Simulating Campi Flegrei magma ascent using continuous decompression experiments

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The Campanian Volcanic District is located in the middle-southern part of the Campanian plain with the Campi Flegrei Volcanic Field and the Monte Somma-Vesuvio strato-volcano. In this project, degassing processes during magma ascent are realized by using continuous decompression experiments with a synthetic trachytic 39 ka Campanian Ignimbrite (CI) melt composition.

So far, the experiments were performed in an internally heated argon pressure vessel coupled with a high-pressure low-flow metering valve and a piezoelectric nano-positioning system using a starting pressure of 200 MPa, H_2O content of about 5 wt% and two different decompression rates (0.024 and 0.17 $MPa \cdot s^{-1}$) at a superliquidus temperature of 1050 °C to ensure a crystal free melt and a homogeneous bubble nucleation. Experiments were conducted with both, glass powder and cylinders, subsequently decompressed to 50, 75 and 100 MPa and rapidly quenched.

The influence of the two different starting materials on the degassing behavior was recognized. Analyses of BSE-images revealed a different degassing behavior of glass cylinder experiments compared to powders, where the first nucleation of bubbles is initiated at higher pressure (smaller ΔP) by dissolved nitrogen (from trapped air between the single glass grains). Nitrogen, has a low solubility in silicate melts (75-150 ppm per 100 MPa [1]), supporting our suggestion that the nucleation of bubbles using glass powder as starting material is triggered by dissolved nitrogen. The same effect was observed by repeating these experiments with a phonolitic Vesuvius 79AD composition. Besides H_2O content and target pressure, changes in decompression rate lead to significantly different degassing behavior of the melt when comparing both starting materials. A decompression rate of 0.17 $MPa \cdot s^{-1}$ generate more and smaller bubbles limited by H_2O diffusivity in the melt compared to a slower decompression rate of 0.024 $MPa \cdot s^{-1}$.

In ongoing experiments, approximately 0.4 wt% chlorine (average Campanian Ignimbrite melt inclusion data [2]) will be added as a volatile component to study the influence on the degassing behavior of hydrous CI melt.

[1] Carroll & Webster (1994) *RiMG* **30(1)**, 231-279. [2] Marianelli *et al* (2006) *Geology* **34(11)**, 937