COMPOSITION INHOMOGENEITY OF KIMBERLITIC GARNET NODULES AS AN INDICATOR OF THEIR METASOMATISM AND DISINTEGRATION

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Nodules of magnesian garnet of size 2 - 8 mm carrying numerous inclusions of other minerals and featuring peculiar composition and structure have been found in Internatsionalnaya, Mir, XXIII Congress of CPSU and Dachnaya diamondiferous pipes of the Malobotuobinsky region. Among them are several parageneses of minerals related with each other by common compositional features. At the same time, compositions of garnets and inclusions of other minerals vary within rather wide range: from high-chromous knorringite-containing garnet with inclusions of jadeite-ureyitic clinopyroxene, high-chromous chrome-spinellid, chromium-containing amphibole to moderate- and low-chromous high-magnesian garnet containing a set of inclusions represented by high-chromous ferrimagnetic picroilmenite, low-chromous clinopyroxene, in rare cases - high-titanous amphibole. Some of high-chromous garnets fit into diamond association; however, most of them fall into one of two wehrlitic paragenesis types: the first one containing chrome-spinellid inclusions, and the second one carrying picroilmenite inclusions. This latter type of mineral paragenesis is of rare occurrence in kimberlites.

The unique feature of the formations at question is composition inhomogeneity shown both by host mineral and by inclusions of other minerals within the boundaries of practically every grain studied. The inhomogeneity occurs as: a) rather regular zonation manifested in lowering Cr_2O_3 contents fron grain center towards its periphery and in a change of mineral inclusions (chrome-spinellid is typically localized in grain centers, giving way to picroilmenite at the periphery); b) block structure of garnet grains (areas with increased Cr_2O_3 content alternate with those of low-chromous composition). In the first case inclusions are represented by numerous chrome-spinellid grains, in the second case - by picroilmenite grains. Interblock boundaries are either sharp or gradual (transition zone width about I mm).

Somewhat peculiar composition is featured by the whole set of minerals at question; they bear evidences of formation under high oxygen potential conditions, which is manifested in increased Fe^{3+} content in each of these minerals. Garnet exhibits an increased iron index (f = 0.25 - 0.30) and high proportion of Fe^{3+}; picroilmenite is classed as a ferrimagnetic variety with high (up to 20 %) content of hematitic component. Chrome-spinellid contains a high proportion of magnetitic minal. The examination of concentrations of rare earth elements in individual nodules performed by N.V.Sobolev

has revealed that RE contents of these latter are rather high (verbal communication).

All the aforesaid implicates that the garnet nodules characterized above appear to be particularly abyssal upper-mantle formations. Some of them apparently had been crystallized under diamond stability conditions; thus they are concentrated, by and large, in highly diamondiferous pipes. Nevertheless, diamond is absent from this mineral association. It is likely that diamond could be annihilated at large depths where primary mineral parageneses had experienced the action of oxidized metasomatized fluids which served as a source of K, Na, Ti and a number of other incompatible elements. Penetration of abyssal fluids which had caused an essential transformation of upper mantle material zones was apparently promoted by rock deformation and cataclasm, in particular, by disintegration of rocks to the point of fragmentation of garnet grains. Mechanic mixing of the material, including crushed garnet grains, and agglutination of these latter have caused the formation of compositional inhomogeneity within individual nodules. Sharp distinctions in composition between individual blocks of garnet grains could not long survive under upper mantle conditions. It is most likely that the mantle metasomatism process, in combination with material crushing, immediately preceded the formation of kimberlitic melt and evacuation of unbalanced parageneses to the surface, where they could be preserved in a metastable state.