Cu isotope composition of sulfide mineralization of ultramafic-hosted hydrothermal field (12º45´N, MAR)

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The aim of this study was to measure the natural variation of copper isotopic composition (IC) of different mineral phases occuring within ultramafic-hosted modern hydrothermal field (12˚45´N, MAR). This may provide some suggestions about source of metal. Studied samples are represent primary and secondary copper minerals such as chalcopyrite, bornite, isocubanite, covellite, chalcosine, digenite, atacamite, pyrite and sphalerite. Isotopic measurements were collected on a ThermoFinnigan Neptune MC-ICP-MS using sample-standard bracketing and mass bias correction using a nickel internal standard.

The obtained data demonstrate considerable variation of Cu IC within studied ore field as well as clear difference between average Cu IC in sulfide ores from the another individual ore fields. Observed variations are higher than those already known for the similar fields.

Observed variations of Cu IC for primary sulfides within each ore field are quite restricted (±0.5‰ δ^{65}Cu). At the same time, δ^{65}Cu variation within each single chimney is exceeded 2.0‰ from central to external part of the field for the same minerals (chalcopyrite, bornite).

The lack of obvious correlation between Cu IC of sulfides and Cu content, and ore type (massive, spotted, “black smokers”) and position in space and hydrothermal activity (active, passive, relict) allow us to suggest that IC of primary sulfides reflects characteristics of the metal sources (high-temperature ore fluid or magmatic melt).

The primary sulfides of the studied ore field with the age of high-temperature activity about 200 000 years and developed over ultramafic substrate, characterize the most depleted IC: up to -4.2‰ δ^{65}Cu. Maximum shifts towards heavier IC (up to 3‰ relatively the coexisting primary chalcopyrites) have been observed for the minerals of atacamite group that is in a good agreement with experimental data. In addition, our data shows that sulfides of ore fields developed over ultramafic basement are characterized by more depleted Cu IC than sulfides from the ore fields associated with basalts.

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