PGE enrichment of quenched sulfide solid solutions, Noril'sk 1, Russia

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Results

The deepest terminations of the vertical massive sulfide veins of the Rudnaya Mt. (the Noril'sk 1 intrusion) are composed of naturally quenched monosulfide solid solutions (Mss), intermediate solid solutions (Iss), pentlandite and platinum-group minerals. According to EPMA study, sulfides have variable nonstoichiometric atomic ratios of major components different to the typical compositions of base metal sulfides. Iss is represented by intimate intergrowths of chalcopyrite and cubanite solid solutions with the average compositions $Cu_{0.79}Ni_{0.05}Fe_{1.13}S_{2.02}$ (Ccp_{ss}) and $Cu_{0.83}Ni_{0.17}Co_{0.01}Fe_{1.94}S_{3.04}$ (Cub_{ss}). Pentlandite is heterogeneously (fig.1) enriched in Pd (over 4.5 wt%), whereas Mss contains up to (g/t): 30 Rh, 190 Pd 160 Pt, 35 Au, and 120 Ag according to LA-ICP-MS data.

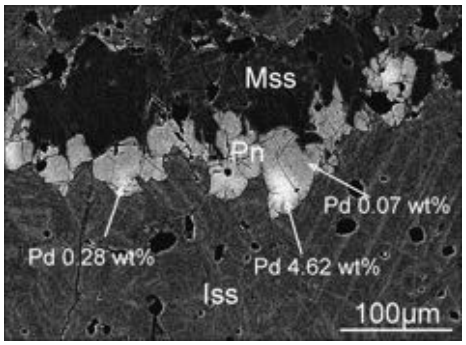

Figure 1. BSE image of Pd-rich pentlandite (Pn) at the contact of Mss and Iss.

Discussion

Heterogeneous distribution of Pd in pentlandite could be caused by hydrothermal transfer [1] or due to Pd incorporation into peritectic pentlandite at the magmatic stage [2, 3]. The mineral associations are not hydrothermally reworked and we favour the second suggestion. The PGE enrichment of Mss is not consistent with the available experimental data and raises a question as to a mechanism of the enrichment.

[1] Polovina et al. (2004) Can. Min. **42**, 261-277. [2] Distler et al. (1996) Geol. Ore Deposits **38**, 41–53. [3] Mansur et al. (2019) Geology **47**, 1-7.