Temporal geochemical evolution of Pobeda hydrothermal sulfide system

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We present the first attempt to reconstruct temporal and geochemical evolution of Pobeda ore cluster hydrothermal system (Mid-Atlantic Ridge) applying detailed mineralogical (EMPA and LA-ICP-MS), geochemical (XRF, AAA, ICP-MS) investigation and ^{230}Th/U dating to 24 monomineral samples or coeval mineral aggregates, separated from multi-mineral sulfide ores. This data gave evidence that hydrothermal discharge started at Pobeda-1 field around ~177,5 kyr and lead to deposition of high-temperature pyrrotite-pyrite ores enriched in Mo, Si, Ag and depleted in Zn, Sr, Ga, Sn, Co, Ni, V, Ti in comparison with other sulfides within the cluster. Later on, several episodes of hydrothermal activity lead to the formation of pyrrotite-pyrite, pyrite-chalcopyrite, pyrite-wurtzite and chalcopyrite-sphalerite ores, which alternate each other within the cluster in time interval up until recently.

Despite their different ages, Fe-type pyrrotite-pyrite ores show the highest concentrations of Mn, P and Mo. Isocubanite-chalcopyrite ores of Cu-type are enriched in Co, Ni, Cr, V, Se, Te, Ba and Bi, while Zn-type chalcopyrite-sphalerite and pyrite-wurtzite ores are enriched in Ga, Ge, In, As, Cd, Sn, Sb, Hg, Ag (up to 88 ppm), Au (up to 3,7 ppm), Pb, Th and U. Only distribution of Sr, As and Sb in sulfide samples correlates significantly with age. For other elements we assume that their variations are caused mainly by changes in T, pH, and/or proportion of the sea water mixing with the discharged hydrothermal fluid.

Mineral trace element distribution have given additional evidence to support this idea - early pyrite-1 is enriched in mid- and low-temperature element associations (As, Sb, Ag and Ba, Pb, Tl). Pyrite-2 accumulates Mn, Tl, Co, euhedral pyrite-3 shows the highest mid- and high-temperature element assemblage (Se, Co, Cu, In, Cd, Zn), while late pyrite-4 is depleted in Bi, Se, Te and enriched in Mn, Tl, W, Pb, Ag.

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