American Mineralogist, Volume 97, pages 1452–1459, 2012

Experimental study of mineral equilibria in the system $K_2O(Li_2O)$-Al_2O_3-SiO_2-H_2O-HF at 300 to 600 °C and 100 MPa with application to natural greisen systems

Yu.B. Shapovalov* and T.V. Setkova*

Institute of Experimental Mineralogy, Russian Academy of Science, 142432, Academician Osipyan str., 4, Chernogolovka, Moscow region, Russian Federation

Abstract

We present the results of experimental studies on mineral and phase transformations in the model system $K_2O(Li_2O)$-Al_2O_3-SiO_2-H_2O-HF at 300 to 600 °C and 100 MPa using the method of univariant assemblages. The phase diagrams involve equilibrium curves among topaz, andalusite, muscovite, pyrophyllite, AlF_3, and K_nAlF_{3+n} built from our experiments, which have allowed us to determine the topaz stability field. Topaz is stable in solutions with HF concentrations from $3\cdot10^{-3}$ to $8\cdot10^{-1}$ *m* and with KF concentrations lower than $7.5\cdot10^{-3}$ *m*. As temperature increases, topaz becomes stable at higher HF concentrations.

Application of the results to the Akchatau greisen W-Mo deposit provides an explanation of the observed zonation as a manifestation of metasomatic processes and imposes constraints on the mechanism and conditions of formation of the Akchatau deposit as well as on the compositions of the F-rich fluids participating in the greisenization.

Keywords: Greisens, topaz, mineral equilibria, hydrothermal systems