Cristallinity, structure and volatile content of Panum Crater's magma

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Despite the many studies in the literature, the influence of magma physicochemical properties, particularly viscosity, on the building and dynamics of volcanic domes is not fully understood, hitherto. The link between temperature, chemical composition and crystalline content of magmas has been assessed only partially, and still represents a major issue in Earth and Material sciences. Understanding physicochemical properties of crystal-bearing melts is of prime importance for understanding the growth and evolution of volcanic domes, as well as the transition of the eruption toward other eruptive styles. Panum Crater is the most recent dome eruption at the chain of Mono Craters in the north side of Long Valley caldera (California). It is a dome composed of obsidian and pumice, which emplaced in 1350 AD inside a tuff-ring [1]. The coexistence of these products represents an ideal case to assess physicochemical properties at the atomic level of melt structure and their role in eruptive dynamics.

In this communication, we present a large range of physical and chemical properties measurements (determination of the water concentration by Raman and FTIR spectroscopy, viscosity and density measurements, as well as C and H isotopes to have an integral vision of the matter. Our results lead us to propose a piston-like dynamic model for the eruption based on the formation of a shallow (200-300 m), degassed, magma plug overlying a relatively volatile-rich portion of the same silicic magma that rose and expanded under closed system-degassing conditions. In our model, the sudden and preliminary gas release that flashed groundwaters and created the tuff-ring [1], formed the shallow, degassed magma plug, down to a depth determined by a rheological boundary with the lowermost magma portion. The latter acted first as a thermostat, keeping the shallow, degassed, one under superheated conditions, so preventing the onset of crystallization at shallow depth. Subsequently, the rapid expansion of the volatile-rich lowermost magma, allowed the rapid evolution of the shallow magma through the glass transition when rapidly pushed out to surface, thus forming the obsidian body which surround the highly vesiculated pumices. The model can be extended to other volcanic domes of much larger size, provided a deep source.

[1] Miller, C. D., Holocene eruptions at the Inyo volcanic chain, California: Implications for possible eruptions in Long Valley caldera, Geology, 13, 4-17, 1985.

L2009R2: A Cluster IDP Sampling a Diversity of Formation Conditions

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We performed XRF, Fe- and Cr-XANES on L2009R2, a large aggregate interplanetary dust particle (IDP) that fragmented dispersing over several hundred micrometers on impact with the stratospheric collector. Most ~8 μm pixels gave Fe-XANES spectra consistent with Fe^{2+} or Fe^{3+}, but the spectrum of one pixel is consistent with Fe or Fe-Ni metal with some structural disorder. Cr-XANES was performed on eleven spots where the Cr concentration was high enough to get good quality spectra. Six areas of L2009R2 are consistent with Cr^{3+} (overplotting chromite or Cr-diopside), while four areas plot between Cr^{2+} and Cr^{3+}. One area overplots the Cr^{2+} spectrum of olivine from the ureilite meteorite CMS04048. This is significant because Cr has been identified in natural terrestrial materials in only the Cr^{3+} and Cr^{6+} valence states [1], with only rare occurrences of Cr^{2+} in extraterrestrial materials. The most reduced Fe was found in the same area as oxidized Cr and the most reduced Cr was found in an area dominated by oxidized Fe. L2009R2 has a CI-like element abundance pattern, suggesting it consists of fine-grained matrix and larger minerals that grains aggregated into this ~50 μm particle. The XANES results on L2009R2 span a wide range of oxidation states, indicating this IDP is an aggregate of grains formed in a diverse variety of environments, some oxidizing and others reducing.

[1] Eeckhout *et al*, *Am. Min.*, **92**, 966f, 2007.

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