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Experimental investigations of influence of pressure on the solubility of sulfur in silicate melts.

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Sulfide-silicate demixing of silicate melts on immiscible silicate and sulfide liquids occurs at magma sulfur saturation. This type of liquation plays an important role in geochemistry of mantle magmas, in processes of magmatic differentiation, and in ore deposit formation. The major parameter defining sulfide-silicate stratification of silicate melts is solubility of sulfur in magmas. It is considered that «solubility of sulfur» is concentration of sulfur in silicate melts.
The previous researches have established positive dependence of solubility of sulphur on temperature [1, 2], melt composition [3, 4], oxidation-reduction conditions [5, 6] and our experimental data confirm it. However, available data does not give a simple answer about dependence of solubility of sulfur from pressure in modelling and natural "dry" sulfide-saturated silicate melts. The reason of difference in experiments remains not clear and further work is needed on this topic.
In this paper, we report our findings on the influence of pressure on the solubility of sulfur in hydrous magnesian melts. This melts are represent by olivine basalt – picrite, coexisting with Fe-Cu-Ni sulfide melt and harzburgite (Ol+Opx) and it was investigated in a temperature range from 1200 to 1350º and a pressure range from 0.2 to 2.5 GPa. Experiments were carried out on the piston-cylinder at =1-2.5GPa and in an internal-heated pressure vessels at P=0.2-0.6 GPa by a quenching technique.
Our findings disagree with all previous studies demonstrating the positive [7] or negative [8, 9] influence of pressure on the solubility of sulfur in silicate melts. Our researches have shown complicated influence of pressure. Concentration of sulfur in glasses increases with increase in pressure from 0.2 to 0.6 GPa in experiments where andesite was used as a starting material. The sulfur concentration increases from 0.09 wt.% at 0.2 GPa to 0.4 wt.% at 0.6 GPa and =1200º. In hydrous magnesian basalts (12-18 % MgO), we observe an extremum around 1.5 GPa. Solubility of sulfur increases from 0.31 wt.% to 1.01 wt.% at P=1-1.5 GPa, T=1300º and decreases till 0.19 wt.% at P=2.5 GPa, T=1350º. At ultrahigh (>4GPa) pressure concentration of sulfur in magmas will change slightly, considering increase of magnesian basalt liquidus in temperature and positive influence of temperature on the solubility of sulfur.
Extreme character of the pressure dependences plays an important role in transportation of sulfide-silicate melts from the deep magmatic centers into the modern magmatic chambers where most of open deposits of hypabyssal ore-bearing magmas are localized. Possible explanation of an extremum in the field of 1.5-2.0 GPa is character of dissolution of water in silicate melts.
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