

Degassing, redox and sulfide saturation of sulfur-rich basanite at El Hierro, Canary Islands

MARC-ANTOINE LONGPRÉ^{1*}, PATRICK BEAUDRY¹,
NOBUMICHI SHIMIZU² AND JOHN STIX³

¹CUNY Queens College, Flushing, New York, USA
(correspondence: mlongpre@qc.cuny.edu)

²Woods Hole Oceanographic Institution, Woods Hole, Massachusetts, USA

³McGill University, Montreal, Quebec, Canada

In 2011-2012, a shallow submarine eruption off the south coast of El Hierro, Canary Islands, sporadically produced gas-filled basanite lava balloons that buoyantly rose to the sea surface. We present ion and electron microprobe measurements of volatile element concentrations and sulfur speciation in olivine-hosted melt inclusions from the sulfide-bearing El Hierro basanite. The results reveal that melt inclusions are sulfur-rich, with up to 5080 ppm S, far exceeding the expected sulfur concentration at sulfide saturation (SCSS) of 1300-1700 ppm over a wide range of pressure, temperature and oxygen fugacity conditions [1]. However, the presence of dissolved sulfate species ($S^{6+}/\Sigma S$ of up to 0.7) appears to have greatly enhanced the SCSS of the El Hierro magma, in agreement with the model of [2]. Positive correlations between sulfur concentration, $S^{6+}/\Sigma S$ and water content in melt inclusions suggest that coupled H_2O and S degassing caused reduction of the oxidation state of the initially highly oxidized magma [3]. Most Fe-($\pm Cu$)-S blebs present as inclusions within clinopyroxene and titanomagnetite phenocrysts — but not olivine — are texturally late, hinting to the possibility that degassing and accompanying redox reactions may have triggered sulfide saturation upon magma ascent. Our findings provide new insights into the behavior of sulfur in oxidized basaltic magmas and have implications for ore-forming processes as well as the mantle source and volatile fluxes at alkaline ocean island volcanoes.

[1] Liu et al. (2007), *GCA*, **71**, 1783-1799. [2] Jugo (2009), *Geology*, **37**, 415-418. [3] Moussallam et al. (2014), *EPSL*, **393**, 200-209.