An experimental investigation into plagioclase-hosted melt inclusion volatile exsolution

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Ideally, mineral-hosted melt inclusions preserve liquids that represent material at equilibrium at the time of entrapment. However, a variety of post entrapment processes can alter those liquids. One of those processes receiving attention recently is that of crystal relaxation, the expansion of the crystal lattice in olivine as it adjusts to lower pressures during ascent or during re-heating. Such expansion/relaxation processes can potentially alter the materials in the melt inclusion, particularly the volatiles. We conducted a set of time-series experiments from 30 min to 4 days on plagioclase-hosted melt inclusions to evaluate whether relaxation occurred in plagioclase. We found that Na_2O, CaO and Al_2O_3 compositions of the melt inclusions decreased, and SiO_2 and MgO increased as a function of run time, these observations are not consistent with plagioclase melting alone. Our preliminary data on CO_2 contents of plagioclase-hosted melt inclusions indicate that melt inclusions homogenized for 30 min are significantly higher in CO_2 (1850 ppm) than those from melt inclusions homogenized for 4 days (up to 60% CO_2 lower in the melt inclusion glass; 715 ppm). We attribute most of the CO_2 loss in the 4-day experiments to migration of CO_2 from the melt inclusion glass into a vapor bubble. This gas cannot be re-dissolve into the melt inclusions glass owing to a loss of pressure in the crystal due to crystal relaxation. For this reason, we suggest to avoid re-homogenizing plagioclase-hosted melt inclusions for more than a few hours, 20-30 min should be enough, and to interpret their chemistry with care.