Stable isotope study of magmatic sulfide Ni-Cu-PGE ores of the Noril'sk Province (Russia)

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Combined Cu-S isotope data for Ni-Cu-PGE sufide deposits associated with the economic Noril'sk-1, Talnakh and Kharaelakh intrusions, the subeconomic Chernogorsk, Zub-Marksheider, and Vologochan intrusions, and the non-economic Nizhny Talnakh intrusion within the Noril'sk Province, and the J-M Reef from the Stillwater Complex (Montana, USA), are presented for the first time.

In terms of Cu-isotopes, the majority of the analysed samples fall within a tight cluster (δ^{65}Cu from -1.1 ‰ to 0‰) characteristic of the ores from the economic Ni-Cu-PGE deposits at Talnakh and Stillwater. The other samples that reflect overall δ^{65}Cu isotopic variability (from -2.9‰ to 1.0‰.) are represented by the subset of sulfide samples from the Kharaelakh and Noril'sk-1 intrusions. Three economic deposits are characterized by distinct mean δ^{65}Cu values (-1.56±0.27‰ at Kharaelakh, –0.55±0.41‰ at Talnakh and 0.23±0.28‰ at Noril'sk) matching those of the carbonaceous chondrites and iron meteorites [1, 2]. The determined δ^{65}Cu variability is interpreted to represent a primary signature of the ores, though a magmatic fractionation of Cu isotopes and/or assimilation of the ore material from external source (in case of the Kharaelakh ores) cannot be ruled out.

The overall δ^{34}S isotopic variability in the intrusions ranges from -0.7‰ to 13.8‰. The restricted but distinctly different sulfur isotopic compositions of disseminated and massive ores at Khraelakh (12.2±0.5‰ and 12.7±0.1‰, respectively) and Talnakh (10.8±0.1‰ and 10.9±0.1‰, respectively) is likely the result of processes of sulfur fractionation at deep levels of the tectonosphere (i.e., in deep-seated chambers), rather than at shallow levels or at the present site of their location. Finding of mantle-like δ^{34}S (0.39±1.6‰) in the subeconomic sulfide ore from the highly contaminated Zub-Marksheider intrusion implies that sulfides have a deep-seated origin.

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[1] Luck *et al* (2003) *GCA* **67**, 143-151 [2] Luck *et al* (2005) *GCA* **69**, 5351-5363