

Petrography of drilling core samples at Unzen (wells of USDP-1, 3)

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In this study, USDP-1 and 3 boring core samples were investigated petrologically for the purpose of understanding endmembers of magma mixing and the mixing mechanism during the growth of Unzen volcano.

USDP-1 and 3 boring core samples show fluctuation of SiO₂ content in depth, respectively. USDP-1 shows 5 chemical stages in each of which SiO₂ increases upward, USDP-3 shows 2 chemical stages.

The Unzen volcanic rocks are porphyritic and contain phenocrysts of plagioclase, hornblende, biotite, orthopyroxene, clinopyroxene, quartz, and opaque minerals. Plagioclase phenocrysts can be divided into two types; dusty plagioclase and clear plagioclase. The former has dusty zone or sieve texture, whereas plagioclase doesn't. Since dusty zone and sieve texture are dissolution textures formed by magma mixing, the existence of these textures shows magma mixing before eruption of these volcanic rocks.

This study was focused on one of 5 stages of USDP-1, stage3, and one of 2 stages of USDP-3, stage1, especially. Phenocryst abundance increases with SiO₂ content. Phenocryst abundance of clear plagioclase, hornblende, biotite increases, whereas only phenocryst abundance of dusty plagioclase decreases. Felsic and mafic magma components before magma mixing were estimated by correlating the sum of phenocryst abundance of hornblende and biotite with SiO₂ content, and phenocryst abundance of dusty plagioclase with SiO₂ content. SiO₂ content of felsic magma is about 68 wt. % - 69 wt. % and that of mafic magma is about 52 wt. % - 55 wt. %.

Width of dusty zone in plagioclase phenocrysts decreases with the increase in SiO₂ content for both USDP-1 and 3. This decrease may represent decreasing temperature of mixing magma.

From the above facts, the possible magma mixing model for each chemical stage is as follows. At first, mafic magma injected into felsic magma reservoir, where felsic magma and mafic magma were about about 68 wt. % - 69 wt. % and about 52 wt. % - 55 wt. % in SiO₂, respectively. Felsic magma was rich in crystal and mafic magma was poor in crystal. Heterogeneous textures were formed by mixing of them. Successive mixing caused the temporal increases in phenocryst abundance and SiO₂ content in mixing products, together with temporally decreasing mixing temperature.