



Redox and compositional control on the degassing behaviour of magmatic volatiles

R.E. Botcharnikov (1), F. Holtz (1), M. Wilke (2), and S.V. Churakov (3)

(1) Institute for Mineralogy, Leibniz University of Hannover, Hannover, Callinstr.3, 30167 Germany (r.botcharnikov@mineralogie.uni-hannover.de), (2) Helmholtzzentrum Potsdam Deutsches GeoForschungsZentrum (GFZ), Telegrafenberg, 14473 Potsdam, Germany, (3) Paul Scherrer Institute, CH-5232 Villigen, Switzerland

The processes of fluid saturation and exsolution from magmatic melts are controlled by magma storage conditions and composition. Redox conditions prevailing in the magma chamber have a predominant control on the speciation of magmatic volatiles in melt and fluid phases, and thus, on the mechanisms of release and partitioning of volatiles. The incorporation of volatiles in the magmas is also controlled by the silicate melt structure and, hence, by the melt composition. Here we present a compilation of recent experimental data on the solubility behaviour of H₂O, CO₂, and S in magmas with a wide range of compositions and at various T, P and redox conditions. The results indicate that the effects of redox conditions are in particular important for carbon- and sulphur-bearing species due to changes in speciation and hence, in the corresponding fugacity of each species. For instance, a decrease in logfO₂ from FMQ to FMQ-2 leads to >20-30% decrease in the concentration of dissolved CO₂ in rhyolitic and basaltic melts due to decreasing fugacity of CO₂ in expense of fCO, which is almost insoluble in the melts. The saturation of the magma with graphite at given high fH₂ imposes the principle control on the fugacities of C-, O-, and H-bearing species and results in higher fluid/melt ratios for given H₂O/CO₂ ratios in melts. Melt composition exerts a relatively weak control on C solubility behaviour but imposes an influence on speciation of carbon. Reduction of the magma and magma compositional evolution from basalt to rhyolite drastically decrease S solubility in melts but increase S partition coefficient between fluid and melt (upto 3 orders of magnitude), leading to effective S degassing. The effects of redox conditions and melt composition on the behaviour of water are relatively minor compared with that for carbon and sulphur.