THE Ca-ESKOLA COMPONENT OF ECLOGITIC CPX AS A FUNCTION OF P-T AND BULK COMPOSITION: AN EXPERIMENTAL STUDY TO 12 GPa

KONZETT, J. [1] & PROYER, A. [2]

[1]Institut für Mineralogie und Petrographie, Univerität Innsbruck, Innrain 52, A-6020 Innsbruck, Austria
[2]Institut für Erdwissenschaften, Universität Graz, Universitätsplatz 2/II, A-8010 Graz, Austria
e-mail: juergen.konzett@uibk.ac.at

In recent years an increasing number of high-P metamorphic localities has been described where Cpx contains oriented needles/rods of quartz/coesite with or without Cam (ZHANG et al., 2005 and references therein). These inclusions are often taken as UHP-indicators and are ascribed to the presence in solid solution of a Cpx $Ca_{0.5}\square_{0.5}AlSi_2O_6$ (Ca-Eskola pyroxene CaEsk) under high P that decomposes through a reaction $2\ Ca_{0.5}\square_{0.5}AlSi_2O_6 \rightarrow CaAl_2SiO_6 + 3\ SiO_2$ during exhumation. To study the conditions under which Cpx incorporates $CaEsk_{ss}$, we performed experiments in the P-T range 6 - 12 GPa and 950 – 1500 °C using bulk composition 95-1C of TSAI & LIOU (2000) that contains Cpx with oriented quartz-rods. Cpx analyses were normalized to 6 ox. and Fe_{tot} = FeO which yields a minimum amount of $CaEsk_{ss}$. From 6 12 GPa, Cpx in the assemblage Grt + SiO_2 ± Rt does not show any significant deviation from 4.00 cations / 6 oxygens. This is thought to be due to the absence of a suitable Al-buffer phase that allows the formation of $CaEsk_{ss}$ through a reaction such as $Ca_3Al_2Si_3O_{12} + 2\ Al_2SiO_5 + 7\ SiO_2 = 6\ Ca_{0.5}\square_{0.5}AlSi_2O_6$. To test this hypothesis, two additional bulks were used representing 95-1C + 10 and 25 wt% Ky added. At 6 GPa / 950 °C, Cpx in 95-1C + 25 % Ky coexists with Grt + Ky + Coe + Rt and shows a significant non-stoichiometry with 3.950 ± 0.007 (n = 10) cat / 6 ox, corresponding to 10 mol% $CaEsk_{ss}$. 95-1C + 10 % Ky does not form Ky at 6 GPa / 950 °C and produces Cpx + Grt + Coe + Rt that only shows a slight deviation from ideal stoichiometry with 3.987 ± 0.006 (n = 10) cat / 6 ox corresponding to 3 mol% $CaEsk_{ss}$. At 6 GPa / 1200 °C, $CaEsk_{ss}$ increases to 14 and 11 mol% and at 7 GPa / 950 °C, Cpx in 95-1C + 25 % Ky and 95-1C + 10 % Ky has 9 and 5 mol% $CaEsk_{ss}$ respectively. Providing that breakdown of $CaEsk_{ss}$ is responsible for oriented SiO_2-inclusions in Cpx, then this study indicates that (1) an Al-buffer phase such as Ky or Phe is required to generate significant $CaEsk_{ss}$ in Cpx of metabasic eclogites and, hence, (2) that eclogites with oriented SiO_2-inclusions in Cpx did contain Ky or Phe at least during a part of their prograde P-T history.

References

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