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Origin of felsic magmas of some large-caldera related stratovolcanoes in central part of NE Japan

M. BAN[1], A. WAKO[2] and S. HIROTANI[2]

[1]*Department of Earth and Environmental Sciences, Faculty of Science, Yamagata University*
[2]*Graduate School of Science and Engineering, Yamagata University*

Recent studies (e.g. [1]) revealed that some Quaternay volcanoes in NE Japan are closely related to the precursory large-caldera volcanoes. Rocks from such volcanoes range from basalt to dacite or rhyolite in contrast that those of the large-caldera volcanoes are mainly composed of dacite or rhyolite. Thus clarifying the genesis of the felsic magmas in the stratovolcano is helpful to comprehend the magmatism of the large-caldera volcanoes. In this study we focused on three post large-caldera stratovolcanoes, Aoso, Takamatsu and Gassan from front to back arc side.

All rocks of three volcanoes belong to calc-alkaline series. Silica contents are 52-70, 50 to 69, 50 to 65% for Aoso, Takamatsu, Gassan. Intermediate rocks possess features suggesting magma mixing/mingling. Such features are rarely observed in Si-poor and Si-rich rocks, suggesting that rocks of these volcanoes are formed by mixing/mingling between mafic and felsic end-member magmas. The estimated mafic end-members are basalts containing olv+plg and silica contents are 52, 50, 50% for Aoso, Takamatsu, Gassan, while the felsic end-members are dacites or rhyolites containing qtz±bt±hbl±opx+cpx+plg and silica contents are (61-)70, 69, 65% for Aoso, Takamatsu, Gassan, respectively.

Following data are suggesting the consanguinity between mafic and felsic end-member magmas. (1) Increasing of potassium contents in mafic magma from front to back arc side has been well contemplated and this feature is observed in mafic end-members obtained in this study. We notice that the increase in potassium contents is observed in felsic end-members as well. (2) Sr isotopic data determined only for the Aoso volcano, but the data show that rather constant through all range of the Aoso rocks [2]. Fractional crystallization process of phenocrystic minerals from the mafic end-member cannot explain the whole rock compositions of the felsic end-member, for example Zr and Y contents are too low to be produced by the fractionation. Alternative process to produce the felsic end-members is partial remelting of solidified mafic end-member magmas. The trace element composition shows the felsic end-member can be fromed by the remelting when leave hbl gabbroic residues.

References

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