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ELECTRONIC ARTICLE

Diopside + F-rich phlogopite at high *P* and *T*: Systematics, crystal chemistry and the stability of $KMgF_3$, clinohumite and chondrodite

GEORGE E. HARLOW

Department of Earth and Planetary Sciences, American Museum of Natural History, New York, New York 10024-5192, U.S.A.
gharlow@amnh.org

ABSTRACT

Multianvil experiments have been carried out from 3.0 to 11 GPa and from 1100 to 1500 DEGC on an equimolar mixture of natural diopside ($CaMgSi_2O_6$) and F-rich phlogopite ($K_{1.7}Na_{0.24}Mg_{5.6}Al_{2.4}Si_{5.8}O_{20}[F_{1.7}OH_{2.3}]$) to examine the behavior of K and F at high *P* and *T* in this system. As the first extensive experiments in the KCMASH composition space to include fluorine, the subsolidus crystallization of the perovskite $KMgF_3$ and F-bearing clinohumite and chondrodite at high pressures, up to 10 GPa and 1400 DEGC, is noteworthy. The compositions of crystalline phases produced in the experiments vary systematically with *P* and *T*. In clinopyroxene: Kcpx ($KAlSi_2O_6$) content in clinopyroxene increases with increasing pressure at pressures above 5 GPa without a noticeable temperature effect; CaTs ($CaAl_2SiO_6$) content is negatively correlated with P above 3 GPa and is positively correlated with *T*. In amphibole, an ^{M4}K-substituted potassic richterite, ideally $K(KCa)Mg_5Si_8O_{22}(OH,F)_2$: K content is positively correlated with *P*; Al and F content decrease with *P*; and F content is positively correlated with *T* and is lowered by coexisting $KMgF_3$. In garnet, $^{[6]}$Si and Na content increases upon increasing *P*; Ca-Mg systematics are complicated by growth zoning of crystals. All of the above trends may merit further calibration in geobarometry above 6 GPa, where published Al-in-Opx and Opx-Cpx barometers fail for these experiments. Although fluorine content in hydrous minerals decreases upon increasing *P*, fluorine enlarges the high *P-T* stability field of the hydroxy-minerals, so F content, even at low levels, must be considered in modeling phase stabilities for mantle assemblages. However, the strictly subsolidus paragenesis of humites in these experiments adds to the evidence that mantle humites form via metasomatic rather than magmatic interactions.

* 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/v4/v4n3/v4n3abs.html.

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