Mineralogical residence of Platinum Group Elements (PGE) in the Fe-Ni-Cu sulfide deposits of the Ivrea Verbano Zone (Italy)

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We present a residence-study of platinum group elements (PGE) in base metals sulfides (BMS) as well as in specific platinum group minerals (PGM). The PGE, Te and Re contents were analyzed by electron microprobe. The investigated Fe-Ni-Cu deposits of the Ivrea Verbano zone occur: 1) within layers of the igneous complex, 2) within an ultramafic sill intruding metasediments and 3) within ultramafic pipes intruding gabbros and metasediments.

PGE hosted by base metals sulfides (BMS)

Pyrrhotite (Po), pentlandite (Pn) and chalcopyrite (Ccp) were analyzed. Nearly two thirds of the analysis (n=349) contain Ir, Rh, Pt and Pd above detection limits (d. l.) (100, 32, 93 and 30ppm). BMS from all the three types of deposits contain PGE. Generally Te is above d. l. (100ppm); enriched in Pn. Different analyses of one specific mineral showed that the PGE are distributed dishomogeneously and that the quantities do not correlate with Te. Pt and Ir are mainly hosted by Po and Pn but not by Ccp. Pd is carried by each of the mentioned minerals. Rh occurs mainly in Po and only rare in Ccp and Pn. Re is only hosted by Po. Ir is enriched in Po and Pn and Ccp contains no Ir above d. l. Re was only detected in Po. Os data was neglect due to an interference with Cu. Ru was always below the d. l. of 35ppm.

PGE hosted by platinum group minerals

We investigated several PGM included within the base metals sulfides (sizes <10μm). The following species were found: Pd-rich melonite, merenskyite, moncheite, sperrylite and irarsite in decreasing order of abundance. According to the mineral chemistry, Te was partly substituted by Bi.

Our mineralogical observations suggest that the PGE, together with other chalcogens, were initially dissolved and collected by an immiscible sulfide liquid probably as small clusters. Subsequently, they were exsolved together with Te, Bi and As and crystallized as discrete PGM which are described for our investigated samples.

REE patterns in the ore-bearing of the Chortovo Koryto gold deposit (Eastern Siberia)

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REE are usually considered as inert components at the metamorphic and metasomatic processes. But in recent years more and more papers indicating their mobility in the hydrothermal systems are published. The REE distribution in the rock associations of the orogenic gold deposit Chortovo Koryto was studied by ICP-MS method.

This deposit is located on the boundary between Baical-Patom fold-thrust belt and Siberian Craton. The gold ore are represented by system of quartz vein in the metaterrigenous slice of the Early Paleozoic formation Mikhailovskaya. The rock metamorphism corresponds to the greenschist facies. The composition of ore beds includes metaaleurolite - Qtz + Ab + Mus + Chl ± Bt (SiO_2 60-80%; Al_2O_3 8-19%; CaO 0.1-0.6%; K_2O 1.7-3.5%), carbonaceous slates - Qtz + Ab + Mus + Chl + C (SiO_2 41-64%; Al_2O_3 13-29%; CaO 0.05-2.1%; K_2O 1.9-6.8%), and altered rocks - Anc + Cal + Mus + Ab + Chl (SiO_2 29-68%; Al_2O_3 9-16%; CaO 6-12%; K_2O 1.4-7.6%).

The morphology of Chondrite normalized REE patterns of metaaleurolite is similar to the main sedimentary standards (La/Yb 7.3-11.4; Eu/Eu* 0.62-0.81), but differs in lower accumulation level of lanthanides (37-88 ppm). In the carbonaceous slates Σ REE increases up to 186 ppm mostly due to light REE (La/Yb 18, 5-31, 2), at the same time an evident negative Eu anomaly is shown (Eu/Eu* 0.41-0.66). In the altered rocks a maximum enrichment (Σ TR 251-875 ppm), lanthanides differentiation (La/Yb 41, 3-50, 1) and absence of Eu anomaly (Eu/Eu* 0.89-1.02) are observed; from axil zone in direction of contacts Σ REE decreases from 413 to 251 ppm.

LILE and HFSE distribution in studied rocks indicates that the ore system was formed with presence of two source matters. Metaaleurolites and carbonaceous slates are compared with upper crust (Zr/Hf 31.4-39.1; Ta/Nb 12.02-17.01); altered rocks are similar to the rock basalt-andesite-rhyolite volcanic series of greenstone belts and they supplement with OIB.

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