

## Volatile compositions of apatite grains from pyroclastic flow deposits of Aso volcano

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Water in the Earth is important for life and mantle dynamics. The amount of water in the early Earth is one of the most essential constraints for revealing the origin of the Earth's water.

An important clue to the water budget in the early Earth is apatite inclusions in ~4.4 Ga zircon from Jack Hills in Australia. Because apatite has volatile components, it is expected to determine the amount of water in the interior of the early Earth from OH composition of the Jack Hills apatite. However, partitioning of OH between apatite and melt is unclear.

We analyzed volatile compositions of apatite grains from pyroclastic flow deposits of Aso volcano in order to reveal the relationship between OH composition of apatite and H<sub>2</sub>O composition of melt. The H<sub>2</sub>O concentrations in the host magma have been estimated from those of melt inclusions in plagioclase phenocrysts. It shows that mafic melt contains more H<sub>2</sub>O than silicic melt does. F concentrations in apatite in each sample show large variations while Cl concentrations are constant, suggesting that F and OH substitute for each other. OH concentration in apatite of mafic sample was larger than that of silicic one, that is, OH concentration in apatite and amount of H<sub>2</sub>O in melt show negative correlation.

The negative correlation would have been caused by difference in Ca content between mafic and silicic samples. It is possible that Ca in melt combines F and affect partitioning F between apatite and melt (Mathez and Webster, 2005). Mafic melt contains more Ca than silicic melt and Ca may disturb partitioning F for apatite and OH concentration can be increase in apatite. Another possibility is that the water compositions of melt inclusions do not represent those in the host melt. The melt inclusions have many bubbles, and the more bubbles they have, the less H<sub>2</sub>O they contain. It means that H<sub>2</sub>O in melt inclusions was lost to the bubbles, resulting in underestimation of water contents in the host melt. Actually another study calculated the amounts of H<sub>2</sub>O in the mafic and silicic melts of the Aso pyroclastic flow and results were 4.1-7.7wt% and 4.1-5.7wt% respectively (Kaneko et al., 2007). If these results are correct, then OH concentration in apatite and the amount of H<sub>2</sub>O in melt are positively correlated.

Range of the amount of F and OH in each sample could mean that melt composition gradually changed by degassing or/and crystallization differentiation. For precise determination of OH partitioning between apatite and melt, it is necessary to reveal the effect of Ca or other components to partitioning behavior of volatile components between apatite and melt.

Keywords: apatite, water, volatile component, the early Earth, magma