A geochemical and petrological study for the origin of magmas and magma plumbing system of Kirishima volcano group

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Kirishima volcano group (KVG) which is located on the northernmost part of the Ryukyu arc consists of ˜30 composite cones. Their ejecta varies from basaltic to dacitic while two-pyroxene andesite is most dominant. Shimanto supergroup and Kakuto ignimbrite deposit underlies KVG. Shimanto sedimentary rocks show high $^{87}Sr/^{86}Sr$ ratio (ave. 0.7145; Shinjoe, 1997). KVG is surrounded by 3 calderas; Kakuto, Kobayashi and Anraku caldera. In this paper, we discuss the magma plumbing system and the origin of the magma of KVG by geochemical and petrological analysis. 52 rock samples were corrected to cover nearly all the KVG area. Lithology of the samples are lavas and pyroclastic rocks like scorias, pumices and agglutinates. Most of the samples are completely fresh and some of the samples contain less than 1% clay minerals. We carried out XRF analysis for 52 samples. 20 samples were analyzed with TIMS for Sr and Nd isotopic composition, and 8 samples were measured for Pb isotopic ratio. Samples from the northwest part of KVG are relatively uniform (SiO_2 = 55.80-61.37; MgO = 5.03-2.99; $^{87}Sr/^{86}Sr$ = 0.7046-0.7049), whereas samples from the southeast part show broader range of compositions (SiO_2 = 51.62-68.49; MgO = 5.76-0.72; $^{87}Sr/^{86}Sr$ = 0.7045-0.7068). In any composition diagrams, compositional area of the northwest cones are encompassed within that of the southeast cones. This observation may support Miyamoto (2006)‘s model which argues that a large magma chamber exist beneath the northwest part of KVG and magma mixing process in the chamber homogenized the compositions of magmas of the northwest cones. We also tried to reproduce the rather wide compositional variations of magmas of the southeast cones by using model calculations. In a $^{87}Sr/^{86}Sr$ - $^{143}Nd/^{144}Nd$ diagram, data points of KVG show loose bow-shaped pattern within a composition of lower crust (e.g., Rudnick et al., 1986). The pattern deviates from compositional area of Shimanto sedimentary rocks that have far higher Sr isotopic ratio for similar Nd isotopic ratio. Assuming that the end members of the magmas are basalt from KVG and Shimanto sedimentary rocks that could comprise the upper crust, it was difficult to reproduce the trend of the southeast cones whether we assume simple mixing or assimilation and fractional crystallization model calculation. On the other hand, by assuming that the felsic end member were Aira silicic magma composition (Kurasawa et al., 1984; Tsukui and Aramaki, 1989; Arakawa et al., 1998) that could be produced by large-scale partial melting of middle-lower crust, the isotopic trend of the southeast cones comes to be partly reproduced. On $^{206}Pb/^{204}Pb$ - $^{208}Pb/^{204}Pb$ diagram, data points are plotted within the area of lower crustal composition. Lower crust could be involved in the generation of KVG magmas.