Bubble number densities in rhyolitic pumices: constraints from fast decompression experiments

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It is well-known that bubble number densities (BNDs) in natural pumices are controlled by decompression rates (e.g., Toramaru 2006, *JVGR* 154: 303-316). Conventional decompression experiments of hydrous rhyolitic magmas have reproduced BNDs up to ~10^5 mm^{-3}. In order to reproduce the large bubble number densities (BNDs) measured in natural pumices up to ~10^6 mm^{-3}, we made a series of fast decompression experiments of hydrous, crystal-free rhyolite.

The initial water content in the starting material was ~7 wt %, temperature was equal to 700 or 800 degree C, and decompression rates ranged from 1 to 100 MPa/s. We used the same experimental techniques as Mourtada-Bonnefoi and Laporte (2004, *EPSL* 218: 521-537), except that the decompression rates in their experiments were much smaller: 0.03 to 1 MPa/s.

Homogeneous bubble nucleation occurred in all the decompression experiments. At 800 degree C, we measured BNDs equal to ~10^5 mm^{-3} at 10 MPa/s, and ~10^6 mm^{-3} at 100 MPa/s. These values are consistent with the BNDs extrapolated from Mourtada-Bonnefoi and Laporte's data toward higher decompression rates. The BNDs observed at 700 degree C and 1 MPa/s (~10^4 mm^{-3}) are comparable to those measured at 800 degree C and 1 MPa/s by Mourtada-Bonnefoi and Laporte (2004). Changes in temperature hardly affect BNDs.

In conclusion, we confirmed that BNDs are strongly dependent on the elevated decompression rates and were able to reproduce experimentally the large BNDs measured in rhyolitic pumices by decompression at the rates of 10-100 MPa/s.