



A new approach to the study of mineral inclusions in diamond

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We report for the first time a complete X-ray diffraction in-situ crystal-structure refinement of a single crystal of olivine and a garnet still trapped in a diamond (Udachnaya kimberlite, Siberia and Slave Craton, Canada). A novel experimental procedure for mineral inclusions in diamond, consisting of accurate crystal centering allowed us to overcome previously reported experimental problems and to refine the crystal structures without extracting the inclusion from the diamond host. For olivine the data allowed us to obtain the cation distribution over the two crystallographic sites and then its composition. Using a new pressure-volume equation of state for the same composition we could obtain the internal pressure and then we could calculate the pressure of formation of the diamond - olivine pair (assuming no plastic deformation).

For garnet the structural data allowed us to obtain its chemical composition starting from an improved model already formulated by Merli et al. (1995) on a database of 281 garnets and considering 4 end-members: pyrope, almandine, grossular and uvarovite. The andradite end-member was not considered as for garnets found in these diamonds the Fe³⁺ is not more abundant of 0.03 a.p.f.u. (De Stefano et al. 2009). The data we obtained cannot be influenced by the internal pressure as such pressure for garnets has been reported to be zero or very low (e.g. Liu et al. 1990). Even for 0.25 GPa of internal pressure the rigid structure of garnet would not show any significant differences for example in its bond-lengths (Zhang et al. 1999).

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