American Mineralogist, Volume 95, pages 537–544, 2010

Solubility of manganotantalite and manganocolumbite in pegmatitic melts

Alexander Bartels,[1,*] Francois Holtz,[1] and Robert L. Linnen[2]

[1]Institut für Mineralogie, Leibniz Universität Hannover, Callinstrasse 3, 30167 Hannover, Germany
[2]Department of Earth Sciences, University of Waterloo, 200 University Avenue West, Waterloo, Ontario N2L 3G1, Canada

Abstract

Solubility experiments of $MnNb_2O_6$ and $MnTa_2O_6$ were conducted in two nominally dry to water-saturated pegmatitic melts with different amounts of Li, F, P, and B at 700 to 1000 °C and 200 MPa to determine the maximum concentrations of Nb and Ta in pegmatitic melts. The Li_2O, F, B_2O_3, and P_2O_5 contents in the melts were 1.16, 2.99, 1.78, and 1.55 wt% for melt composition PEG1 and 1.68, 5.46, 2.75, and 2.75 wt% for melt composition PEG2 and the resulting Al/(Na+K+Li) ratio for both melts is 0.92. The experimental data show that the solubility product of manganocolumbite increases by a factor of three upon increasing the water concentration from 0 to 4 wt%. Considering that pegmatitic melts at pressures above 50 to 100 MPa are hydrous (>4 wt% H_2O), the increase in solubility by this magnitude, over the stated range of water concentration, is not significant for pegmatites. The data also point out that the solubility of $MnNb_2O_6$ and $MnTa_2O_6$ is strongly temperature dependent, increasing by a factor of 50 for manganocolumbite and 15–20 for manganotantalite from 700 to 1000 °C under water-saturated conditions. The solubility also increases with increasing content of fluxing elements like Li, F, B, and P. In the pegmatite melt containing the highest amount of fluxing elements, the maximum concentrations of Ta and Nb are higher by nearly one order of magnitude when compared to a subaluminous rhyolitic melt.

Keywords: Pegmatitic melt, volatiles, solubility, columbite, tantalite