Petrology of Aoso volcano, northeast Japan arc -origin of the two petrologic features in Aoso-Osore volcanic zone-

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The Aoso volcano is a representative of the Aoso-Osore volcanic zone, which defines the volcanic front of the northeastern Japan arc. The Aoso-Osore volcanic zone characterized by Low-K and occurrence of the hornblende andesite. In this study, we examine the origin of these two petrologic features in Aoso-Osore volcanic zone based on the detailed magma process of Aoso volcano.

The activity of Aoso volcano is classified into three stages, earlier, caldera formation, and later stages. Sr and Nd isotopic ratios of all the rocks from the Aoso volcano fall into a narrow range, which show the consanguinity of these rocks.

Rocks from the earlier stage are olivine-bearing clinopyroxene-orthopyroxene basaltic andesite to andesite. Petrologic features, such as the bimodal distribution of phenocrystic compositions, resolved textures, and linear trends in co-variant diagrams in bulk compositions, suggest that the rocks are derived by simple two component mixing of mafic and felsic end-members. The mafic end-member magma (ca.1135-1205 degrees cels.; SiO2=50-54wt%) contains olivine (Fo80) and plagioclase (An90). The felsic end-member magma (ca.900-950 degrees cels.; SiO2=60-65%) contains, orthopyroxene (Mg-v=64-66), clinopyroxene (Mg-v=68-72), and plagioclase (An70) phenocrysts. The trace element model calculations show that the felsic end-member magma cannot be derived from mafic end-member magma through the fractional crystallization process. It is probable that the felsic end-member magma is derived from the melting of lower crustal materials (amphibolitic residue with the mafic end-member composition) produced by the heat of the mafic end-member magma.

Rocks of the caldera forming stage are quartz-orthopyroxene-clinopyroxene-hornblende andesite. Bulk compositions slightly differ from the linear trend of earlier stage in co-variant diagrams. The trace element model calculations show that the andesitic magma (ca.870 degrees cels.) is derived from felsic end-member magma of the earlier stage through the fractional crystallization process.

Rocks of the later stage are clinopyroxene-quartz-hornblende-orthopyroxene dacite and quartz-bearing clinopyroxene-orthopyroxene dacite. Rocks from each geologic unit have a peculiar geochemical composition respectively. The temperature of dacitic magmas increases from 770 to 950 degrees cels. along with its geologic history. The trace element model calculations show that these dacitic magmas of this stage are derived from the melting, to varying degrees, of lower crustal materials.

The Low-k feature in andesite to dacite of the Aoso-Osore volcanic zone attributed to the characteristics of the mafic end-member magma, and the occurrence of the hornblende andesite is derived by the characteristics of andesitic to dacitic magmas formed by crustal magma process. One more important point is that the temperature of the mafic end-member magma is enough high, which is similar to that of Quaternary basaltic magmas from the Sekiryo volcanic zone.