144}$Nd) for late-Pliocene to Quaternary volcanic rock in Aso area in SW Japan, were determined to reveal temporal changes of the magma characteristics and a mechanism of magmatic system of super caldera volcano and to evaluate a possibility of Aso-5th next super-eruption. Two high-Mg volcanic rocks were dated.

In this study, volcanic activities in Aso area are divided to 5 stages depending on ages and characteristics of forms of eruptions. 1) Early pre-caldera stage: HMA (3.9Ma (Shinmura et al., 2008)) and high-Mg picritic basalt (2.9Ma (in this study)) are distributed on southwestern somma of Aso caldera. 2) Late pre-caldera stage: Volcanic rocks exposed on caldera wall and somma are erupted at 2.2-0.4Ma (Pre-Aso volcanic rocks defined by Watanabe et al., 1989). They are basaltic to rhyolitic. 3) Caldera forming stage-1st to 4th: 4 Super eruptions (at ca. 270, 140, 120 and 90 ka) with voluminous pyroclastic flows including scoria and pumice (Aso-1st to 4th (Watanabe, 2001)). 4) Inter-caldera stage (1/2, 2/3 and 3/4): Volcanic activities between super eruptions, mainly consisted of andesite lava flows (distributed on somma and outside of caldera). 5) Post caldera stage: Volcanic activities after last super eruption (Aso-4th), forming Aso central volcanic cones with rhyolitic to basaltic volcanic products.

MgO contents of volcanic rocks at only early pre-caldera stage are extraordinary high (6.5-15.7 wt. %). Volcanic products of inter-caldera stages except of volcanic rocks from Neko-dake, show same geochemical characteristics (high K_2O contents, same REE patterns and isotopic ratios). Contents of K_2O and REE of volcanic products of post caldera stage are lower than those of caldera forming stages, and higher than those of pre-caldera stages. Isotopic ratios of volcanic products at each stage distributed in $^{87/86}$Sr-$^{143/144}$Nd diagram are as follows. 1) early pre-caldera stage: separately distributed in two areas (component A: around (0.7040, 0.51285), component B: around (0.7044, 0.51270), 2) late pre-caldera stage: distributed between component A and B along mantle array, 3) caldera forming stages: distributed in an area surrounded by component A, a point (0.7040, 0.51270) and a point (0.7042, 0.51270), showing that component of low Nd ratio affecting component A, 4) inter-caldera stage: distributed within the area of caldera forming stage (excepting for ratios of Neko-dake), 5) post caldera stage: distributed between component A and B like that of late pre-caldera stage, slightly deviating from mantle array toward low Nd ratio direction.

Source materials of volcanic products of each stage and possibility of Aso-5th next super eruption are inferred from these results. HMA and high-Mg basalt at early pre-caldera stage are oldest volcanic products in an area of Aso volcano. These have two end components (A and B). These components were source materials of volcanic products at late pre-caldera stage. At caldera forming stages and inter-caldera stages, source material was component A affected by materials having low Nd ratio. Component A and B were source materials at post caldera stage again, but slightly affected by materials having low Nd ratio. Geochemical characteristics of post caldera volcanic products are not same as that of inter-caldera stage, and this implicates that next super eruption will not occur in same cycle as Aso-1st to 4th.