

CLINOPYROXENES WITH ORIENTED INCLUSIONS OF QUARTZ AND CALCIC AMPHIBOLE FROM THE SAUALPE AND POHORJE MOUNTAIN ECLOGITES – INDICATORS OF UHP-CONDITIONS?

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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 calcic amphibole. These inclusions are often taken as UHP-indicators and are ascribed to the presence in solid solution of Ca-Eskola pyroxene $\text{Ca}_{0.5}\square_{0.5}\text{AlSi}_2\text{O}_6$ (CaEsk) under high-P that decomposes through a reaction $2 \text{Ca}_{0.5}\square_{0.5}\text{AlSi}_2\text{O}_6 \rightarrow \text{CaAl}_2\text{SiO}_6 + 3 \text{SiO}_2$ during exhumation. The mechanism by which composite oriented inclusions with qtz + Cam lamellae form is not yet understood. Hence, great caution is advised when using these inclusions as UHP indicators. H_2O required for Cam formation may be derived locally from H-defects in cpx or from an external source during low-T (low-P) retrogression. Cpx with and without composite qtz + Cam rods or with a zonal distribution of inclusions were studied from Saualpe and Pohorje Mountain eclogites using EMPA, LA-ICP-MS and IR-spectroscopy. Eclogites from both localities show an assemblage grt + cpx + ky + rt ± czo ± qtz ± phe ± Cam ± zrn. Peak metamorphic conditions were 2.5 GPa and 750-780°C. IR-spectra of cpx without visible inclusions show absorption-bands at 3460-3525 cm^{-1} corresponding to H_2O concentrations of 150-580 ppm. Polarized spectra of cpx with oriented inclusions show additional bands at 3625-3673 cm^{-1} typical of Ca-amphibole. It is only in one sample that clear areas contain more H_2O (305 ppm) than areas with inclusions (290 and 260 ppm) indicative of H_2O transfer from cpx to Cam. Trace element concentrations of cpx from Pohorje eclogites are extremely low (rock/chondrite = <0.01-1) and do not show significant differences between clear and inclusion-bearing areas with the exception of Li that is consistently higher in clear areas (15-18 ppm) compared to inclusion-bearing areas (9-10 ppm). Likewise, multiple EMPA analyses of a zoned cpx-crystal did not reveal any difference in the major element composition between clear and inclusion-bearing areas, both showing an averaged composition $\text{jd}_{27}\text{di}_{64}\text{cats}_{03}$. Assuming $\text{Fe}_{\text{tot}}=\text{FeO}$, both clear and inclusion-bearing areas of the zoned cpx show a nearly perfect stoichiometry with $\Sigma\text{cat} = 4.002 \pm 0.007$ and 4.002 ± 0.004 (n=10) per 6 oxygens, respectively. This coincidence in composition does not support the presence under peak metamorphic conditions of a significant CaEsk-component in the clinopyroxene investigated. In addition, the presence of cal, dol and ab-rich plag as additional phases appearing in some of the composite qtz + Cam rods would rather indicate a low-P formation of these oriented inclusions.