Experimental continuous decompression of rhyodacite magma erupted from Chaos Crags, Lassen Volcanic Center, California

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Our recent study (2013) of sample LQ13-01 showed the 1103 ±13 years BP pyroclastic flow from the Chaos Crags, Lassen Volcanic Center, California had pre-eruptive magma storage conditions with maximum temperature 775 °C and pressure 110-125 MPa under H_2O-saturated conditions. Here we present continuous decompression experiments conducted to assess rates of ascent of Chaos Crags magmas.

Chaos Crags group 1 lavas (early pyroclastic flows and domes A and B) are homogeneous petrographically and compositionally (69-70 wt. % SiO_2), whereas group 2 (domes C-F) are comparatively heterogeneous (67-69 wt. % SiO_2), with increasing abundance (10-15%) of mafic inclusions throughout the emplacement sequence. Group 2 has dehydration breakdown reaction rims surrounding biotite and amphibole phenocrysts.

Starting material for continuous decompression experiments was our phase equilibrium experimental run product CCPb-34 (2013), with sufficient H_2O to ensure H_2O-saturated conditions, starting temperature of 775 °C and pressure of 120 MPa at fO_2 NNO+1 (±0.5-log units). Experiments are underway with decompression rates ranging from 0.19 MPa/hr to 8.53 MPa/hr, corresponding to total decompression times of 16 hours to 54 days.

Preliminary EPMA and SEM analyses of continuous decompression experimental run products show dehydration reaction rims around biotite and amphibole at decompression rates ≤ 1.0 MPa/hr. Using amphibole geospeedometry, such as Browne and Gardner (2006), and biotite geospeedometry, preliminary comparisons of experimental run products and natural samples suggest decompression > 1.0 MPa/hr for group 1 lavas, and slower decompression (≤ 1.0 MPa/hr) for group 2 lavas.