

Melt inclusion study on the pantelleritic Plinian eruption of the Green Tuff, Pantelleria Island

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Pantelleria Island is the type locality for the peralkaline rhyolitic rocks called pantellerites. In the last 50 ka, after the Plinian, caldera-forming, Green Tuff eruption, volcanic activity at Pantelleria consisted of effusive and mildly explosive eruptions which mostly vented inside and along the rim of the caldera producing silicic lava flows, lava domes and poorly dispersed pantelleritic pumice fall deposits.

During the last two decades, a wealth of studies focused on melt inclusions in pantellerite magmas, all converging in underlying the H₂O-rich character of these melts together with high contents of halogens. Recent study on the volatile content of pantellerites from Pantelleria yielded a pre-eruptive H₂O content ≤ 4.9 wt.% and P ≤ 1.5 kb [Gioncada e Landi, 2010; Neave et al., 2012] and chlorine up to 0.9 wt.% for magmas erupted during the most recent effusive and strombolian activity at Pantelleria. Recent experimental data confirmed the H₂O-rich character of these magmas [Di Carlo et al., 2010]. However data on pantelleritic magmas emitted during large explosive eruptions associated with caldera collapses, are up to date sporadic and not exhaustive. Our study is aimed to determine the pre-eruptive volatile contents of the pantellerite magmas erupted in the Green Tuff eruption, the last caldera forming event at Pantelleria.

All melt inclusions analyzed have rhyolitic composition (SiO₂ 70-72 wt.%, Na₂O+K₂O 10-11 wt.%) and show extreme peralkalinity, with an (Na+K)/Al clustering at 2-2.2. Fluorine in MI range between 0.13 and 0.3 wt.%, while S (< 350 ppm) is close to, or lower than, the detection limit (200-300 ppm) of the microprobe. Glasses of GT, both MI and matrix glass, are characterized by a chlorine content as high as 1.1 wt.%, which remains basically unchanged in the all glass analyzed (between 1 and 1.1 wt.%). This value is higher than that found in the younger pantelleritic eruptions of about 0.2-0.3 wt.%.

Dissolved H₂O contents in MI (measured by FT-IR) cover a range from 1.4 to 4.2 wt.%, which is comparable with the H₂O measured in MI from pantelleritic pumices erupted during younger effusive, or mildly explosive, eruptions. The maximum values are slightly lower than the highest content of water found in pantelleritic melts at Pantelleria (4.9 wt.%) [Neave et al., 2012]. The CO₂ content was always below the detection limit of FT-IR method (50 ppm).

Chemical composition and volatile contents in the pantelleritic melt inclusions of the Green Tuff contributed to:

- derive the entrapment pressure/depth of magma accumulation, using appropriate solubility models;
- compare data derived for the Green Tuff Plinian eruption with data available for effusive and mildly explosive eruption (strombolian), at Pantelleria;
- track volatile build-up with magma evolution, i.e. pre- and syn-eruptive degassing.

References

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