



The role of syn-eruptive crystallization on pantelleritic eruptive dynamics

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Pantellerites are strongly peralkaline rhyolites occurring mainly in extensional tectonic setting, from oceanic islands (Ascension Island) to continental rift zones, as for example Pantelleria Island in the Sicily channel rift zone, Kenyan and Ethiopian Rift Valleys and Mayor Island (NZ-Taupo Volcanic Zone). Peralkaline magmas are noted for their ability to shift between explosive and effusive eruptive styles, which is strictly associated with viscosity, degassing kinetics, the initial temperature and crystal content of the magma.

The present experimental work aims at unravelling pre- and syn-eruptive crystallisation dynamics and time-scales of most explosive eruptions that are so unforeseeable and not yet systematically studied, but essential to assessing volcanic hazards of the Pantelleria system.

Crystal nucleation and growth of alkali feldspars in pantelleritic melts have been investigated by cooling and decompression experiments conducted at the T-P range more plausible for the Pantelleria system ($T=680-800$ °C, [1]; 25-100 MPa). The studied melt composition belongs to the Fastuca pumice fall eruptive unit of Pantelleria which is rich in Na and Fe and it presents a peralkalinity index of 1.4.

Textural analysis on the hydrous samples reveal that crystal fraction (φ) varies from average pre-eruptive values of 0.02 to 0.2 during magma ascent from magma chamber depths (ca. 3-4 km, at 100 MPa) to shallower depths (corresponding to pressures of 50 MPa), leading to an increase of viscosity of 1 log unit (value estimated using the equation in [2], starting from the pre-eruptive low viscosity of the pure pantelleritic liquid calculated by [3]), which may contribute to enhance a more explosive magma eruptive behavior. Also considering fast decompression rates (DP/Dt) (in the range of 0.2-0.6 MPa/s), it results a large decrease in pressure along the conduit, promoting volatile exsolution and higher magma accelerations, which along with increasing viscosity, crystallinity, and velocities, could lead to magma brittle behavior and trigger explosive eruptive events.

A better understanding of how these explosive pantelleritic eruptions work will lead to improved volcano monitoring and disaster mitigation in high-risk volcano-tectonic areas as for instance is Pantelleria Island, where about 10.000 inhabitants live permanently.

References:

[1] Di Carlo I. et al. (2010) *Journal of Petrology* 51 (11), 2245–2276. [2] Vona A. et al. (2011) *Geochimica et Cosmochimica Acta* 75(11), 3214–3236. [3] Di Genova D. et al. (2013) *Volcanol. Geotherm. Res.* 249, 201–216.