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ELECTRONIC ARTICLE

Metapelite phase equilibria modeling in MnNCKFMASH: The effect of variable Al_2O_3 and MgO/(MgO + FeO) on mineral stability

DOUGLAS K. TINKHAM, CARLOS A. ZULUAGA, AND HAROLD H. STOWELL

Department of Geological Sciences, University of Alabama, Tuscaloosa, Alabama 35487-0338, U.S.A.
<tinkh001@bama.ua.edu>

ABSTRACT

A series of MnO-Na_2O-CaO-K_2O-FeO-MgO-Al_2O_3-SiO_2-H_2O (MnNCKFMASH) metapelite pseudosections highlights the dependence of predicted mineral assemblages on bulk rock Al_2O_3 and Mg# [MgO/(MgO + FeO)]. T-X_{Al} pseudosections portray the dependence of staurolite, biotite, and aluminum silicate on Al_2O_3 content, allowing the distinction between high-Al and low-Al pelite, as commonly portrayed with KFMASH modeling. The MnNCKFMASH system also shows the effect of Al_2O_3 on plagioclase and zoisite stability, which cannot be done in the KFMASH system. Comparison of MnNCKFMASH to KFMASH pseudosections highlights the consequence of ignoring the important rock constituents MnO, Na_2O, and CaO when constructing pseudosections. KFMASH cannot model important phases such as plagioclase and zoisite, and there are significant differences in predicted garnet, biotite, and chloritoid stability in the two different systems. In particular, KFMASH does not model garnet stability appropriately at low pressures and temperatures because it cannot account for the stabilizing effect of Mn. The comparisons also show that the method of calculating a KFMASH bulk rock composition equivalent to a real rock composition is problematic and has significant implications for the predicted pseudosection assemblage stability.

Comparison of the MnNCKFMASH pseudosections to natural assemblages observed in the Waterville Fm., Maine, indicates that the MnNCKFMASH system comes very close to modeling naturally developed mineral assemblages successfully. The only major discrepancy between predicted and observed assemblages is the inability to predict the paragenesis staurolite + andalusite using an average or natural Waterville Fm. composition.

Garnet thermobarometric results from the Waterville Fm. are in poor agreement with pseudosection topology for an average Waterville Fm. composition. This suggests that if quantitative *P-T* path information is to be derived through a combination of pseudosections and thermobarometry, samples will have to be investigated on an individual basis in more detail than was done in this study.

* This article is designed to be read on a computer with internet access. The full text of the article can be obtained in pdf format at http://gmr.minsocam.org/papers/v3/v3n1/v3n1abs.html.

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