



Diamond origin in the mantle carbonate-silicate (±sulfide) melts: peculiarities clarified with high-pressure experiments

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Multicomponent carbonate-silicate-carbon melts, as the basic parental media, are responsible for diamond origin in the Earth's mantle conditions. This model is consistent with as experimental results on diamond nucleation and growth in melts of this type chemistry and so the mineralogical data for syngenetic inclusions of minerals, melts and fluids in mantle-derived diamonds. The parental media for natural diamonds consist of major (or basic) carbonate and silicate components as well as minor (or admixed) components like sulfides, phosphates, haloids, oxides, carbon dioxide, water, etc. High-pressure experiments demonstrate that both the major and minor components may be efficient in diamond nucleation. This fact is meant that experimental studies have to be focused on a substantiation of parental compositions which are common as for diamonds and so for their syngenetic inclusions. Under this approach, a variety of key peculiarities of the mantle diamond origin are clarified. Experiments at 7.0 GPa on melting relations of the model aragonite CaCO_3 – pyrope $\text{Mg}_3\text{Al}_2\text{Si}_3\text{O}_{12}$ – pyrrhotite FeS system and eclogitic garnet - pyrrhotite join revealed a nearly complete immiscibility of sulfide and silicate melts, sulfide and carbonate melts, as well as sulfide and completely miscible carbonate-silicate melts. The lack of any solubility of silicate and carbonate components in sulfide melts is found. This experimental evidence points to the fact that sulfide melts, although provide diamond formation, are not efficient for syngensis of diamonds and their silicate and carbonate inclusions, in contrast to the carbonate-silicate melts. The parental carbonate-silicate media are compositionally variable in the context of major and minor components. Experiments at 7.0 – 8.5 GPa demonstrate efficiency for diamond nucleation of carbonate-silicate melts which are significantly rich (about 70 wt.%) with silicate components.

High pressure experimental evidence for the complexity of alkaline alumina-silicate and carbonate reactions during chemical evolution of the mantle carbonate-silicate (carbonatite) systems have revealed for the magnesite MgCO_3 – aragonite CaCO_3 – nepheline NaAlSiO_4 – coesite SiO_2 system. Formation of pyrope-grossular garnets accompanied with alkaline carbonate and CO_2 -fluid components was found at 7.0 GPa as the result of liquid-phase reactions. *Supports*: RAS program on HP research (2006), RFBR grants 05-05-64101 and 04-05-97220 (jointly with the Ind. Sci. Ministry / MD).