



The effect of redox state on the solubility of C-O-H fluids in silicate melts: new experimental evidences

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The redox state of natural magmas is extremely important for the equilibrium speciation of volatiles in magmatic fluids which, in turn, can strongly control the fluid-saturation conditions of magmas. In this study we present new experimental results on C-O-H solubility in Fe-poor rhyolitic and ferro-basaltic melts obtained at various redox conditions ($\log fO_2 = NNO+4$ to -2.5). The solubility of C-species in melts in equilibrium with C-rich fluids shows deviation from an expected ideal distribution of CO_2 between fluids and silicate melts, even at relatively oxidizing conditions. The data illustrate that the solubility of CO_2 is strongly decreasing with decreasing fO_2 below $\log fO_2 = NNO-2$ in both rhyolitic and basaltic systems. This effect of redox state increases with pressure increase from 200 to 500 MPa. The influence of fO_2 on the solubility of C-species in melts equilibrated with C-O-H-bearing fluids does not depend on both the Fe concentration of the melt and the carbon speciation in the melt (CO_2 molecular in rhyolites and carbonate groups in basalts). The observed effect can be attributed to an increase in CO/CO_2 ratios and, hence, to a decrease in fCO_2 in the fluid phase with decreasing fO_2 . Since CO is known to be an insoluble species in silicate melts, the bulk carbon solubility is mainly controlled by fCO_2 . The prevailing oxygen fugacity in natural magmas, especially in basaltic ones, is usually relatively low. Thus, fCO/fCO_2 ratios are high and the redox state must be taken into account on modelling the evolution and degassing of natural magmatic systems. The datasets provided in this study can be used to predict accurately the fluid saturation levels in basaltic and rhyolitic systems from the concentrations of C-O-H in glass inclusions.