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Detection of liquid H_2O in vapor bubbles in reheated melt inclusions: Implications for magmatic fluid composition and volatile budgets of magmas?

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Abstract

Fluids exsolved from mafic melts are thought to be dominantly CO_2-H_2O ± S fluids. Curiously, although CO_2 vapor occurs in bubbles of mafic melt inclusions (MI) at room temperature (*T*), the expected accompanying vapor and liquid H_2O have not been found. We reheated olivine-hosted MI from Mt. Somma-Vesuvius, Italy, and quenched the MI to a bubble-bearing glassy state. Using Raman spectroscopy, we show that the volatiles exsolved after quenching include liquid H_2O at room *T* and vapor H_2O at 150 °C. We hypothesize that H_2O initially present in the MI bubbles was lost to adjacent glass during local, sub-micrometer-scale devitrification prior to sample collection. During MI heating experiments, the H_2O is redissolved into the vapor in the bubble, where it remains after quenching, at least on the relatively short time scales of our observations. These results indicate that (1) a significant amount of H_2O may be stored in the vapor bubble of bubble-bearing MI and (2) the composition of magmatic fluids directly exsolving from mafic melts at Mt. Somma-Vesuvius may contain up to 29 wt% H_2O.

Keywords: Raman spectroscopy, Mt. Somma-Vesuvius, volatile solubility, mafic melt, sulfur budget, melt inclusion, fluid inclusion, heating experiments