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Conditions of crystallization of the Ural platinum-bearing ultrabasic massifs: evidence from melt inclusions

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Conditions of the Ural platinum-bearing ultramafic massifs formation attract attention of numerous researchers. A most important peculiarity of such plutons is their dunite cores, to which commercial Pt deposits are related. There are a different opinions about genesis of these massifs and usual methods not always can solve this question.

As a result of melt inclusions study in the Cr-spinel the new data on physical and chemical parameters of dunite crystallization of the Nizhnii Tagil platinum-bearing ulrabasic massif (Ural) was obtained. The comparative analysis of Cr-spinels, containing melt inclusions, has shown essential differences of these minerals from chromites of the ultrabasic ophiolite complexes and of modern oceanic crust.

Contents of major chemical components in the heated and quenched melt inclusions are close to those in the picrite and this testifies dunite crystallization from ultrabasic (to 24 wt.% MgO) magma. On the variation diagrams for inclusions in Cr-spinel the following changes of chemical compositions are established: during SiO_2 growth there is falling of FeO, MgO, and increase of CaO, Na_2O contents. Values of TiO_2, Al_2O_3, K_2O and P_2O_5 remain as a whole constant. Comparing to the data on the melt inclusions in Cr-spinel from the Konder massif, we see that values of the most part of chemical components (SiO_2, TiO_2, K_2O, P_2O_5) are actually overlapped. At the same time, for the Nizhnii Tagil platinum-bearing massif the big maintenances of FeO and CaO in inclusions are marked. Distinct dependence of the majority of components from the MgO content in inclusions is observed: values TiO_2, Al_2O_3 FeO, CaO and Na_2O fall at transition to more magnesia melts.

On the peculiarities of distribution of petrochemical characteristics melt inclusions in considered Cr-spinels are co-ordinated with the data on evolution of compositions of melts and rocks of model stratified ultramafic plutons during their crystallization in the magmatic chambers. On the diagrams an association of melt inclusions with the data on inclusions in Cr-spinels from the Konder platinum-bearing and Karashat ophiolite massifs is clearly visible.

Our computer simulations on the basis of melt inclusion compositions by the PETROLOG program package (Danyushevsky, Plechov, 2011) allowed to evaluate the crystallization temperature of dunites of the Nizhnii Tagil platinum-bearing massif in the intrusive chamber. The most part of olivine was formed from 1430 to 1360°C and continued to crystallize until to 1280°C. Cr-spinel crystallized from melts in the range of temperatures from 1345 to 1310°C.

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