



Modeling the interplay of $f\text{O}_2$ of fS_2 along the FeS-silicate melt equilibrium

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In this contribution we will discuss a simplified thermodynamic description for the saturation of pure and stoichiometric FeS, either liquid or solid, in magmatic systems. The Conjugated-Toop-Samis-Flood-Grjotheim model (Moretti and Ottonello, 2005) has furnished the reference theoretical frame, since already accounting for the solubility of gaseous sulfur and the speciation and oxidation state of sulfur in silicate melts. Therefore, we provide here internal consistency with these previous modeling efforts. If perhaps this does not guarantee the highest possible precision in reproducing the features of the available reference datasets, it however limits the biases that inevitably arise when merging different sets of experiments that are incomplete at different degrees. Our choice encompasses the many sources of uncertainties that originate by considering all possibly useful data from the geoscientific literature. The derived model provides an effective sulfogeobarometer, which is superior with respect to previous model performances. For magmas rising from depth to surface, our appraisal of molar volumes of melt sulfur-bearing species allows us to model how iron-sulfur multiple interactions affect oxidation-reduction processes at the different pressures, approaching or not the FeS saturation threshold, either for liquid or solid phases. In this respect, the nature of the operating oxygen fugacity buffer is critical. On the basis of model results on some typical compositions of volcanological interest, Sulfur Contents at Sulfide Saturation (SCSS) have been calculated, to be applied in all those cases the redox constraint is lacking.