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# New insights into the formation of the Rajapalot deposit from stable Ni, Cu and Fe isotopes

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In the early 2010s, new extensive gold-cobalt mineralized systems were identified in the Rompas-Rajapalot area in the Peräpohja schist belt, northern Finland. One of them, the Rajapalot deposit, is suggested to have formed via multistage ore-forming processes and/or remobilization of the primary ore [1]. This study aims to better understand the source regions and mineralization processes of gold and cobalt in the area by utilizing a combination of Ni, Cu and Fe stable isotopes. Moreover, we provide novel insights into the behaviour of these isotopes in a Co-enriched orogenic gold deposit.

Bespoke analytical workflows were developed to support the utilization of stable transition metal isotopes in the study of mineralization processes. Ni, Fe and Cu stable isotopes were analysed from pyrrhotite (Ni, Fe), pyrite (Fe) and chalcopyrite (Cu, Fe). Individual sulfide grains were extracted from thick sections using a microdrill attached to an optical microscope. Ni, Cu and Fe were separated from the matrix using tailored ion exchange chromatography methods. After matrix removal, the isotopic compositions were measured from the solution by MC-ICPMS.

The $\delta^{56}$Fe values show clear differences between the various analysed sulphides. Most variation is seen in pyrite $\delta^{56}$Fe (-2.08 ± 0.15‰ – +3.29 ± 0.14‰) relative to IRMM 14. The $\delta^{56}$Fe in chalcopyrite is solely positive (0.10 ± 0.18‰ – +1.45 ± 0.12‰) with a limited range of $\delta^{65}$Cu values (-0.3 ± 0.02‰ – 0.23 ± 0.03‰) relative to IRMM 647. Pyrrhotite shows both low and high $\delta^{56}$Fe relative to IRMM 14 and the measured $\delta^{60}$Ni values show a shift towards the light compositions (-1.03 ± 0.09‰ – +0.18 ± 0.09‰) relative to NBS986 standard. Initial data analysis shows a correlation between pyrite generations and the $\delta^{56}$Fe values. Subtle correlations are also seen between the isotopic composition of pyrrhotite and chalcopyrite and the mineralization. These preliminary findings suggest that the isotopic composition of sulphides can be used as a tool to study Au-Co-mineralization but also show potential as a vectoring tool towards ore.

[1] Raicˇ, Molnár, Cook, O'Brien & Lahaye (2022), *Solid Earth* **13**, 271–299.