# PRIMARY MELT INCLUSIONS IN ECLOGITE DIAMONDS AND THEIR GENETIC IMPLICATION.

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Study of primary melt microinclusions in diamonds from the Mir pipe (Bulanova et al., 1988; Novgorodov, Bulanova, 1989; Novgorodov et al., 1990) is very important for understanding petrological and geochemical aspects of mantle processes. These works, together with other published data, permit the following main conclusions regarding genesis.

1. Melt inclusions of andesite composition in diamonds are thought to represent a fragment of initial melting of diamondiferous mantle eclogites (Green, Ringwood, 1968; Sobolev, Sobolev, 1975). From data available, all calculated temperatures for the association garnet/omphacite (Ellis, Green, 1979, P=50 kb) of inclusions in diamonds from the Mir, Roberts Victor, Premier, Orapa, Sloan kimberlites and Argyle lamproites fall in the interval between the wet and dry soludus for eclogites on P-T diagrams. Diamondiferous eclogites probably experienced partial melting if they initially contained some volatiles ($H_2O$, $CO_2$).

2. It appears that a high-potassium melt represents a fragment of the final evolutionary stage of mantle eclogites. Its disproportionation might occur as follows: $mK_2O \cdot nNa_2O \cdot Al_2O_3 \cdot 6SiO_2 \cdot V^I \rightarrow 2mSa + 2nJd_{ss} + [1 - (m+n)]\ Ky + 5[1 - (m+ 0.6n)]\ Cs + V^{II}$, where $V^I$ = dissolved volatiles, $V^{II}$ = fluid phase. The fluid phase should be in equilibrium with the association Gar + Omph + Sa + Ky + Cs + Rut + FeS. Xenoliths containing such a suite of minerals from Roberts Victor (Smith, Hatton, 1977) and Udachnaya (Spetsius et al., 1984) are likely to represent relics of similar processes that occurred in the upper mantle. The above reaction may explain transition from rutile eclogites into kyanite ones.

3. Fluid microinclusions in coated and cubic diamonds from Zaire and Botswana (Navon et al., 1988, 1989), which are enriched in $SiO_2$, $K_2O$, $TiO_2$, FeO and trace elements, probably characterize the subsolidus evolutionary stage. Data on melt and fluid microinclusions, although they are available only

for several samples from the Yakutian and African diamondiferous provinces, seem to reflect a single geochemical trend of mantle eclogite evolution.

4. It appears that a clear core of eclogite diamonds crystallized from melt whereas rims from a fluid phase supersaturated with carbonaceous matter relative to diamond. The core-rim interface is a phase boundary whereat the solidus temperature of the system is attained. The medium evolved with decreasing P and T, which was probably consistent with a rising mantle diapir represented by heterogeneous eclogite material.

5. High $K_2O$ content of omphacite inclusions in diamonds from various parts of the world may indicate their crystallization in the presence of a substantially high-potassium melt or fluid.

6. Recently, preliminary data on the U content of coated diamonds were obtained using f-radiography (L.L.Kashkarov, unpubl. data). The U content is 0.6 ± 0.1 ppm in clear cores of diamond, >3 - 7 ppm in melt inclusions, 50 - 100 ppm in local cracks. The medium from which diamonds crystallized seems to have been rich in U.

7. Methodologically, the studied melt microinclusions represent a new type of inclusions. A local crack and a disordered graphite film which are related to such inclusions may be the result of partial degassing during kimberlite magmatism in the crust where $P_{fl} > P_{tot}$ was attained at the inclusion-matrix interface. These features can be used as visual indicators in choosing diamond crystals that are likely to contain primary melt inclusions.