

ALUMOSILICATE MELT IN THE EQUILIBRIUM – CONTAINING MIXING CHLORINE, FLUORINE FLUID

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Financial support by RFBR, grant N 00-05-64990

Herald of the Earth Sciences Department RAS, № 1(20)'2002

URL: http://www.scgis.ru/russian/cp1251/h_dgggms/1-2002/informbul-1.htm#magm-7.engl

Together with water, sulfur components, HCl and alkali chlorides are major constituents of volcanic gases and therefore must have been important components of the earth's primary atmosphere and have a severe impact on climate till now. Geochemical and experimental data on contents of chlorine and fluorine are often contradictory in spite of fluorine loss during eruption is negligible. Meanwhile, fluorine concentration, using data of melt inclusions changes from 0,029 weight % in basalt melts up to 2,09 weight % in acidic melts. These components also have a fundamental influence on magmatic and post-magmatic processes and often occur together. Taking into account the impossibility of quantitative estimation of volatile components losses in the process of evolution of the fluid-magmatic systems and hence the impossibility of estimation of original chlorine and fluorine concentrations in magmas the experimental modeling of the fluid-melt equilibrium seems most correct. Considering the large number of factors that influence the behavior of chlorine and fluorine in magmatic- fluid systems, it is necessary to obtain data on elements partitioning in model systems to carry out a rigorous thermodynamic data analysis. It is also interesting to investigate practically unknown the mutual influence of chlorine and fluorine solubility in aluminosilicate melts and water fluids.

Systematic experimental study of contents of chlorine and fluorine in melts at 750-800°C and 2 kbar was conducted using cation-change method. Solid starting materials were dehydrated gels of 5 compositions of systems Ab-Ort with different ratio of Na and K. The compositions of fluid were water-solutions 0,5 M (NaCl+ KCl + NaF +KF). Run duration was usually 912-1200 hours. Chloride and fluorine contents in solutions were measured using ion-selective electrodes, Na, K- using an inductively coupled plasma. Cl, F as well as Na, K, Al and Si were measured by electron microprobe.

The main results are:

Distribution coefficients of fluorine in mixing (fluid-melt) systems change from 0.11 to 0.22 and practically not depend from systems composition. The chlorine concentration in these melts is unimportant. The distribution coefficients of Na and K are close to the unity and, so, the reaction change constant is close to the unity too. It corresponds to practically ideal substitution of alkali elements in two phases. The experimental studies of chlorine solubility in melts in presence of SiO₂ in the some systems were investigated. It was shown that chlorine concentration decreases with contents of SiO₂ and make equal to zero at superfluous SiO₂ (3.5 weight %).

The obtained results on solubility of fluorine testify, that in the systems without cation change, the concentration in melt are lower. The essential difference between two types of the systems (with and without cation change) is the dependence of Cl and F content in melts from the presence in the system one or two volatile components.