# Temporal and spatial dependency of permeability on super-critical fluid flow in porous rock media

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Behavior of high-temperature, high-pressure fluid flow in volcanoes depends on permeability of rocks in fluid paths. High pressure fluids or vapors in volcanoes, which are in super-critical states, are essential factors of volcanic eruptions. Especially, phreatomagmatic eruptions are caused by excess pressures of the fluid degassed from magma body or heated water contacted with magma or high temperature rocks in volcanoes. Alteration processes of rocks and minerals with super-critical fluid can change permeability of rocks by spreading of the fluid path or obstruction with precipitated minerals. In this study, experimental reproduction on the hydration and alteration processes of porous rock media with super-critical fluid flow were carried out to observe temporal and spatial dependency of permeability.

Starting materials of the experiments are powdered rhyolitic obsidian and dacite. Powdered starting materials are placed in a SUS316 sample tube. Inner diameter and length of the sample tube are 9.4mm and 572mm, respectively. Run products are retrieved by cutting off the sample tube and observed by SEM. Permeability of run products are also measured by gas flow method.

Experimental pressure is 50MPa. Flow rate of distilled water at room temperature is 0.1ml / minute pumped by a low speed high-pressure pump. Temperature of the sample is approximately 450 degree C for rhyolitic glass powder or 420 degree C for dacite powder at the first half of the sample tube, and then decreased to approximately 310 degree C at the outlet of the sample tube. Run durations are 3 to 8 days.

Obsidian grains and groundmass glass of dacite partially dissolved and changed to porous at higher than approximately 400 degree C. Alteration products of the volcanic glass including clay minerals, cristobalite and plagioclase occur in grain boundaries and cemented grains within a few centimeters from the outlet of the sample tube.

Volcanic glass including rhyolitic obsidian and groundmass of dacite easily hydrated at 50MPa and over 400 degree C. Then, hydrated volcanic glass grains expand by foaming of water vapor. Expansion of grains in vapor path can decrease permeability effectively.

Effective sealing for fluid flow may be brought by expansion of hydration of volcanic glass at super-critical conditions, and by the alteration products at sub-critical conditions. Accumulation of the high-pressure super-critical fluid body may depend on modal abundance of volcanic glass in rocks around the fluid.