

Sulphur and iron oxidation state in synthetic fluid-saturated melts

M. Wilke (1), R. Botcharnikov (2), and K. Appel (3)

(1) GFZ Potsdam, Germany (max.wilke@gfz-potsdam.de), (2) Institut f. Mineralogie, Leibniz Universität Hannover, Germany, (3) HASYLAB, Deutsches Elektronensynchrotron, Hamburg, Germany

Sulphur is typically a trace element in silicate melts (rarely more than 5000 ppm) and one of the main constituents of volcanic gases. It is an important element in magmatic processes for two main reasons. First, S (as sulphide) controls the behavior of several metals in silicate melts. These metals (which include Cu, Ni, Re, Os, Pd, Pt, Au) are either of economic interest or are used as tracers of large-scale Earth processes. Second, explosive volcanic events are capable of releasing large amounts of S into the atmosphere, significantly affecting global climate due to injection of sulphate aerosols into the stratosphere. It is well established that the sulfur solubility in silicate melts is a function of redox conditions and melt composition. At oxidizing conditions, sulfate is the dominant species whereas sulfide is the dominant species at reducing conditions. Furthermore, the S solubility at reducing conditions is known to strongly correlate with total Fe content. It is still highly debated to what extent the redox equilibria of the heterovalent elements Fe and S interact during magmatic processes. Here we present data on the S and Fe oxidation state determined by micro-XANES on synthetic fluid and sulfur-saturated hydrous glasses quenched from 200 MPa and 1050°C. Studied compositions range from basalt to rhyodacites. The sulfur oxidation state shows a sharp transition from sulfide to sulfate between oxygen fugacities between QFM and QFM+1 for all studied compositions. The Fe oxidation state varies between 8% and 30% ferric iron in the range QFM-2 to QFM+2 for basaltic and andesitic compositions. In comparison, the Fe oxidation state of the rhyodacitic composition is slightly offset to higher ferric iron contents.