

Etna Basalt in coexistence with S-rich hydrous fluid: an experimental study at 1200 °C

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Magmatic degassing is strongly controlled by pressure, temperature and the amount and composition of volatile components. It has recently been observed, that there is a correlation between the S/Cl ratio of emitted gasses and the eruption style of Mt. Etna's 2002/2003 eruption [1]. That makes it of particular interest to investigate the partitioning behaviour of S and Cl between basaltic melt and hydrous fluid.

Since now, there even exist no reliable data on the solubility of sulfur in hydrous silicic melts at temperatures above 1050°C. Thus, this study is focused on the solubility of S in natural hydrous Etna basalt at high temperature of 1200 °C at 200 MPa. Here we report an experimental setup to perform these high temperature experiments.

Sulfur is known to be a very aggressive component limiting the application of experimental approaches that use noble metal capsules, especially Pt and AuPd. Therefore we applied a double capsule technique using single crystal olivine capsules (San Carlos olivine) as sample containers, inserted into outer Au₈₀Pd₂₀ capsules.

The starting material was a fused and water presaturated trachybasalt from Mt. Etna (2001 eruption), containing 5 wt.% H₂O. As sulfur source, native S, palladium sulphide (PdS) and pyrrhotine (FeS) were used. The initial S concentration was between 1-1.5 wt.% S (with respect to the amount of starting material). All experiments were conducted in internally heated pressure vessels (IHPV) at a range of redox conditions from relatively reducing at around the quartz-fayalite-magnetite (QFM) oxygen buffer to oxidizing conditions of about QFM+4. The run time was between 6 and 24 h.

All glasses obtained from these experiments were in coexistence with FeS and/or PdFeS phases, contain 600 to 3700 ppm sulfur and were enriched in MgO due to reequilibration with MgO-rich olivine. Water concentrations of H₂O-presaturated basaltic glasses decreased from 5 wt.% to 2.8 wt.%. No sulfur could be detected outside the olivine containers, improving this experimental setup to be a sufficient barrier for sulfur or S-rich components.

[1] Aiuppa et al. (2004) EPSL 222, 469-483.

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