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# Pyroxene Phenocrysts as Tracers of Melt Water Content in Lunar Basalts

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Being partially protected by host minerals from loss of volatiles, lunar olivine-hosted melt inclusions have been studied for $H_2O$/Ce ratios to indicate the water content in the primitive lunar mantle [e.g., 1-3]. We recently reported new $H_2O$/Ce data in pyroxene-hosted melt inclusions from rapidly quenched lunar pigeonite basalts 15597 [4]. However, large enough melt inclusions are sparse in lunar basalts. Here we present a new approach to estimate $H_2O$/Ce ratios in melt from pyroxene phenocrysts in 15597. Previous studies on terrestrial samples have successfully demonstrated that pyroxenes can be used to constrain the water content in the surrounding environment [e.g., 6-7].

Pyroxene phenocrysts in 15597 are zoned with pigeonite cores and augite rims [5]. In this work, we analyzed both pigeonite and augite in 15597 by SIMS for $H_2O$ and Ce concentrations. Using the partition coefficients of $H_2O$ and Ce between basaltic melt and augite/pigeonite [8-10], the $H_2O$ and Ce concentrations in the equilibrium melt are estimated. Our results show that the melt $H_2O$/Ce ratios estimated from pigeonite are about 16 – 25, in agreement with those directly measured from pyroxene-hosted melt inclusions in the same lunar sample. The melt $H_2O$/Ce ratios estimated from augite are lower and more scattered. We conclude that pigeonite, as cores of 15597 pyroxene phenocrysts, preserves the melt $H_2O$/Ce ratio well, while low $H_2O$ in augite may be due to either degassing from the melt with continued crystallization or diffusive loss of $H_2O$ from augite that forms rims of pyroxene phenocrysts. The new results further confirm the correlation between $H_2O$/Ce ratio and lunar basalt cooling rate.

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