Volatile Content of Volcanic Glasses From Subglacial Volcanoes In British Columbia, Canada

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Volatiles (mainly H_2O and CO_2) in magma drive volcanic eruptions [1]. H_2O and CO_2 dissolved in molten rock under high pressure at depth are liberated as lithostatic pressure is reduced while magma ascends to the surface at a volcano. Consequently, near the surface CO_2 first and H_2O afterward diffuses out of magma into gas bubbles. If the ascent rate of the magma is rapid, volatile exsolution can lead to rapid fragmentation of the quenching magma and to explosive volcanic eruptions [2]. Bulk chemical methods for volatiles such as manometry provide the total volatile content in a sample, but they say nothing about the distribution of volatiles in a volcanic glass sample [3]. Common geologic processes such as degassing and rehydration would produce contrasting volatile gradients in vesicular volcanic glass samples. A degassing trend would show depletion in H_2O in proximity to the vesicle, whereas a rehydration trend would exhibit sharp enrichments in H_2O. We aim to measure H_2O concentrations by synchrotron Fourier transform infrared (FTIR) spectromicroscopy to determine whether total volatile contents are influenced by degassing or rehydration processes.

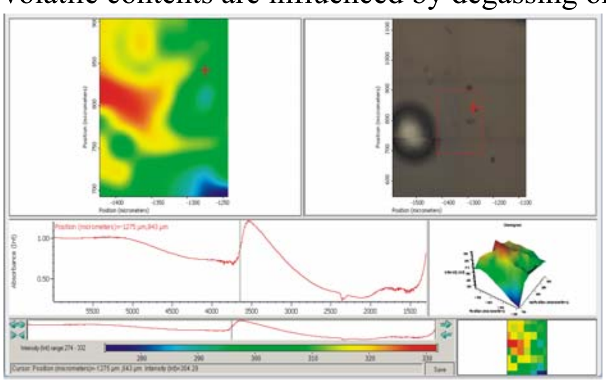

Figure 1: Area map of contoured absorbance for the 3500 cm^{-1} peak adjacent to a vesicle in sample AM02-11. Red indicates the highest absorbances, whereas blue represents the lowest. Absorbance is a good proxy for H_2O concentration, though measured H_2O concentration depends on absorbance, thickness, density and molar absorptivity. Absorbance (and H_2O content) increase toward the vesicle.

Area maps and intensity profiles were generated for volcanic glass samples using the synchrotron FTIR at the SRC. The maps and profiles were created using Omnic and Atlus mapping software version 7.3. Data were collected with an aperture setting of 20x20µm and step values of 30µm for area maps and 45 µm for line maps to ensure nearly complete coverage. Preliminary maps and profiles suggest that both degassing and rehydration have taken place in the samples. In some glass samples, absorbance decreases adjacent to the vesicle suggesting that H_2O has diffused out of the samples during eruption. Yet other vesicles show the opposite trend with higher absorbance measured in the vicinity of the vesicle wall (Fig. 1) suggesting that secondary meteoric H_2O has diffused into the glass after the eruption. Well defined H_2O gradients can be used to calculate diffusion timescales that may provide insight on the duration of key volcanological processes.

References:

[1] P.J. DeGroat-Nelson, B.I. Cameron, J. Fink, and J.R. Holloway, EPSL, 185, 331-341 (2001)
[2] J.M. Castro, M.manga, and M.C. Martin, Geophys. Res. Lett., 32 (2005)
[3] A.R.L. Nichols and R.J. Wysoczanski, Chem. Geol., 242, 371-384 (2007)