

Magma evolution at Unzen Volcano - analysis of USDP-4 drilling slime

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A challenging drilling project which aims at penetration into a hot magmatic conduit is carried out at Unzen Volcano. The penetration using well, USDP-4, is scheduled this spring to summer.

Drilling slime in USDP-4 collected in 2m depth intervals down to 820 m was washed and divided into three grain size groups; coarse, medium, and fine. Based on their morphology and color, the original rock phases were estimated as lava flows, and pyroclastic- and debris-flow.

Rocks comprising drilling slime are porphyritic and contain phenocrysts of plagioclase, hornblende, biotite, orthopyroxene, clinopyroxene, quartz, and opaque minerals. Plagioclase phenocrysts can be divided into two types; dusty and clear plagioclase.

The chemical composition of juvenile materials (fresh and representative in each slime) in USDP-4 shows linear trends in the Harker diagrams. The SiO₂ content is variable with depth. Especially, to the depth of 300m from 600m, the SiO₂ content decreases gradually upward from 600 m to 300 m in drilling depth, repeating both the increase and decrease. The incompatible element ratios are also changeable in this depth interval.

Magnetic susceptibility of the slime shows a variation with depth, and the value is concordant with the total iron content of juvenile materials. As the rock texture does not changed largely and magnetic susceptibility is almost identical between different grain size groups, magnetic susceptibility may represent chemistry composition of the juvenile materials.

Since magma mixing occurs in the Unzen volcanic rocks, the changes in chemical compositions and magnetic susceptibility may result from different mixing ratios between mafic and felsic two endmember magmas.