

NATIVE METALS IN KIMBERLITES OF YAKYTIA AND THEIR GENESIS.

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Study of accessory minerals in rocks of the kimberlite formation and mantle xenoliths has revealed the presence of various native metals and associated oxygen-free compounds in them. Of minerals of the native element classes, iron, nickel, copper, gold, zinc, aluminium, lead, tin, chromium and antimony were found. A manganese variety (more than 1 wt.% Mn) has been established for iron; zinc, tin and tin - zinc varieties for copper; a ferrous variety for zinc; copper, magnesium, magnesium - copper and manganese - zinc varieties for aluminium; and a tin variety for lead. Seven intermetallic compounds: CuZn , $(\text{Cu,Fe,Mn})\text{Al}_6$, $(\text{Fe,Mn})\text{Al}_6$, CuAl_2 , Cu_6Sn_5 , $(\text{Cu,Zn})_{14}(\text{Sn,Sb})$, $(\text{CuZn})_8(\text{Sn,Sb})$; two antimonides: Cu_2Sb (cuprostibite), SnSb (stistaite); and moissanite were found in association with the native metals and their chemical varieties.

The species and compositions of the studied minerals are similar in both rocks of the kimberlite formation and xenoliths of unaltered and serpentized rocks. However, most favourable for the appearance and for preservation of native metals among kimberlite magmatites are autolith - bearing kimberlite breccias with a high proportion of groundmass, alneites, and phlogopite - rich and for highly carbonatized varieties of kimberlite. Comparison of the data obtained for rocks with unaltered, partly and completely serpentized olivine revealed no relationship between the degree of serpentization and the number of grains and species of native metals.

Minerals of the native element classes were formed in two stages. The first (mantle) stage was related to evolution of upper mantle material. The second (mantle - crust) stage was related to processes that took place in the kimberlite system proper. P-T parameters varied within 3,5 - 65 kb and 700-1300°C during the first stage and from near - surface conditions to 65 kb and 200 - 1200°C during the second stage.

Two mechanisms are suggested for the formation of native metals. The first one involves reduction of rock - forming elements of a silicate - oxide substrate due to a change in redox conditions. The second envisages crystallization of the metals by gas condensation of elements of an intratelluric fluid. The reduction mechanism is restricted by a buffering effect on reduction reactions of a silicate - oxide substrate: even with excess CH_4 and H_2 the H_2O that forms during reaction prevents fO_2 from reaching the value at which native iron is produced (Persikov, 1985). Rare finds of native iron attest to a lack of wide - scale reduction.

A wide occurrence of methane in a gaseous phase of mantle and kimberlite rocks suggests the appearance of organometallic compounds as agents of elements migration in fluids. Desintegration of such complexes can explain the formation of native metals and moissanite.

From the above said, the similarity between mineral associations produced during the two stages of native mineral forming processes becomes understandable.