

# **Diffusion, exchange and solubility of water in rhyolitic glass: Implications for the interpretation of the $\delta D$ value**

EMMA GATTI<sup>1</sup>, SALLY NEWMAN<sup>1</sup>, YUNBIN GUAN<sup>1</sup>,  
DRAGAN NIKOLIC<sup>3</sup>, JOHN EILER<sup>1</sup>

<sup>1</sup>Division of Geology and Planetary Science, California  
Institute of Technology, Pasadena, CA, USA.  
egatti@caltech.edu

<sup>2</sup>NASA Jet Propulsion Laboratory, California Institute of  
Technology, Pasadena, CA, USA.

Magmatic water dissolved in volcanic glass is a proxy of pre-eruptive volatiles in the melt, and its deuterium/hydrogen ratio (D/H) can constrain magmatic sources and processes, such as degassing and contamination. However, erupted glass hydrates over time, incorporating meteoric water through the glass surface. Such externally derived water disturbs the concentration, speciation and D/H ratio of water in the glass; given enough time, all magmatic water will be substituted with meteoric water. This environmental imprint of meteoric water can be used as a proxy for the D/H ratio of ancient precipitation.

Here we examine the kinetics of hydration of igneous glasses, including how meteoric water diffuses inside the glass and exchanges with the initial volcanic water over time. We focus in particular on the following questions: i) How can we distinguish between magmatic and meteoric waters when both components are present? ii) Are the D/H ratios of the magmatic and meteoric pools preserved through time, or do the two water pools exchange with each other and/or with the outside environment? iii) How do diffusion and exchange vary with time, i.e. with the progressive saturation of the glass?

We will present a time-sequence of hydration experiments on natural obsidians studying the kinetics of water diffusion and exchange. Samples of known initial water content and  $\delta D$  were drilled from the core of large obsidian blocks and they will be artificially hydrated with deuterated and possibly tritiated water at constant temperature for three different time periods. The initial and final  $\delta D$ , together with the thickness of the hydration rim, will be measured with a traditional IRMS and a in-situ nanoSIMS method. We plan to model diffusion rates and exchange rates on the basis of the experimental data, and to assess the effect of the shift from diffusion to exchange regime on the D/H ratios of both waters as glass saturation approaches.