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Platinum mineralization of the Svetloborsky and Nizhny Tagil intrusions, Ural Platinum Belt

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Nizhny Tagil and Svetloborsky intrusions related to the Ural-Alaskan type are the source of placer platinum (Razin, 2008). We have studied the platinum mineralization directly in the host dunite in order to identify its potential and improved methods of enrichment and extraction. The higher concentrations of Pt (0.1-22.5 ppm) in Svetloborsky intrusion were found in dunites close to contact with pyroxenites (Telegin et al, 2009). Rocks enclosing mineralization are serpentinized and contain chromite as accessory disseminations. Platinum mineralization in Nizhni Tagil intrusion is associated mainly with the chromite ore which forming the south-western semicircular area (Ivanov, 1997). The large-volume samples from both intrusions were used for mineralogical studies. They were crushed and concentrated in the heavy liquid. The results are:

1. Platinum ore including Pt-Fe, Pt-Fe-Cu, Pt-Cu alloys and other PGM are within the unaltered dunite and as well as in intensive serpentinized rocks. Petrochemical composition of host rocks and their degree of serpentinization is not correlated with the volume of platinum mineralization. It is important that the small crystals of platinum are located directly in the olivine matrix, and large anhedral grains tend to chromite grains.

2. The small cubic crystals of platinum in both intrusions are early-magmatic and were formed together with olivine. They prevail over the larger grains anhedral late-platinum, which is associated with the chromite schlieren. The predominance of small grains of platinum (up to 90% in Svetloborsky and 80% in Nizhniy Tagil intrusions) indicates that it is necessary to break the rocks up to -0.1 mm to obtain the maximum amount of platinum.

3. About half of the platinum grains from both intrusions related to the magnetic fraction, that does not allow us to offer a magnetic separation as a method of extracting platinum. The magnetic and nonmagnetic platinum does not differ from each other by morphology of grains and the ratio of Pt and Fe.

4. Magmatic Pt-Fe alloys of the Nizhniy Tagil intrusion occur in association with laurite and related to ferrous platinum, which contain some concentrations of Ni and Ir whereas the primary Pt-Fe alloys of the Svetloborsky intrusion have compositions similar to the Rh-, Pd-containing isoferroplatinum. In addition, there are numerous sulfides and arsenides PGE (erlichmanite, laurite, sperrylite, cooperite) as inclusions in platinum and the individual grains in a concentrate. The compositions of Pt-Fe alloys and mineral assemblages indicate that the formation of the ore zone of the Nizhniy Tagil intrusion occurred in the more reducing conditions than the formation of ore zone of the Svetloborsky intrusion.

5. The formation of post-magmatic Pt-Fe-Cu-Ni alloys associate with the processes of serpentinization of dunites. The general trend of replacement is: Pt-Fe alloys $\rightarrow$ Pt_2CuFe $\rightarrow$ $PtCu_3$. The first part of this trend (Pt_3Fe $\rightarrow$ Pt_2CuFe) is characteristic of the Svetloborsky intrusion, and the second part (Pt_2CuFe $\rightarrow$ $PtCu_3$) is widespread in the Nizhny Tagil intrusion.