Dynamics of magma mixing and structure of silicic magma chamber: Evidence from petrogenesis of two types of mafic inclusions of Kurodake volcano, Central Hokkaido, Japan

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Kurodake volcano was formed about 0.2 Ma with andesitic lava flows and dome. The lavas contain a number of mafic inclusions (< 20 vol.%) ranging in size from < 1 cm to about 30 cm in diameter. The mafic inclusions have typically rounded to ellipsoidal shapes, and have sharply defined smooth contacts with the host lavas. The mafic inclusions are classified into two types, referred to as Fine-type and Coarse-type, on the basis of size of groundmass. The groundmass of the Fine-type inclusions is composed of acicular minerals (0.1 to 0.3 mm in size). On the other hand, the groundmass of the Coarse-type inclusions is composed of considerable tabular minerals (> 85 vol.% and 0.2 to 0.5 mm in size). The plagioclase phenocryst, microphenocryst, and groundmass core compositions of the host lavas have a large variation in composition from An_{38} to An_{90}. They can be classified into three groups based on their core compositions: An-rich (An > 80), intermediate (60 < An < 80), and An-poor (An < 60). The plagioclase phenocrysts have various core compositions ranging from An-poor to An-rich. The An-rich and An-poor plagioclase phenocrysts show normal zoning and reverse zoning, respectively. The plagioclase microphenocrysts and groundmass have narrowly core compositions than the phenocrysts. Most of plagioclase microphenocrysts and groundmass are classified into the intermediate. In the Fine-type inclusions, An-rich and An-poor plagioclase phenocrysts coexist, and most of plagioclase microphenocrysts and groundmass are classified into the intermediate. While, in the Coarse-type inclusions, most of plagioclase phenocrysts, microphenocrysts, and groundmass are classified into the An-poor. These features suggest that the Fine-type inclusions are formed from hybrid layer between mafic and silicic magmas, whereas, the Coarse-type inclusions are formed by undercooling around margin of silicic magma chamber. We presume that the margin of the silicic magma chamber is highly crystalline. When the host magma included the Fine-type inclusions uprises, the host magma engulfs the highly crystalline part as the Coarse-type inclusions.