Composition of Pd-Pt tellurides in magmatic sulfide globules, NW Mongolia: Dependence on the host phase

Corresponding author: Andrey Vishnevskiy, VS Sobolev Institute of Geology and Mineralogy, Siberian Branch of Russian Academy of Sciences, vishnevsky@igm.nsc.ru

Co-authors:
Maria Cherdantseva, VS Sobolev Institute of Geology and Mineralogy, Siberian Branch of Russian Academy of Sciences, mariacherdantseva@gmail.com

During crystallization, mafic sulfur-rich magmas divide into sulfide and silicate melts. As PGE and chalcophile elements have high partition coefficients for the sulfide liquid, they accumulate in it. With further decrease in temperature, from sulfide liquid crystallizes two solid solutions: intermediate (ISS) and monosulfide (MSS), which then resolve to form base metal sulfides – pentlandite, pyrrhotite, chalcopyrite, and cubanite. Some elements remain in the sulfides, and some form their own mineral phases (PGM). Understanding the distribution of these minor elements is very important to facilitate the search and mining of Cu-Ni-PGE deposits. Therefore, on example of a small ultramafic body with sulfide mineralization was conducted a study how affect the hosting phase on distribution of PGM.

In the studied intrusion that is located in the NW part of Mongolia on Tsagaan-Shuvuut Ridge have been identified 3 types of rocks containing sulfide globules, which differ in their shape and size: melanocratic olivine gabbro with large (up to 4 cm) flattened sulfide globules, melanocratic olivine gabbro with average (up to 1 cm) spherical sulfide globules, trachytoid leucocratic gabbro with small (up to 0.4 cm) globules. The PGMs (~60%) are generally minerals of moncheite group (Pt,Pd,Ni)(Bi,Te)2. Since these phases vary in composition and were encountered in all three types of globules so that their composition must vary depending on the hosted phase and on the type of rock in which they are located. Comparison was made by interrelation of Ni-Pt-Pd and Bi-(Pt+Pd+Ni+Cu+Fe)-Te and compositions were put on ternary diagrams in these coordinates.

The typical compositions of these minerals placed along the two series of solid solutions: PdTe2-NiTe2 and PdTe2-PtTe2. Our results are significantly differ from typical and points are located inside the ternary diagram without visible trends. It may be related with a considerable admixture of Bi. The tellurides, localized in chalcopyrite are characterized by two small variation fields: Ni-rich moncheite in large flattened sulfide globules and moncheite in medium spherical globules which are significantly richer in Pd. Compositions of tellurides localized in chalcopyrite from small sulfide globules exist in both fields. More Pd-enriched tellurides are characteristic for pyrrhotite-hosted grains from average spherical globules. Compositions of tellurides hosted by pyrrhotite from large flattened sulfide globules are greater enriched in Ni. Pt-rich phases are existed only in large and small sulfide globules in pentlandite and chalcopyrite.

Ratios of Te-(Cu+Ni+Fe+Pt+Pd)-Bi showed that all moncheite compositions only slightly vary in content of Bi and Te. Most compositions of all globule types and hosted minerals form very narrow variation field. Pyrrhotite-hosted tellurides don't exist beyond this field. Slight offset towards enrichment in bismuth has occurred only for tellurides from average and small sulfide globules. Some bias towards enriching in sum of cations (Cu+Ni+Fe+Pt+Pd) and greatest variability of composition are typical for tellurides, localized mainly in pentlandite, and rarely in chalcopyrite.
from all types of sulfide globules. We also conclude that the predominant host phases are pentlandite and chalcopyrite (ISS). The smallest amount of PGM occurred in pyrrhotite and it doesn’t host Pt-rich grains.