Simulating magma ascent: An experimental challenge

H. MARXER*, P. BELLUCCI, S. ULMER AND M. NOWAK

University of Tuebingen, Department of Geosciences
*correspondence: holger.marxer@uni-tuebingen.de

Isothermal decompression experiments with H_2O-bearing phonolitic melt (synthetic Vesuvius AD 79 "white pumice" composition) were conducted at super-liquidus *T* (1323 K) in an internally heated argon pressure vessel. The samples were decompressed from 200 MPa at true and interpolated decompression rates (DRs) of 0.0028-4.8 $MPa{\cdot}s^{-1}$, applying a novel continuous decompression (CD) [1] as well as former stepwise decompression (SD) techniques to investigate the effect of decompression path on melt degassing. At target *P* the samples were quenched rapidly.

The comparison of the vesiculated glass products in terms of bubble number density (BND), size distribution of bubbles and residual H_2O-content in the glass reveals a massive influence of the applied decompression path on the degassing behavior of the melt. Decompression of the H_2O-bearing melt induces supersaturation with H_2O. At a certain ΔP, bubbles will nucleate homogeneously within the melt and grow by H_2O diffusion into the bubbles to regain equilibrium. The extent of supersaturation is controlled by the actual decompression rate, because the diffusion distance of H_2O is limited within a certain time. The experiments have shown that the BND increases with decompression rate, whereas average size decreases. At low CD rates of ≤0.024 $MPa{\cdot}s^{-1}$ only few bubbles nucleate in the melt, because the decompression rates provide sufficient time for H_2O diffusion into existing bubbles. Bubble growth is the predominant degassing process. Residual H_2O-contents in the glasses indicate that an equilibrium degassing path can be simulated at low decompression rates. In comparison to CD, all corresponding SD run products feature higher BNDs and smaller bubble diameters for low decompression rates. SD results in instantaneous supersaturation due to rapid *P* drop, which can only be reduced by a massive nucleation event. The differences between the decompression techniques decrease with increasing nominal decompression rate due to the effect of a rapid *P* drop, enhancing bubble nucleation.

SD techniques are not suitable to investigate the dynamic processes during continuous magma ascent, at least at low nominal decompression rates. Ongoing experiments with CD will give new insights into the dynamic processes within ascending magma prior to eruption.

[1] Nowak *et al.* (2011): Am. Mineral., 96, 1373-1380.

Direct link between end-Triassic CAMP volcanism, C-cycle perturbation and mass extinction

ANDREA MARZOLI[1,2], **JACOPO DAL CORSO[1]**, FABIO TATEO[2], HUGH C. JENKYNS[3], HERVÉ BERTRAND[4] AND NASRRDDINE YOUBI[5]

[1]Dipartimento di Geoscienze, Università di Padova, Italy – e-mail:andrea.marzoli@unipd.it, jacopo.dalcorso@unipd.it
[2]IGG-CNR, Padova, Italy; tateo@igg.cnr.it
[3]Department of Earth Sciences, University of Oxford, UK; hughj@earth.ox.ac.uk
[4] Université Lyon1 and Ecole Normale Supérieure de Lyon, France; herve.bertrand@ens-lyon.fr
[5]Department of Geology, Cadi Ayyad University, Marrakech, Morocco; youbi@uca.ma

The eruption of continental flood basalts of the Central Atlantic Magmatic Province (CAMP) is coeval with mass extinction at the Triassic–Jurassic (Tr–J) boundary. In order to define the role of CAMP volcanism in triggering the biotic turnover, it is crucial to define whether or not onset of CAMP preceded the main end-Triassic climate disruption marked by a significant negative Carbon isotope excursion (CIE) of up to – 8 ‰. However, the temporal relationships between volcanism and CIE still remain circumstantial due to the difficulty in correlating a continental event (volcanism) with one recorded in marine sediments (CIE). Sediments underlying CAMP basalts in Morocco are characterized by high contents of MgO (10–32 wt.%) and of mafic clay minerals (11–84%). This geochemical signature must be linked to deposition of mafic clay minerals derived from early-erupted CAMP basalts. The measured C-isotope compositions of bulk organic matter show marked negative CIEs (up to -6‰) in association with the highest MgO peaks. This geochemical anomaly can be readily correlated with the initial negative CIE shortly preceding the Tr–J boundary. Our data show that the end-Triassic CIE and associated mass extinction occurred when CAMP had already been active and supports the hypothesis that the cause of the mass extinction was CAMP volcanism.

www.minersoc.org
DOI:10.1180/minmag.2013.077.5.13