Direct observation of bubble growth in ascending magmas

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How bubbles nucleate and grow in an ascending magma during its eruption? Dr. Takehiro Koyaguchi of the University of Tokyo has suggested me to think about a possible experimental design using diamond anvil cell, which allow us to see magmas at high temperature and pressure conditions.

Rigorous temperature control, which maintains the temperature of each diamond to be kept within a few dgree C, is one of advantage of using the Bassett-type of externally heated diamond anvil cell (DAC), and eliminates possible problems associated with phase separations along temperature gradients. The temperature was calibrated by visual observation of the melting points of NaNO3 (307 dgree C), CsCl (645 dgree C) and NaCl (801 dgree C) at ambient pressure.

For direct observation using DAC, chips of the quenched glass are loaded into a sample room of Rhenium gaskets with distilled water and an air bubble. Upon heating the air bubble is found to diminish into the H2O fluid at a homogeneous temperature, depending on a bulk density of H2O. This allows us to estimate the pressure and temperature path inside of the sample room using equation of state of H2O. Subsequent heating produces a single fluid phase surrounding by aqueous fluids. Upon decompression and/or cooling, bubbles nucleation and growth should be observed.

Although there are some difficulties in the experimental techniques, proposed experiments should fed lights on the bubble nucleation and growth in ascending magmas.