

Volatile contents of bubble-bearing melt inclusions from Klyuchevskoy volcano (Kamchatka) determined by mass-balance and experimental homogenization methods

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Primitive olivine-hosted melt inclusions (MI) provide information concerning the pre-eruptive volatile contents of silicate melts, but crystallization of the host phase along the wall of the MI and diffusion of H⁺ through the host promote exsolution of CO₂ and potentially other volatiles from the melt into a separate fluid phase. Experimental rehomogenization and analysis of MI, or a combination of Raman spectroscopy, numerical modeling, and mass balance calculations are potentially effective methods to determine the original volatile contents of MI. In order to compare these different approaches, we studied MI from a suite of samples from Klyuchevskoy volcano for which volatile compositions have been determined using experimental rehydration, Raman spectroscopy, and numerical modeling. The maximum CO₂ contents of MI are in agreement (~3600-4000 ppm), regardless of the method used to correct for CO₂ in the bubble, but significantly more uncertainty is incurred using mass balance calculations. This uncertainty is largely due to the lack of precision associated with the petrographic method of determining the relative bubble volumes and may also be related to the presence of daughter minerals at the glass-bubble interface. The most reliable results will be obtained when multiple redundant methods are employed to account for postentrapment processes affecting MI.