Geochemistry and mineralogy of precious metals in carbonaceous magmatic rocks from the East Sayan ophiolites.

B.B. DAMDINOV, A.G. MIRONOV, S.M ZMODIK

Geological Institute SD RAS, Ulan-Ude, Russia
Geological Institute SD RAS, Ulan-Ude, Russia
United Institute of Geology, Geophysics and Mineralogy SD RAS, Novosibirsk, Russia

Carbonaceous ultramafic rocks in the East Sayan have been known since 1936. Our studies show that free carbon presents in the primary dunites and harzburgites (stockwork-like carbonization), also in serpentinites, talc-carbonaceous rocks and secondary apobasic albitites (veined bodies of the carbonaceous rocks). Carbon-bearing ultrabasites, serpentinites and talc- carbonaceous rocks are enriched in Pt (to 1.27 ppm), Pd (to 0.11 ppm), Au (to 2.4 ppm) and Ag (to 265.2 ppm), althogh distribution of these elements is irregular. Heavy paltinum-group elements (PGE) haven't been determined, whereas their enrichment is fixed in free carbon. According to the data of diffractometric and thermic analyses, free carbon from the carbonaceous ultrabasites is presented by graphitoid with high-degree of ordering. Isotopic composition of free carbon has a $\delta^{13}C$ value similar to the mantle values (-8 – -16‰).

Precious metal minerals are presented by native gold of various grade, often with Hg (to 27.22 wt.%) and Cu (to 27.85 wt.%) impurities, in the carbonaceous ultrabasites. Platinum-group minerals (PGM), such as native palladium ($PdPt_{0.1}$), palladium-rich platinum ($PdPt_{1.1 - 1.5}$), maslenitskovite ($(Pt, Pd)_3Sn$), atokite (Pd_3Sn), rustenburgite (Pt_3Sn), zvyagintsevite ($(Pd, Pt)_3(Pb, Sn)$) have been revealed in these rocks. In addition, intermetallides of Sn, Pb, Cu, Sb wuth Pt and Pd impurities are determined.

Carbonaceous albitites are characterized by low contents of PGE (<2 ppb) and enrichment in Ag (32 ppm) and Au (0.13 ppm). Free carbon of albitites corresponds to that from ultrabasites by compositon and isotope ratios. Therefore, we may suggest the similar sources of free carbon for albitites and ultrabasites. Precious metal minerals from carbonaceous albitites are presented by native silver with Hg (to 1.16 mas.%) and Cr (0.14 mas.%) impurities. Mineral has it's own name, i.e. kongsbergite. Distribution of free carbon in rocks indicates that stockwork-like carbonizastion occurs in the crystallization stage of ophiolite ultrabasites, whereas veined bodies are formed by redistribution of the primary carbon and synchronous with secondary metasomatic rock formation. The isotopic data and number of other features allow to suggest that free carbon entrance was occurred in mantle fluids, that introduce precious metals, because it is known, that these metals form the soluble compounds with carbon. Elevated heavy PGE contents in free carbon apparently reflect the mantle ratios of these elements.

LA-ICPMS of sulphides: Evaluation of an XRF glass disc standard for analysis of different sulphide matrixes

L. DANYUSHEVSKY, P. ROBINSON, P. MCGOLDRICK, R. LARGE AND S. GILBERT

CODES SRC, University of Tasmania, Hobart, Australia (L.Dan@utas.edu.au)

A standard has been developed for quantitative analysis of sulphide minerals using a combination of UP213 laser probe and HP4500 quadrupole ICP-MS. Standard STDGL-2b is a mixture of 25% Zn concentrate CZN-1 and 75% pyrrhotite RTS-4, which contains ~ 45 wt% Fe, 35 wt% S, 11 w% Zn and 1.9 wt% Pb and Cu, Ni, Co, Mn, Cr, V, Cd, Ti, Sr and Ba as trace elements at concentration levels suitable for quantitative analysis. This mixture has been doped with a number of additional trace elements (Ge, As, Se, Mo, Ag, In, Sn, Sb, Te, W, Au, Tl, Bi, PGE Sc, Y, Th, U, PGE, REE, HFSE), and an XRF glass disc has been prepared by fusing 0.4 g of the sample with 4.121 g of 12-22 lithium borate flux and 0.606 g of $LiNO_3$. The amount of trace elements added has been chosen such that, at standard analytical conditions (laser beam size 60-80 µm; laser beam energy ~ 5-6 J/cm^2), signal on the mass-spectrometer is > 1000 cps. However, Os and Pd have been lost completely through volatilisation during disc preparation, whereas Te and Ir are partially retained in the disc, but their signal is ~ 750 cps. The homogeneity of the disc has been tested by performing 50 evenly distributed spot analyses. During each analysis, background was collected for 30 sec. and signal for 60 sec. For most elements, standard deviation is < 6%, however PGEs and Au are more variable (~ 15%), and Se and Tl have standard deviations of ~ 10%. Element concentrations in the disc were analysed by XRF and then on small chips of the disc by standard solution ICPMS using Element high-resolution instrument and HP4500 quadrupole.

The suitability of STDGL-2b for quantitative analysis of sulphide minerals has been tested by analysing 5 pressed-powder pellets of pyrite, pyrrhotite, chalcopyrite, galena and sphalerite. To ensure that a reasonable range of trace elements is present in all five powder pellets at levels above their detection limits, 2 wt% of each of other four powders has been added to each powder prior to final grinding. Each powder mix was milled for ~5 minutes to ensure homogeneity and fine grain size. The compositions of the powders have been analysed by XRF and standard solution ICPMS simultaneously with STDGL-2b. We have also analysed a pressed-powder pellet of PS-1 (Wilson et al., 2002), a sulphide standard developed by USGS. 20 spot analyses have been performed on each pellet, which allowed for <10% error on their compositions.

We will discuss precision and accuracy of sulphide mineral analysis by LA-ICPMS using XRF glass discs as standards.