



Chloride-carbonate-silicate liquids at HP conditions: experiments and application to natural diamond-forming processes.

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Four compositional groups of alkalic chlorine-bearing liquid inclusions are distinguished in diamonds from kimberlites worldwide: silicate, carbonate-silicate, carbonate, and chloride-carbonate. The continuous trends between silicate, carbonate-silicate, and carbonate inclusions, as well between carbonate and chloride-carbonate inclusions, suggest perfect miscibility of these two groups of liquids within the field of diamond stability. An absence of continuous trends between silica-rich and chlorine-rich inclusions indicates a wide miscibility gap between these liquids under the upper mantle conditions. Based on the natural data only, the liquid immiscibility model (Perchuk et al., 2002; Navon et al., 2003) has never been substantiated experimentally. Experiments are performed on phase relations in the model chloride-carbonate-silicate systems at 5 GPa and 1300-1600°C with application to alkalic liquids trapped in natural diamonds.

Major factors that rule an evolution of melts in the chloride-carbonate-silicate systems at high pressures are the following.

- (1) Melts within the carbonate-silicate and chloride-carbonate boundary joins are homogeneous liquids, while high-temperature miscibility gap is characteristic for the chloride-silicate join.
- (2) Miscibility gap between Cl-saturated carbonate-silicate è Si-saturated chloride-carbonate melts exists in the ternary system. Carbonate-silicate and chloride-carbonate branches of the miscibility gap converge with an increase of carbonate content in the

system.

(2) Crystallization paths are directed toward the lowest-temperature eutectic within the carbonate portion of the system.

(3) Silica-undersaturated phases (olivine, spinel, periclase, etc.) are preferentially stable at the liquidi of the systems.

(4) Decrease of temperature displaces the miscibility gap toward the more silica-rich portion of the system expanding the compositional range of the homogeneous silica-bearing chloride-carbonate melt.

These factors determine diverse compositional trends for evolution of both the immiscible and the homogeneous melts in the chloride-carbonate-silicate systems. These trends are consistent with the natural data on evolution of liquid inclusions in diamonds from the Botswanian, Yakutian, Brazilian and Canadian kimberlites.

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