



## **Melting relations of the model garnet-pyrrhotite-Ca-Mg-carbonate system compressed at 7–20 GPa: implications for diamond genesis**

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Chemical model of multicomponent parental medium for mantle-derived diamonds is determined by generalized data for compositions of their mineral, melt and fluid syngenetic inclusions. The occurrence of silicate minerals of peridotite and eclogite suites, sulphides, and carbonatitic melts among the inclusions is well-defined for the upper mantle environment. The silicate, sulphide, and carbonate phases were also identified for the deeper transition zone and lower mantle conditions. At present a concept of diamond formation in the melted parental medium is well justified, and this raises the problem of melting relations between the mantle silicate, carbonate and sulphide components involved in the processes of magmatic evolution of the mantle substance and diamond genesis. For high-pressure high-temperature experimental study at 7 – 20 GPa and 1000-2000°Ñ, a model Mg-Ca-garnet - pyrrhotite - Ca-Mg-carbonate system, based on the most representative components of the mantle parental medium for diamonds, was chosen. Experiments at 7 GPa (with the use of a toroidal anvil-with-hole apparatus in Chernogolovka) revealed complete carbonate-silicate liquid miscibility for the upper mantle conditions. The uniform carbonate-silicate melts were involved into the relations of complete liquid immiscibility with the sulphide melts. The solubility of sulphide components in carbonate-silicate melt is very low within 0.3 – 0.8 wt. %. On the other hand, microprobe analyses of coexisted phases demonstrate the lack of any solubility of silicate and carbonate components in sulphide melts. The experiments show that formation of syngenetic silicate and carbonate inclusions in the mantle-derived diamonds is possible in the carbonate-silicate (carbonatite) parental

melts but impossible in the sulphide ones (both the carbonate-silicate and sulphide melts with dissolved carbon are effective for diamond nucleation and growth). Experiments at higher pressures up to 20 GPa (using multianvil press in Bayreuth) enable to observe the same effects, that is, an essentially complete liquid immiscibility between sulphide and uniform carbonate-silicate melts. Besides, a cation exchange was established for the co-existing immiscible melts. As a result, small quantities of CaS- and  $\text{FeCO}_3$ -components were formed in sulphide and carbonate-silicate melts, respectively. The experimental study supports the version that carbonate-silicate melts with dissolved carbon are the dominating parental media for the bulk of natural diamonds at PT conditions of the upper mantle, transition zone and, as this can be reasonably expected, of lower mantle.

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