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Potassium in eclogitic clinopyroxene: the role of ferric iron

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Eclogite samples from Paleozoic Maksyutov complex, southern Urals, Russia, contain clinopyroxene (Cpx) with up to 1000 ppm K, as was analyzed by the SIMS method. Moessbauer spectroscopy on the Cpx separates from the same samples revealed a significant proportion of Fe^{3+}/Fe(tot). The ferric iron content correlates well with the potassium, thus implying that at least part of the K-Cpx is present as a K-aegerine (K-Aeg) end-member, $KFe^{3+}Si_2O_6$. To test this hypothesis experimentally, we have attempted to synthesize a K-Aeg-bearing Cpx at high pressure (P) – temperature (T) conditions. Experiments were done in a conventional piston-cylinder apparatus with the NaCl pressure assembly in Au-Pd capsules to prevent dissolution of Fe into the capsule walls. Mechanical mixes of reagents with the bulk compositions corresponding to the jadeite - K-Aeg join with X(K-Aeg) = Fe^{3+}/(Fe^{3+}+ Al) = 0.1 and 0.2 were used as starting materials. The runs were made at T = 1000^{o}C and P = 2 GPa. Run products were investigated with SEM, BSE and EMP methods. The resulting phase assemblage for both starting compositions consisted of Cpx + alkali feldspar +/- Magnetite. Cpx formed large sub-hedral grains with distinct grain-to-grain compositional heterogeneity. Compositional variations within individual grains (zoning) was much less pronounced. Maximum K content of the synthesized Cpx corresponds to 0.2 wt.% K_2O, with a strong correlation of the amount of K and Fe^{3+}, what appears to support a significant stabilizing effect of ferric iron on K substitution in Cpx. This work was supported by RFBR grant 06-05-64976 to LYA.