

Experimental studies on degassing of sulfur-bearing andesite and basalt

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A new experimental approach was applied to investigate kinetics of S (and Cl) distribution between fluid and H₂O-S±Cl-bearing andesitic and basaltic melt. The data provide first insights into the partitioning of S (and Cl) between fluid and melt upon degassing at disequilibrium conditions. Experiments under oxidizing conditions (> QFM+3; i.e. when S⁶⁺ is the only S species) with andesitic melt composition, revealed a strong decrease of the S content in the melt by about 85% during fast decompression (0.1 MPa/s). During subsequent annealing the released S was partly resorbed by the melt. On the other hand, at lower oxygen fugacity (QFM+1 to QFM+1.5; i.e. when S²⁻ become abundant), a resorption of sulfur by the melt did not occur. The observations indicate a different behavior of sulfide and sulfate during kinetically-controlled degassing which need to be considered when modeling decompression induced magma degassing. In contrast to the andesitic systems, no evidence for kinetically controlled transient release of sulfur upon fast decompression was observed for basaltic melts.

Our studies indicate that strong changes in bulk melt composition from basaltic to rhyolitic have only minor effect on $D_{S,fl/m}$ under oxidizing but a major effect under reducing conditions. These differences are interpreted to be directly related to the large effect of FeO content in the melt on S²⁻ solubility. The new data obtained on S (and Cl) fluid-melt distribution are of high relevance for developing volcanic degassing scenarios and have implications for formation of magmatic ore deposits.