

Relict edenite in a garnet lherzolite from the Chinese Su-Lu UHP metamorphic terrane: Implications for metamorphic history

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ABSTRACT

Study of mineral inclusions in garnet in orogenic peridotites provides important information on their metamorphic history. Similar study of mineral inclusions in pyroxene is also encouraging. Edenite is found as relict inclusions in phlogopite-clinopyroxene intergrowths forming the cores of clinopyroxene porphyroblasts in a garnet lherzolite at Zhimafang in the Chinese Su-Lu ultrahigh-pressure metamorphic terrane. Texture shows that the phlogopite and clinopyroxene were products of the breakdown of edenite. The composition of the edenite is represented by $K\text{-Ed}_{6.0}\text{Ed}_{7.7}\text{Fe-Ed}_{6.6}\text{Ts}_{8.4}\text{Fe-Ts}_{1.8}\text{Tr}_{1.2}\text{Cm}_{5.4}$. Those of the clinopyroxene and phlogopite are, $\text{Ur}_{4.5}\text{Jd}_{3.7}\text{Ae}_{6.5}\text{CaTs}_{2.2}\text{Di}_{8.1}\text{En}_{1.9}$ and $\text{Phl}_{86.0}\text{Na-Phl}_{13.3}\text{Na-Ann}_{0.7}$, respectively. The edenite breakdown is accompanied by gains of Ca, Si, and Cr, and losses of H, Mg, Al, Fe, Na, and K. The hypothetical composition of clinopyroxene resulting from isochemical breakdown of edenite is higher in Jd, CaTs, and En but lower in Di components than the cores of clinopyroxene porphyroblasts. The calculated mode of phlogopite is much higher than measured. The gain of Si and loss of H can be explained by involvement of SiO_2 -enriched fluids during formation of the Cpx+Phl intergrowth, whereas the other gains and losses suggest the existence of an older generation clinopyroxene slightly more enriched in Ca and Cr and depleted in Na, Mg, and Al, which homogenized with the clinopyroxene produced by the breakdown of edenite. Interaction with fluids also increased the Ca/Mg ratio of the system. It is suggested that, after having been exhumed to a shallow level for the first time, the peridotite was infiltrated by crust-derived fluids resulting in the replacement of clinopyroxene by edenite. During subduction, the edenite was replaced by clinopyroxene + phlogopite. Relics of edenite in clinopyroxene were able to survive ultrahigh-pressure metamorphism.