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Sulfur behavior in Etnean magmatic system (Italy)

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Sulfur is an essential volatile component of basaltic magmas and it is mostly dissolved as S^{6+} and/or S^{2-} depending on the redox conditions.

Mt. Etna continuously discharges enormous quantity of SO_2 (~3563 t/d [1]). However these high flows are not fully understood in terms of S origin (magmatic or crustal) and of its behavior during magmatic evolution (fractional crystallization, magma mixing, vapor/melt fractionation [2]).

Our research combines the study of sulfur in natural olivine hosted melt inclusions with an experimental study on S solubility in hydrous alkali basalts at magmatic conditions.

We report new data of S in melt inclusions, belonging to six of the most characteristic Etnean eruptions of the last 14 ky, from the oldest and most primitives (Mt Spagnolo and FS eruptions) up to the recent paroxysm event of April 2013. These melt inclusions were entrapped at different depths inside the magmatic system (up to ~ 18 km, corresponding to a pressure of almost 5 kbar) as defined by H_2O-CO_2 contents. Sulfur content, evaluated by EMP and SIMS methods, reach 3600-4100 ppm in the most primitive melt inclusions of Mt Spagnolo and 2006 eruptions (Fo_{87} and Fo_{80}).

Sulfide globules were observed in some melt inclusions of 2002/3, 2008 and 2013 products, but also in host olivine crystals, probably reflecting sulfide saturation of the melt during the entrapment of the melt inclusions.

We therefore carried out IHPV experiments in Etnean mafic melts at sulfide saturation in order to investigate how the variations in S content observed in melt inclusions can be explained by the changes in magma composition and/or magmatic conditions (T-P-fO_2)

References:

[1] Salerno, Oppenheimer, Caltabiano, Randazzo, Bruno & Longo (2009), *Journal of Volcanology and Geothermal Research* 183, 76-83.

[2] Liotta, Rizzo, Paonita, Caracausi & Martelli (2012), *Geochemistry Geophysics Geosystems* 13, Q05015.